

Handbook of Research on Global Supply Chain Management

Bryan Christiansen
PryMarke, LLC, USA

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For my daughter, Nicole Christiansen, who will always be foremost in my heart.

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Reza Aboutalebi, University of London, UK

In this study, after analyzing hundreds of papers and books by using a meta-analysis technique, it was revealed that supply chain management suffers from a lack of strategies for many aspects of real-world supply chain activity. Existing supply-related strategies are very primitive and incomplete. Real-world activities in modern supply chains are complicated and multidimensional; consequently, supply chain strategies should reflect and manage these realities. This study aims to reduce the existing shortcomings in current supply chain strategies by proposing the taxonomy of supply chain strategies.

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Tan Miller, Rider University, USA

Renato de Matta, University of Iowa, USA

Minghong Xu, University of Illinois at Chicago, USA

Over the last several decades, practitioners have used the Square Root of N (SQRTN) and the Portfolio Effect models to develop estimates of the change in finished goods inventory investment that will result from potential consolidations of existing supply chain networks. The relative simplicity of these two models has made them commonly used tools of consultants and practitioners. However, what is often overlooked or ignored in practice is that these models may or may not provide accurate projections, and that there are limitations to the range of problems which these models can address. In this paper, we evaluate the accuracy of projections made by the SQRTN and portfolio effect models under a variety of network conditions, and we provide guidance on when and how practitioners can both use and supplement these models. Our evaluations are based on the results of simulation studies which we conducted for this paper as well as many years of inventory management practice in private industry.

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Kijpokin Kasemsap, Suan Sunandha Rajabhat University, Thailand

This chapter reviews the perspectives of fostering supply chain management (SCM) in global business, thus describing the theoretical and practical concept of SCM; the applications of SCM; fostering SCM through knowledge management (KM) in global business; the strategic success factors of SCM; and the

significance of SCM in global business. The utilization of SCM is necessary for modern organizations that seek to serve suppliers and customers, increase business performance, strengthen competitiveness, and achieve continuous success in global business. Therefore, it is essential for modern organizations to examine their SCM applications, develop a strategic plan to regularly check their practical advancements, and immediately respond to the SCM needs of customers in global business. Applying SCM will extremely improve organizational performance and reach business goals in global business.

Chapter 4

A “Flying High, Landing Soft” Platform for Supplier Diversity 72
Ye-Sho Chen, Louisiana State University, USA
Nurhan Davutyran, Kadir Has University, Turkey
Iris Ersoy, Vienna University of Business and Economics, Austria

Diversity management has emerged as a unique agenda of today’s corporations in the global economy. One important area of corporate diversity management is supplier diversity, which is an inclusive growth program designed to help develop under-represented businesses into competitive suppliers of corporations. A major challenge of supplier diversity is that many minority suppliers lack the capability to deliver products which the corporate buyers need. Another major challenge is that few minority suppliers have the ability to participate in the global markets opportunities. We address these two problems by proposing an innovative “Flying High, Landing Soft” platform for international education in supplier diversity to help multinationals manage their global supplier diversity.

Chapter 5

An Empirical Investigation of the Role of E-Communication in International Collaborations 85
Ying Zhang, University of Strathclyde, UK

This chapter addresses the role of e-communication in international collaborations by examining its usage, cultural implications, and impact on trust building. Theoretically, this study is informed by social constructionism (Gergen, 1999; Goffman, 1959). Empirical insights were generated from the qualitative case study of WinCo which was an international collaboration between a UK-based wine and spirits multinational company and their distributors. The findings suggest that different e-communication channels are often used by collaborating partners to enhance the breadth and depth of their communication. New participants tend to enhance the skills of e-communication usage through self-learning, formal educational programs, and support from the company’s employee development team. The widespread usage of e-communication impacts on partners’ trust building in terms of their mutual perceptions of one another’s competence and social bonding. National culture also affects partners’ use of e-communication in international collaborative practice.

Chapter 6

Information Quality in Supply Chain Software 105
Farhad Kafi, CADA Corporation, Iran
Majid Kafi, CADA Corporation, Iran

In the new dynamic economic environment where supply chains increasingly face constant change and instability, the better supply chain planning and management enabled by advanced data management systems provides enhanced value proposition for customers resulting in improved profitability for firms along the supply chain. However, achieving such high quality level of supply chain visibility is not an

easy task requiring technological capability, organizational willingness and data quality management intensively demanding attention from both managers and scholars. Therefore, the chapter begins with an overview of the role of information systems in supply chain management followed by a discussion regarding the role of information quality in successful supply chain interactions. Data quality management in terms of strategy and data governance is then reviewed. Finally, data quality tools complementing strategy dimension of data quality management are studied.

Chapter 7

Value Creation and Appropriation in Buyer-Supplier Relationships: Governance, Competition and Cultures 127
Wiboon Kittilaksanawong, Saitama University, Japan

The productive relationship between buyer and supplier is often subject to opportunistic behaviors of the supplier. When selecting a supplier, firms have to balance between benefits of production efficiency and costs of transactional integrity. To minimize the supplier's opportunism, firms devise formal and informal governance mechanisms that match with characteristics of the relationship at the firm level, sourcing strategy of the buyer, at the industry level, competition among suppliers, and at the country level, national culture where the supplier's operations are located. While concurrently employing both formal and informal governance mechanisms may be more effective in suppressing the supplier's opportunism, it may be too costly in the design and implementation. The best strategy for the buyers is to adopt the governance mechanism that matches with characteristics of the relationship at different levels.

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Review of RFID Applications in Perishable Inventory Management..... 139
Linh Nguyen Khanh Duong, Auckland University of Technology, New Zealand
Lincoln C. Wood, Auckland University of Technology, New Zealand & Curtin University, Australia
Xiaowei Wang, Auckland University of Technology, New Zealand

Radio frequency identification (RFID) technology, which enables real time data collection, has been proposed as a promising solution in perishable inventory management. Research shows that RFID technology has many benefits for perishable products; therefore, this chapter presents an overview of RFID technology and its applications to perishable inventory management. The findings provide a comprehensive review and support the managers in evaluating an investment decision to implement RFID and employ RFID in inventory management for perishable products.

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Supply Chain Resilience 147
Alessandra Vecchi, University of Bologna, Italy
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The chapter will consist of a literature review that will be framed to address the following three questions. The first question is "What is a resilient supply chain?" The aim is to provide an in-depth understanding of resilience and to distinguish a supply chain which is resilient from one which is not. The second question is "Why companies should build a resilient supply chain?" Some factors have increased firms' vulnerability and the losses associated with unpredictable events. Companies should understand that the advantages linked to building resilience do not become evident only in case of disastrous events,

but also during the ordinary operations execution. The third question is: “How to build resilience?” The most relevant ways to build resilience will be illustrated by drawing on some short case studies that were purposefully chosen in order to present a practical implementation of some of the different techniques used to create resilience. At the end of the chapter, conclusion, managerial implications, limitations and directions for future research will be provided.

Chapter 10

Partnerships in Supply Chain Management..... 161

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Yücel Öztürkoğlu, Yasar University, Turkey

This chapter considers one of the most important collaborations, namely that of partnership. In recent year’s sophisticated and demanding consumer lead severe global competition between companies. So many companies seek to coordinate cross-firm activities and work mutually over time to produce outstanding performance. The main objective of the companies is to reach higher performance than would be achieved by managing individually. For any supply chain in the competitive environment, widening the boundaries of the firm via partnership formation would be the remedy and partnership creates a synergistic business environment for both sides. The objective of the chapter is to present a comprehensive and integrated view of the literature on all aspects of partnership.

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Strategic Value Creation in a Supply Chain..... 186

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This chapter is designed to give the readers a concise understanding of supply chain strategies and the process involved in its formation. It is a background study on the changing role of supply chain in gaining competitive advantage for the firm. The chapter discusses on traceability and integration along a supply chain, its inception and the advantages to the corporate world through its implementation. The chapter focuses on the topic of value creation in a supply chain through strategic management decisions like vertical and horizontal integration. The value chain analysis model for competitive advantage is covered in this chapter. A discussion on the differences between vertical and horizontal integration systems and the best strategic decision among them is provided. The concepts of sustainable supply chain integration, traceability, and the limitations to their implementation have also been discussed. The best examples on practitioners of supply chain strategy and integration are provided along the chapter.

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International Supply Chain Case Study 205

Thi Song Hanh Pham, Sheffield Hallam University, UK

Fariba Darabi, Sheffield Hallam University, UK

Natalie Victoria Wilmot, Sheffield Hallam University, UK

The chapter aims to explore how some successful global firms organize and manage their supply chain activities at a global level. Three interlink areas of international supply chains including global production, global sourcing, and global distribution within three separate case-studies; Samsung’s global production,

UK Airbus's global sourcing, and Tesco's global distribution are examined in the chapter. The overall results highlight the importance of a holistic approach to international supply chain management. Findings from Samsung's smart phone production network and Tesco's global distribution suggest that firms are able to be successful when they exploit specific opportunities wherever they are located in the world. Whilst Samsung have been successful with keeping in-house production, Airbus are doing well with outsourcing. The Airbus case highlights the importance of risk management in global supply chains. All three cases demonstrate examples of benefits and challenges posed by knowledge sharing with partners in the supply chain.

Chapter 13

Supply Chain Relationships: From Conflict to Collaboration 227
Wesley S. Boyce, Drury University, USA

The evolving field of supply chain management is rooted in the premise that traditionally independent firms need to work together in order to achieve supply chain success. This article outlines supply chain collaboration, which is a critical strategy for the field of supply chain management. While firms have traditionally operated in a manner that only considers their own well-being, a transition is occurring where open market relationships are diminishing and cooperation, coordination, and collaboration are becoming much more common. There are several key dimensions of collaboration that serve as drivers to its success, and firms that engage in these activities should experience closer relationships with channel partners and ultimately achieve higher levels of success. While this issue has been thoroughly covered in the logistics and supply chain management literature, its limited implementation and lack of widespread success provides evidence that the topic should continue to be a focal point in future research.

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Green Supply Chain Initiatives: The India Perspective 240
Debabrata Ghosh, Indian Institute of Management Calcutta, India
Sirish Gouda, Indian Institute of Management Bangalore, India
Janat Shah, Indian Institute of Management Udaipur, India

Emergence of 'sustainability' as the new paradigm of conducting business has led to increased focus on operations of firms in emerging economies such as India. With growing concerns on the environmental impact of products and processes of firms in emerging economies, it becomes imperative to understand the factors steering green initiatives in India. This chapter aims to answer the question regarding what drives firms in India towards greening? Through research and discussions with managers, we observe certain common underlying factors determining firms' greening initiatives. The chapter aims to outline these common factors and takes a look at various approaches of firms in India in line with those factors. The current work aims to provide a better understanding of environmental friendly practices in India to both practitioners and researchers alike and establishes a platform for green supply chain research.

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Sustainability: A Comprehensive Literature 248

*Aroop Mukherjee, Universiti Putra Malaysia, Malaysia**Nitty Hirawaty Kamarulzaman, Universiti Putra Malaysia, Malaysia**Gowri Vijayan, Universiti Putra Malaysia, Malaysia**Selvakkumar K. N. Vaiappuri, Universiti Putra Malaysia, Malaysia*

Sustainability has become vital aspects for today's world and the future to come. Various definition of sustainability have added to the confusion with respect to sustainability in people's mind and in the organizations. A collection of different sustainability frameworks, indicators and tools have provided important insights about the outcomes of the sustainability process and in providing analytical and logical designs for sustainability. However, implementing sustainable practices has been overlooked by the majority of the organizations. Identifying the challenges and integrating with the tools in the form of indicators, assessment, and strategies will be a good start for an organization to be sustainable. The organizations that develop and implement sustainable practices are recognized as a success in sustainability. This chapter aims to provide an outline for sustainability with strategies, assessment, indicators, and application for better products and create and maintain business and customer value.

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Gloria Sraha, Victoria University of Wellington, New Zealand

This research applies interviews to investigate export barriers pertaining in the supply chain system of the agricultural industry of Ghana, as a representative country of Sub Saharan Africa. Evidence is provided from an unexplored area which is likely to bring new insights into export barrier literature primarily focused on lower emerging economies in Sub-Saharan Africa. The study identified four main export barriers; which are logistics, functional, marketing and financial barriers. The study concluded that management of firms have to be proactive in disassembling export barriers to enable a commanding role in pursuit for strong economic and industrial development in African and beyond.

Chapter 17

Cultivating Global Entrepreneurs in the Food Supply Chain 292

*Ye-Sho Chen, Louisiana State University, USA**Ismail Hakki Polat, Kadir Has University, Turkey*

Food supply chain from an entrepreneur's perspective has many needs today. To cultivate food entrepreneurs addressing the growing global demand in food, there is an emerging trend in integrating vital players in food supply chain to form food clusters. Like most of start-up entrepreneurs in other industries, food entrepreneurs have their challenges of identifying market opportunities, building a trusted management team, and securing funding sources to run the businesses. They also need facilities to produce their foods, the facilities needed to be certified by local food authorities, securing product liability insurance, and marketing channels to distribute their food products. In this paper, we discussed how LSU Food Incubator is established and developed to address those challenges. Specifically, it is a "Flying High, Landing Soft" platform. We plan to empower the platform with mobile cloud learning practices and capabilities and extend this platform to emerging markets like Turkey.

Chapter 18

Supply Chain Management: Developments, Theories and Models 313

*Sajad Fayezi, Swinburne University of Technology, Australia**Maryam Zomorodi, RMIT University, Australia*

This chapter aims to develop a holistic framework of supply chain management (SCM) through extensive review of the pertinent literature. To this end, the chapter offers a detailed account of developments, dynamics and complexities of SCM through describing its history, theories and models. The chapter provides the reader with a navigation pane towards various theoretical and conceptual issues that encapsulate the essence of almost 30 years of research in the subject matter. Important implications for supply chain practitioners have also been explained.

Chapter 19

Structuring and Managing Supply Network: A Review of Current Literature and Conceptual Framework 341

Zheng Liu, Xi'an Jiaotong-Liverpool University, China

The concept of supply network has extended supply chain across national borders towards globalization. The aim of this chapter is to provide researchers, business practitioners and university students a picture of the architecture of supply networks. By analyzing two main trends of studies in the field of supply network management, components of supply network are classified into structural and infrastructural factors. Also a comparison is made to identify the difference between supply network and traditionally factory-based manufacturing system. Based on the literature review, a conceptual framework is further proposed which describes the supply network from four essential perspectives: Role/function, Relationship/alliance, Configuration/reconfiguration, and Risk and crisis management. After presenting detailed models and decision making areas of each perspective, suggestions are given on some emerging topics.

Chapter 20

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges: Case of Tanzania 354

*Felix Adamu Nandonde, Aalborg University, Denmark**Winnie Nguni, University of Dar es Salaam Business School, Tanzania*

In absence of effective state institutions, informal and private sector operations tend to govern the market. This problem is evident in the petroleum industry in Tanzania. However, little is known about how players in petroleum industry operate in those business environments. The purpose of this chapter is to explore establishment of a relationship between supplier-logistic firms in a post planned economy. The study employed case study interview with two petroleum products distributors in Tanzania to achieve its objective. Data were analyzed by thematic analytical techniques. Three major findings regarding buyer-suppliers relationships in developing economies are presented: actors do not prefer to enforce contract that they sign, discretionary relationships exist in petroleum business among actors and 'undugunization' is the strongest criteria in selection of actors. Study implies that for a supplier-logistic relationship to exist government has a great role to play in enforcement of laws.

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*Işık Özge Yumurtacı, Izmir University of Economics, Turkey**Bengü Sevil Oflaç, Izmir University of Economics, Turkey*

Retailing is amongst the leading industries that derive demand in the world. There is severe competition among retailers regarding supply chain management (SCM) practices used in this industry. Hence, this chapter mainly aims to address the supply chain management (SCM) practices (quick response, efficient consumer response, category management, continuous replenishment planning, continuous planning forecasting and replenishment, postponement, vendor managed inventory) and future trends in retailing. Moreover, this chapter provides insight for the retail practices preferred in emerging and developed markets. The chapter presents important implications for scholars, business executives, scholar-practitioners and university students who are interested in any part of retailing and supply chain management.

Chapter 22

The History and Development of Purchasing Management and Its Theoretical Framework: A Review of Transaction Cost Economics 379

Richard Glavee-Geo, Aalesund University College, Norway

Purchasing as a management or academic field of study has seen a rise in its awareness. The strategic role it assumes in most organizations and businesses is as a result of the need for firms to reduce cost and to counter increased competition. However, this recognition evolved from “humble” beginnings up to the strategic importance it assumes today in some organizations and as a major field of study in the academia. The historical development of purchasing is worth studying so as to better understand and appreciate the important role it now assumes. Much literature and many theoretical frameworks have been developed to help explain various phenomena in the purchasing field. Transaction cost economics is one of such theories that have been applied. The contribution of transaction cost economics to the growth of knowledge in the purchasing and channel studies has been enormous.

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Implementation of Green Supply Chain Management in a Globalized Economy 402

Harish C. Chandan, Argosy University, USA

Green supply chain management (GSCM) practices help a firm to become eco-friendly, socially responsible, meet customer expectations, deal with industry peer-pressure and comply with government regulations (Luthra, 2014). GSCM refers to the management of all activities involved in sourcing, purchasing, manufacturing, transportation and distribution of products and services to customers in an eco-friendly way (Sharma, 2013). A conceptual framework of GSCM is presented that consists of eco-friendly organizational culture, collaborative relationships, innovative products and eco-friendly processes (Mutingi, 2013). A SWOT analysis for context specific implementation strategies for global GSCM is presented (Lee and Chen, 2010). The contribution of GSCM practices to a firm’s performance is discussed (Laisirihongthong et al., 2013). The critical success factors required to achieve GSCM include top management commitment, government regulations, environment protection literacy and compliance among the supply chain partners, and ISO14001 certification (Jain and Sharma, 2014).

Chapter 24

A Staged Supplier Pre-Evaluation Model To Determine Risky, Potential and Preferred Suppliers 419

Gül Gökay Emel, Uludağ University, Turkey
Gülcan Petriçli, Uludağ University, Turkey

In the late 1980s, the proportion of outsourced materials in the cost of high-tech products was around 80%. In this respect, with increasing globalization and ever-expanding supply chains, interdependencies between organizations have increased and the selection of suppliers has become more important than ever. This exploratory research study intends to develop a novel approach for a specific type of supplier selection problem which is supplier pre-evaluation. A two-staged multi-layered feed forward neural networks (NN) algorithm for pattern recognition was used to pre-evaluate suppliers under strategy-based organizational and technical criteria. Data for training, validation and testing the network were collected from a global Tier-1 manufacturing company in the automotive industry. The results show that the proposed approach is able to classify candidate suppliers into three separate groups of risky, potential or preferred. With this classification, it becomes feasible to eliminate risky suppliers before doing business with them.

Chapter 25

An Empirical View of Knowledge Management 452

Selvakkumar K. N. Vaiappuri, Universiti Putra Malaysia, Malaysia
Nitty Hirawaty Kamarulzaman, Universiti Putra Malaysia, Malaysia
Gowri Vijayan, Universiti Putra Malaysia, Malaysia
Aroop Mukherjee, Universiti Putra Malaysia, Malaysia

This chapter is a comprehensive investigative documentary on knowledge management (KM). It was extensively cover past researches done on knowledge management, exposing its varied dimensions to readers as well as guide the readers through its role in research, business, and daily life. The chapter was well discussed about knowledge, knowledge management and knowledge management systems. It also address the Nonaka's Knowledge Management Model or known as SECI modal in order the readers can understand the knowledge creation process.

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Supply Chain Processes as Key Drivers for Upgrading in the Semiconductor Global Supply Chain: The Case of Brazilian Design Houses..... 466

Marco Antonio Viana Borges, University of Vale do Rio dos Sinos, Brasil
Luciana Marques Vieira, University of Vale do Rio dos Sinos, Brasil

Brazilian government has developed public policies during the last years in order to promote a national semiconductor industry. Under this program, 22 new Design Houses have started their operations. Considering this context, this study aims to understand how Brazilian Design Houses are upgrading to operate as players in the semiconductor global chain. To really move up in the semiconductor global chain, DHs need to improve key supply chain processes, such as marketing and sales, outsourcing and relationship management. This new scenario will characterize the achievement of functional upgrading, in which the companies will develop capabilities to move to higher value added activities in the global chain.

Chapter 27

Picking with Impact: Best Practices for the Quality Improvement and Cost Minimizing of Consignment in the Logistics of an International Manufacturer 478

Matthias Lederer, University of Erlangen, Germany

Ferdinand Niedermeier, University of Erlangen, Germany

Jan Hoppe, REHAU AG+Co, Germany

The picking process in warehouses is an important step in global supply chains because it causes significant costs and has a high impact on customer satisfaction. Especially manual systems may cause high costs and can generate many picking errors such as type and quantity failures. Using the example of consignment at an international manufacturer located in Switzerland, this contribution provides in-depth fundamentals on picking processes. The picking system, typical workflows of manual picking procedures and theoretical considerations of optimal picking quality are given. Using a quality cost as well as a process cost analysis and a cause and effect analysis, the picking process is investigated in this scenario. It turns out that the optimal picking quality is surpassed in the case, which requires a systematic process re-design in order to cut costs. Therefore exemplary technical, organizational and soft best practices are shortly presented. In the scenario a business and technical case of the introduction an innovative weighting system is described.

Chapter 28

Information and Communications Technology (ICT) and the Supply Chain 495

Olayinka David-West, Lagos Business School, Nigeria

Information and communications technology (ICT) is an integral part of supply chain management (SCM) (Anderson, Britt, & Favre, 2007; Subramani, 2004). ICT supports SCM by enhancing supply chain efficiency, effectiveness and competitive advantage at strategic, tactical and operational management levels. Derived from extant literature on the application of ICT in SCM and ICT infrastructure sources, this chapter explores the significance of ICT in the business of SCM and describes the various ICT infrastructures deployed in aid of supply chain collaboration, integration and connectivity. While most related studies focus on organisational perspectives of ICT and SCM like benefits (Auramo, Kauremaa, & Tanskanen, 2005b), buyer-supplier relationships (Bakos & Brynjolfsson, 1993) and so on; the chapter presents a technological viewpoint of ICT and SCM. The chapter explores the function of ICT in SCM and proposes a classification framework of ICT in SCM.

Chapter 29

Supply Chain Risk Management: A Review of the Literature 516

Maryam Zomorodi, RMIT University, Australia

The importance of supply chain management (SCM) has been increasing recently and the concept of supply chain risk management (SCRM) has been gradually expanded. Since the concept of risk and uncertainty permeates all organizational functions, risk management would seem to be a crucial step towards safeguarding a company's competitive advantage. In the case of modern supply chains, which

are composed of complex relationships necessitated by competitive pressures such as outsourcing and globalization, understanding and implementing risk management processes and initiatives at various levels of the chain is essential (Peck, 2006). The purpose of this chapter is to conduct an extensive and structured review of the supply chain risk management (SCRM) literature in order to understand the importance of the risk management concept in the context of organizational supply chains, identify gaps, and suggest future research areas in this important and growing field.

Chapter 30

The Influence of Supply Chain Sustainability Practices on Suppliers..... 531

Xiaowei Wang, Auckland University of Technology, New Zealand

Lincoln C. Wood, Auckland University of Technology, New Zealand & Curtin University, Australia

Literature shows that focal firms (downstream in supply chain, the customers) which initiate supply chain sustainability (SCSIs) can increase their financial performance; however, the impact of SCSIs on the suppliers (upstream in supply chain, supplying firms) is unclear. This chapter analyzes the costs and benefits from the perspective of suppliers in SCSIs by focal companies. Furthermore, impact of suppliers-specific characteristics (firm size, resources dependence setting and self-sustainability) on SCSIs are investigated. According to the findings, we propose a performance implication-based conceptual model of SCSIs from the perspective of suppliers. We conclude that costs of SCSIs happen immediately to suppliers in implementation, but the benefits are expected in long run. These suppliers-specific characteristics are the decisive factors if suppliers can survive over short-run costs and reach the long-run benefits. This chapter extends the understanding of SCSIs from focal companies to suppliers while providing managerial support on collaboration between supply chain actors.

Chapter 31

Methodology to Support Supply Chain Integration A Business Process Perspective 545

Jaime Palma, Instituto Tecnológico Autónomo de México, México

This chapter explains and describes a detailed framework based on integrating a number of different methodological strands from the literature. A literature review was conducted in three different domains - business process re-design, supply chain re-design and e-business process design-. The literature review revealed potential for integrating elements of a number of different methods and techniques found in different methodological strands into a framework for conducting Business Process Re-design (BPR) to support Supply Chain Integration (SCI). The proposed BPR methodology can be applied in any company or sector; methods and techniques incorporated are not specific to any sector.

Chapter 32

Evolution of the Role of Measurement Systems in Industrial Decision Support 560
Mirosław Staron, University of Gothenburg, Sweden
Wilhelm Meding, Ericsson, Sweden
Kent Niesel, Volvo Cars, Sweden
Ola Söder, Axis Communications, Sweden

Measurement data can be used for decision support in multiple ways – from one-time, manual data collection/presentation (reporting) through flexible business intelligence solutions to online, automated measurement systems. In centralized organizations, the measurement data is often collected through reporting, but the trends in modern organizations with empowered teams, globalized development, and needs to monitor continuously longer supply chains requires shift in the design and use of measurement systems. In this chapter, we present a study of evolving measurement systems at three companies with global businesses – Ericsson, Volvo Cars, and Axis Communications. The results of the study include the identification of the timeline of the evolution, distinct generations of measurement systems and information needs in the different phases of the evolution. The experiences show how to evolve centralized decision support systems to support global and distributed decision support.

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Preface

Today's highly competitive global market demands that companies pay closer attention to their supply chain networks more than ever before. However, uncertainty in supply and demand, incomplete product life cycles, and complex product structures prevent supply chains from acquiring faster responsiveness and flexibility. As such, the purpose of this handbook is to provide the reader with different perspectives regarding global supply chains which will permit her or him to adapt current practices to meet present and future realities.

There is certainly plenty of extant literature on the subject of supply chain management. What is attempted in this publication is a collection of viewpoints from academics and practitioners alike which departs from the standard offerings of purely academic- or purely practitioner-oriented literature. In the following pages one can find a diverse composition of topics ranging from information quality in supply chain management software to green supply chain initiatives. Other examples include the following:

- High Level Inventory Network Modeling Approaches
- Cultivating Global Entrepreneurs in the Food Supply Chain
- Strategic Value Creation in a Supply Chain
- Sustainability - A Comprehensive Literature
- Supply Chain Relationships: From Conflict to Collaboration
- Review of RFID Applications in Perishable Inventory Management
- Supply Chain Resilience
- Evolution of the Role of Measurement Systems in Industrial Decision Support: Industrial Experiences and a Research Roadmap
- Supply Chain System and Barriers of Exporting: Evidence from Ghana in Sub-Saharan Africa
- An Empirical View of Knowledge Management
- Supply Chain Process as Key Drivers for Upgrading in the Semiconductor Global Supply Chain: The Case of Brazilian Design Houses
- Picking with Impact - Best Practices for the Quality Improvement and Cost Minimizing of Consignment in the Logistics of an International Manufacturer

The reader may wish to know the background of the author with regards to the topic of this handbook. In a nutshell, I have been involved in supply chain issues since the very early days of what we know now as Enterprise Resource Planning (ERP). Working with Fortune 500 firms in the Americas, Asia, Europe, and Russia to implement their various financial, marketing, manufacturing, supply chain, and related systems in a variety of industries and languages over the years has afforded me a relatively unique perspective with regards to the topic of this publication. I am forever grateful to the IBM Corporation and other firms in Sweden, the United Kingdom, and the USA for the experiences they provided which made this book effort possible.

Preface

There are certainly other areas of supply chain management that could go into a publication such as this to provide an even more holistic view of the subject. Examples can include channel research, hierarchical production planning, advanced planning systems (APS), transport planning for procurement and distribution, and event-based planning; however, the extant literature on these areas is abundant but will be included in future editions of this publication.

On a final note, it is important to highlight the issue of contemporary globalization with regards to fast-changing events that can have a significant impact on supply chains, especially economic and geopolitical concerns. Since supply chains today often span a number of continents and countries, it is critical for business executives to keep a close watch on events such as the European debt crisis, terrorist acts around the world, a potentially nuclear Iran, and even the very recent diplomatic (re)recognition between Cuba and the USA. All of these events provide threats as well as opportunities for global business operations that cannot be ignored.

Bryan Christiansen
PryMarke, LLC, USA
July, 2015

REFERENCES

- Berk, J., & DeMarzo, P. (2014). *Corporate Finance* (3rd ed.). Boston: Pearson.
- Bernstein, J. (2014). *Nuclear Iran*. Cambridge, MA: Harvard University Press. doi:10.4159/harvard.9780674735552
- Christiansen, B. (2015). *Handbook of Research on Global Business Opportunities*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6551-4
- Friedman, G. (2011). *The Next Decade: Where We've Been....And Where We're Going*. New York: Doubleday.
- Haksöz, Ç. (2013). *Risk Intelligent Supply Chains: How Leading Turkish Companies Thrive in the Age of Fragility*. London and New York: CRC Press.
- Kotler, P. (2000). *Marketing Management Millenium Edition* (10th ed.). New York: Prentice-Hall.
- Lechner, F. J., & Boli, J. (2015). *The Globalization Reader* (5th ed.). London: John Wiley & Sons.
- Manzini, R. (2012). *Warehousing in the Global Supply Chain: Advanced Models, Tools, and Applications for Storage Systems*. London: Springer-Verlag. doi:10.1007/978-1-4471-2274-6
- Porter, M. E. (1998). *Competitive Advantage of Nations*. New York: Free Press.
- Stadtler, H., Kilger, C., & Meyr, H. (2015). *Supply Chain Management and Advanced Planning: Concepts, Models, Software, and Case Studies* (5th ed.). London, New York: Springer. doi:10.1007/978-3-642-55309-7

Chapter 1

Strategies for Effective Worldwide Supply Chains

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ABSTRACT

In this study, after analyzing hundreds of papers and books by using a meta-analysis technique, it was revealed that supply chain management suffers from a lack of strategies for many aspects of real-world supply chain activity. Existing supply-related strategies are very primitive and incomplete. Real-world activities in modern supply chains are complicated and multidimensional; consequently, supply chain strategies should reflect and manage these realities. This study aims to reduce the existing shortcomings in current supply chain strategies by proposing the taxonomy of supply chain strategies.

INTRODUCTION

No company can survive without receiving the supplies required for making/providing products/services or without the distributors necessary for selling its products/services. Therefore, supply chain management is crucial for every organization. One of the key contributors to the success and effectiveness of supply chain management is having the right strategies. Sun, Hsu, and Hwang (2009) believe that a proper supply chain strategy can lead to better supply chain management performance. Perez-Franco (2014) stated that inappropriate supply chain strategies can damage innovation in organizations. The current set of supply chain strategies is very basic and incomplete. This chapter introduces a comprehensive set of supply chain strategies to choose from by proposing a taxonomy of supply chain strategies. The taxonomy has emerged as the output of a wide-range meta-analysis of hundreds of supply-chain-related papers and books.

In the remainder of the chapter, first a short background to supply chain and strategic supply chain management is provided, and the difficulties in current supply chain strategies are highlighted. Then, solutions and recommendations to deal with the shortcomings are discussed, leading to the new taxonomy which is presented in this section after a brief description of the research methodology employed in this study. The next section discusses the theoretical and empirical implications of future research directions. Finally, a conclusion completes the chapter.

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Strategies for Effective Worldwide Supply Chains

BACKGROUND

The supply chain has been an inseparable part of doing business in all sectors since trade began a few thousand years ago. The 'Silk Road' is an example of a trade and supply chain between three continents (Asia, Europe, and Africa) more than 2000 years ago. Therefore, conducting business by relying on a worldwide supply chain is nothing new. However, the necessity of having well-developed and appropriate strategies for modern supply chains is relatively new (Sultan & Saurabh, 2013). Modern supply chains, either at the national or international level, require proper supply chain strategies due to the high volume, speed, and variety of merchandise and coverage of modern supply chains compared to traditional or historic ones.

There is consensus among scholars regarding the importance of supply chain management (Felea & Albastroiu, 2013; Oliveira & Gimeno, 2014; Sher & Kim, 2014). Such an essential business activity deserves to have its own dedicated strategies (Ellram & Cooper, 2014), financial systems (Blackman, Holland, & Westcott, 2013) and well-trained staff (Partida, 2013; Swart, Hall, & Chen, 2012). The impact of a good supply chain is not limited to operations management (Frederico & Martins, 2014). As stated by Cordon and his co-authors (2013), "The supply chain poses the most immediate opportunity for significant improvements." (p.42). The study by Lo and Power (2010) revealed that "The way organizations treat their trading partners is affected by the strategy(s) they choose in order to compete." (p. 142). That is to say, a problematic and over-complicated supply chain with unsuitable strategies can create difficulties not only for the operations department but for the whole organization (Cordon, Seifert, & Lang, 2013). Thus, supply chain management and its strategies should be taken seriously in any organization.

Strategic supply chain management is an underdeveloped field with few or no strategies for modern supply chain management. There have been a few but insufficient attempts to develop strategic aspects of supply chains (Singh & Mishra, 2014). Porter's value chain model is the most widely known theoretical framework in supply chains, though this model focuses only on identifying primary and secondary activities in supply chains with no reference to any supply chain strategies. Real-world activities in modern supply chains are complicated and multidimensional; consequently, supply chain strategies should reflect and manage these realities.

It is believed that a lack of, or unsuitable, supply chain strategies can seriously undermine and disrupt supply chain activities (Bode, Wagner, Petersen, & Ellram, 2011; Sun *et al.*, 2009). Strategic supply chain management is not just a limited and company-level issue. The World Economic Forum (2008) in its global risks report mentioned the risk of supply chain disruptions and its consequences as one of the top four threats, alongside food, financial, and energy securities. Therefore, possessing the right supply chain strategies is crucial for any organization. The difficulty is that existing supply chain strategies are not up to the task. These strategy-related weaknesses are explored in the following section.

SHORTCOMINGS IN CURRENT SUPPLY CHAIN STRATEGIES

After analyzing hundreds of papers and books, this study revealed that supply chain management suffers from lack of strategies for many aspects of real-world supply chain activity. Existing supply-related strategies are very basic and incomplete. For instance, Fisher (1997), as one of the pioneers in developing supply chain strategies, suggests just two types of supply strategy: efficiency and responsiveness. He proposes that the nature of products (either functional or innovative) will determine a suitable sup-

Strategies for Effective Worldwide Supply Chains

ply chain strategy. Frazelle (2001) was one of the first scholars to write a book seemingly dedicated to supply chain strategy, nonetheless in his book he, in fact, discussed everything but supply chain strategies. Subramanian and Rahman (2013) tried to deal with supply complexity by suggesting a few basic strategies about product flow and contractual relationships. Dittmann (2012) draws attention to customers then to capabilities, technology, risk and staff in managing supply chains in general and in supply strategies in particular.

Hines (2013, pp. 4-5) claims that customers want seven “Vs” (value, volume volatility, velocity, variety, variability, visibility, and virtuality) that can be delivered by seven “Ss” strategies (sustainability, service, speedy response, suited to customer requirements, standards, systems focused on customer satisfaction, structures and relationships) respectively. Unfortunately, what Hines suggests as seven supply chain strategies are in fact not strategies at all. They are just unrelated sets of activities or influential factors on strategies. Similarly, Lee (2002), by drawing attention to the impact of supply and demand on supply chain strategies, suggested four supply chain strategies: efficient, responsive, risk-hedging and agile. It is self-evident that Lee’s (2002) suggested so-called strategies are characteristics of good supply chains, they are not strategies.

Good supply chain strategies should be able to fulfil the objectives of an organization and other fellow organizations inside a supply chain network. According to Lo and Power (2010), “If members of a supply chain have a common goal to pursue, they can further build their competitive advantage by leveraging a combined focus on this objective.” (p. 140). None of the current supply chain strategies are designed to cover anything beyond an organization. Existing supply strategies focus merely on intra-organizational factors such as lowering product cost, maintaining quality and using the least amount of working capital (Perez-Franco, 2014).

Recently, Pickett (2013) identified some influential factors on supply chain strategies such as “minimizing capital, improving operating margins, lowering the carbon footprint, and enhancing the customer experience” (p. 130), but no supply chain strategies were proposed. Bode *et al.* (2011) focused on two possible strategies (buffering and bridging) when disruption happens in supply chains instead of talking about the right strategies in the first place to prevent any disruptions. Many scholars have attempted to test current limited supply strategies instead of suggesting new strategies. Lo and Power (2010) examined Fisher’s model that includes two strategies (efficiency and responsiveness) and realised that his claim about correlation between supply strategies and product nature is not correct.

A case study by MacKay and Chia (2013) showed that outsourced supply chains as a form of collaboration strategy can create a cost advantage, but in the long run, it may partly hinder new product development. Ironically, vertical integration may look slightly costlier than outsourcing, though it is a better strategy for innovation. Pickett (2013) found that “surprisingly, many companies begin reducing network costs before they define how the network can be fully leveraged to support the business strategy” (p. 130).

A variety of reasons can contribute to shortcomings in strategy development for supply chains. One main reason is insufficient developed human capital in this field. A recent survey by Partida (2013) reveals that there is a huge lack of talent regarding supply chain strategy development. Very few of those who work in supply chain management have the required education or experience in formulation or implementation of the right supply chain strategies. “Without satisfactory performance of qualified and capable employees dedicated to perform as trained, supply chain strategies are difficult to implement successfully” (Swart *et al.*, 2012, p. 10). This study aims to reduce these shortcomings in supply chain strategies by unveiling the taxonomy of supply chain strategies that is discussed in the next section.

Strategies for Effective Worldwide Supply Chains**SOLUTIONS AND RECOMMENDATIONS**

In order to find an effective solution to existing difficulties in supply chain strategies, a large number of mainly supply-related papers and books are reviewed systematically by using the meta-analysis technique. Consequently, a taxonomy emerges that can be seen as a comprehensive solution for a lack of wide and detailed supply chain strategies. In this section, the methodology employed and the taxonomy proposed is briefly discussed.

Research Methodology

The meta-analysis strategy appeared to be a suitable option for this study which is literature review-based theory development research (Borenstein, Hedges, Higgins, & Rothstein, 2009; Cumming, 2011). To determine the studies that can be included in this meta-analysis study, six supply-chain-related keywords were used to search for related papers and chapters in the top 10 related journals and Amazon books.

The six keywords included: supply chain strategy, supply strategy, distribution strategy, sourcing strategy, vertical integration and horizontal integration. The top 10 journals searched were: *Administrative Science Quarterly* (ASQ), *Academy of Management Review* (AMR), *Academy of Management Journal* (AMJ), *Supply Chain Management: An International Journal* (SCMI), *Supply Chain Forum* (SCF), *Journal of Supply Chain Management* (JSCM), *Supply Chain Management Journal* (SCMJ), *International Journal of Managing Value and Supply Chains* (MVSC), *International Journal of Supply Chain Management* (ISCM) and *Supply Chain Management Review* (SCMR).

Hundreds of papers and chapters were found in books (see Table 1); however, the vast majority of them using any of these keywords made no attempt to define the function or types of supply chain strategy. Consequently, these unrelated papers and books were excluded from our study (Cooper, 2009). Analysis of the remaining papers and books that contain relevant discussions has led to detection of a meaningful pattern and connectivity amongst these independent studies. Findings are discussed in the following section.

Table 1. Number of papers and books found based on six keywords

| Keywords | Name of Journal | | | | | | | | | | Amazon Books |
|------------------------|-----------------|-----|-----|------|-----|------|------|------|------|------|--------------|
| | ASQ | AMJ | AMR | SCMI | SCF | JSCM | SCMJ | MVSC | ISCM | SCMR | |
| Supply chain strategy | 0 | 0 | 0 | 87 | 32 | 80 | 1 | 0 | 0 | 31 | 486 |
| Supply strategy | 0 | 2 | 1 | 15 | 1 | 44 | 1 | 1 | 0 | 2 | 157 |
| Distribution strategy | 1 | 0 | 3 | 4 | 0 | 6 | 0 | 0 | 0 | 3 | 712 |
| Sourcing strategy | 1 | 4 | 1 | 25 | 0 | 101 | 2 | 1 | 0 | 7 | 489 |
| Vertical integration | 49 | 108 | 90 | 75 | 0 | 62 | 4 | 2 | 1 | 4 | 1836 |
| Horizontal integration | 4 | 3 | 7 | 8 | 1 | 3 | 0 | 1 | 0 | 3 | 303 |

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Taxonomy of Supply Chain Strategies

The meta-analysis identified some major but fragmented supply chain strategies. These seemingly unrelated strategies are detailed and then connected to each other systematically to shape the taxonomy. This chapter attempts to provide the guidelines required to choose the most suitable domestic and foreign supply chain strategies by introducing the ‘taxonomy of supply chain strategies’.

A supply chain is shaped by a number of vertically and horizontally related organizations that use each other’s outputs as their own inputs. Members of a supply chain network are connected to each other, in terms of ownership, either by collaboration or integration. Collaboration strategies are about doing business with other supply-chain-related but ownership-independent organizations, for instance, a producer buying manufacturing machinery from a company that it does not share ownership with. In contrast, integration strategies focus on doing trade with those supply-chain-related organizations that are partly or fully owned. A bank and a security company that have the same owners and do business with each other is an example of integration strategy (Riemann, 2013).

Furthermore, supply chain strategies in terms of trade borders have two major forms: domestic (supply chain inside one country) or foreign (international supply chain outside a country). Domestic supply chain strategies are not just for domestic companies. Even if an international firm builds all of its products abroad, it needs to use domestic logistics to transport and distribute them. Thus, not only small local companies but also very large multinational enterprises must have ‘domestic’ supply chain strategies (Minea & Surugiu, 2013).

Foreign supply chain strategies are not just for large international enterprises. Any organization of any size that either sells its products/services abroad or uses or trades at least one product/service that is partly or wholly built by/provided by a company abroad may need to consider employing a foreign supply chain strategy. Today, it is almost impossible to find a company that does not possess at least one product that is partly built abroad; consequently, it can be claimed that all existing organizations, regardless of their size, industry or nationality, are part of a worldwide supply chain. In reality, every organization needs to have both domestic and foreign supply chain strategies (Popa & Barna, 2013). The basic taxonomy of supply chain strategies is shaped by combining two basic types of strategy with two types of supply location. This taxonomy encompasses four major supply chain strategies as reflected in Table 2.

Each collaboration or integration strategy can be either vertical or horizontal. Four main forms of supply chain strategy in terms of ownership are: ‘vertical collaboration’, ‘horizontal collaboration’, ‘vertical integration’ and ‘horizontal integration’. Due to the mainly hierarchical nature of supply chains it would be reasonable to consider vertical strategies as partly more important than the set of horizontal strategies (Giri & Rai, 2013).

Vertical strategies can be either ‘upward’ or ‘downward’. The ‘upward vertical’ strategies refer to strategies to collaborate or integrate with suppliers. In contrast, the ‘downward vertical’ strategies are

Table 2. Basic taxonomy of supply chain strategies

| Basic Types of Strategy | Supply Location | |
|-------------------------|------------------------|-----------------------|
| | Domestic | Foreign |
| Collaboration | Domestic Collaboration | Foreign Collaboration |
| Integration | Domestic Integration | Foreign Integration |

Source: Developed for this chapter

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about collaboration or integration with producers, distributors or retailers (Brandon-Jones *et al.*, 2014). The vertical strategies include ‘upward vertical collaboration’ (UVC), ‘downward vertical collaboration’ (DVC), ‘upward vertical integration’ (UVI) and ‘downward vertical integration’ (DVI).

There are two main types of horizontal strategy: the ‘forward horizontal’ which is about collaboration or integration with substitute options (e.g., rail transport in addition to road transport), and the ‘backward horizontal’ which refers to collaboration or integration with another similar option (e.g., working with or having a second retailer). As a result, the four possible horizontal strategies are ‘forward horizontal collaboration’ (FHC), ‘backward horizontal collaboration’ (BHC), ‘forward horizontal integration’ (FHI) and ‘backward horizontal integration’ (BHI). It is a common mistake to associate vertical or horizontal integration strategies with non-organic forms of strategy such as acquisitions or joint ventures (Riemann, 2013). In fact, horizontal or vertical integrations can be done either organically (e.g. a manufacturer establishing its first retail shop), or non-organically (e.g., taking over an existing supplier). To avoid unnecessary complexity, organic or non-organic aspects are omitted from the taxonomy.

As mentioned earlier, from the perspective of the territories in which business among the members of a supply chain network is done, supply strategies can be domestic or foreign. Domestic supply chains have two forms: local or national. Local supply chain strategies are about trade within the supply chain network that is partly or fully located in a town, city or province inside a country. National supply chain strategies cover those supply networks that are situated in different provinces inside the borders of a country. Regional or worldwide supply chain strategies are two aspects of foreign supply chain strategy. While regional supply chain strategies encourage doing business with supply chain networks within a continent, worldwide supply chain strategies are about business with inter-continental supply chain networks (Kull, Ellis, & Narasimhan, 2013).

The comprehensive taxonomy of supply chain strategies emerges as a result of combining detailed types of collaboration and integration with supply locations. The comprehensive taxonomy of supply chain strategies includes 32 strategies of which half are ‘domestic’, either local or national, and the other half are ‘foreign’, with a combination of regional and worldwide development strategies (see Table 3).

Table 3. Comprehensive taxonomy of supply chain strategies

| Types of Collaboration & Integration | Supply Location | | | |
|---|-----------------|--------------|--------------|---------------|
| | Domestic | | Foreign | |
| | Local (L) | National (N) | Regional (R) | Worldwide (W) |
| Upward vertical collaboration (UVC) | L-UVC | N-UVC | R-UVC | W-UVC |
| Downward vertical collaboration (DVC) | L-DVC | N-DVC | R-DVC | W-DVC |
| Forward horizontal collaboration (FHC) | L-FHC | N-FHC | R-FHC | W-FHC |
| Backward horizontal collaboration (BHC) | L-BHC | N-BHC | R-BHC | W-BHC |
| Upward vertical integration (UVI) | L-UVI | N-UVI | R-UVI | W-UVI |
| Downward vertical integration (DVI) | L-DVI | N-DVI | R-DVI | W-DVI |
| Forward horizontal integration (FHI) | L-FHI | N-FHI | R-FHI | W-FHI |
| Backward horizontal integration (BHI) | L-BHI | N-BHI | R-BHI | W-BHI |

Sample decoding: L-UVC = Local upward vertical collaboration; W-BHI = Worldwide backward horizontal integration

Source: Developed for this chapter

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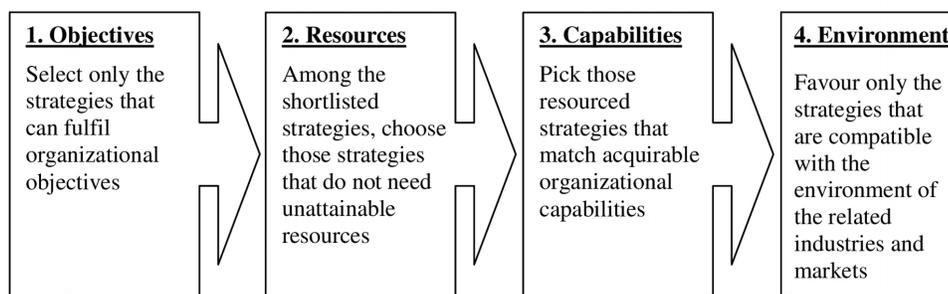
In order to choose a suitable supply chain strategy between collaboration and integration, scholars have suggested different determinants such as cost (MacKay & Chia, 2013; Monin, Noorderhaven, Varra, & Kroon, 2013), supply and demand (Bonardi *et al.*, 2005; Gavetti & Levinthal, 2000), business strategy (Pickett, 2013), type of supplier (Fan, Olorunniwo, Jolayem, & Li, 2013), innovation (MacKay & Chia, 2013), staff capabilities (Kleinbaum, 2012; Partida, 2013), social issues (Levy, 2008; Piskorski, 2013), political markets (Bonardi *et al.*, 2005; Levy, 2008), economic systems (Levy, 2008), supply performance (Fan *et al.*, 2013), marketing (Gavetti & Levinthal, 2000), complexity (Piskorski, 2013), flexibility (Cordon *et al.*, 2013), risk (Fan *et al.*, 2013; Sun *et al.*, 2009), carbon footprint (Pickett, 2013), relational capital (Blatt, 2009) and even organizational justice (Monin *et al.*, 2013). In the next section, a systematic process for selecting appropriate supply chain strategies for different organizations is explained.

Strategy Screening Process to Use the Taxonomy

The strategy screening process is a tool that helps managers to select the right supply chain strategy or strategies from the supply chain strategies taxonomy. The right supply chain strategy for an organization is the strategy that fulfils intended objectives based on acquirable resources and capabilities in the target environment. A combination of these four factors determines the suitable supply chain strategy or strategies for an organization: objectives (corporate- or business-level strategic objectives), resources (financial, human, physical, and intangible), capabilities (abilities, knowledge, and experience of using resources effectively) and environment (economic, regulatory, and social environment of the related industries and markets). While the majority of small and medium sized organizations can select and implement only one or two supply chain strategies at a time, large organizations are required to have a portfolio of supply chain strategies if they want to be successful.

The strategy screening process is a four-step process to pick the most appropriate strategy or strategies among the existing 32 strategies in the taxonomy of supply chain strategies. The four qualifying criteria – objectives, resources, capabilities and environment – act as step one, two, three and four respectively in the strategy screening process. As reflected in Figure 1, during the four stages of the strategy screening process, unrelated and less suitable strategies that do not match the objectives, resources and capabilities of an organization, as well as the environment of the intended markets, would be gradually deleted. The output of the screening process would be only those strategies that can fulfil all four criteria.

Figure 1. Supply chain strategy screening process



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The strategy screening process for the 32 supply chain strategies in the taxonomy can be illustrated in the following strategy screening matrix (see Table 4). In this matrix, each strategy is assessed against the four qualifying criteria. In evaluating each strategy, managers need to tick the related cell in the matrix if the strategy covers the related criterion.

This study has three limitations. The taxonomy of supply chain strategies is not based on primary data; instead, it is based on a meta-analysis of existing studies. The taxonomy has not been examined

Table 4. Supply chain strategy screen matrix

| Types of supply chain strategy | Fulfilment of qualifying criteria | | | |
|--|-----------------------------------|----------|------------|-------------|
| | Objective | Resource | Capability | Environment |
| Local upward vertical collaboration (LUVVC) | | | | |
| Local downward vertical collaboration (LDVC) | | | | |
| Local forward horizontal collaboration (LFHC) | | | | |
| Local backward horizontal collaboration (LBHC) | | | | |
| Local upward vertical integration (LUVI) | | | | |
| Local downward vertical integration (LDVI) | | | | |
| Local forward horizontal integration (LFHI) | | | | |
| Local backward horizontal integration (LBHI) | | | | |
| National upward vertical collaboration (NUVC) | | | | |
| National downward vertical collaboration (NDVC) | | | | |
| National forward horizontal collaboration (NFHC) | | | | |
| National backward horizontal collaboration (NBHC) | | | | |
| National upward vertical integration (NUVI) | | | | |
| National downward vertical integration (NDVI) | | | | |
| National forward horizontal integration (NFHI) | | | | |
| National backward horizontal integration (NBHI) | | | | |
| Regional upward vertical collaboration (RUVVC) | | | | |
| Regional downward vertical collaboration (RDVC) | | | | |
| Regional forward horizontal collaboration (RFHC) | | | | |
| Regional backward horizontal collaboration (RBHC) | | | | |
| Regional upward vertical integration (RUVI) | | | | |
| Regional downward vertical integration (RDVI) | | | | |
| Regional forward horizontal integration (RFHI) | | | | |
| Regional backward horizontal integration (RBHI) | | | | |
| Worldwide upward vertical collaboration (WUVVC) | | | | |
| Worldwide downward vertical collaboration (WDVC) | | | | |
| Worldwide forward horizontal collaboration (WFHC) | | | | |
| Worldwide backward horizontal collaboration (WBHC) | | | | |
| Worldwide upward vertical integration (WUVI) | | | | |
| Worldwide downward vertical integration (WDVI) | | | | |
| Worldwide forward horizontal integration (WFHI) | | | | |
| Worldwide backward horizontal integration (WBHI) | | | | |

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in practice. It should be assessed in different types of organizations to validate its usefulness for practitioners. The comprehensive taxonomy might be considered as partly complex for those researchers or managers who used to very basic and simple types of supply chain strategies.

FUTURE RESEARCH DIRECTIONS

Theoretical Implications

The taxonomy of supply chain strategies provides a comprehensive theoretical framework for any strategy-related research in supply chain management. For future research, it is highly recommended that the possible impact of different industries, countries and organizational characteristics, such as size and legal type, on favouring some supply chain strategies over others is assessed. It would be worthwhile finding out the extent to which the position of an organization in the supply chain network (e.g., being the very first supplier, or being the very last retailer) can influence choice of supply chain strategy. Other recommended research evaluates the effect of related and unrelated diversifications on prioritizing particular supply chain strategies.

Empirical Implications

Managers would find the taxonomy of supply chain strategies a useful and practical tool in selecting the most suitable supply chain strategies in their organizations. The taxonomy has been developed based on real-world supply chain activities, thus it can be utilised for such activities. Compared to previous primitive strategies, the taxonomy of supply chain strategies provides wide and detailed types of strategy for supply chain activities at different levels. This taxonomy can be used by any organization of any size in any industry or country. It considers intra- and inter-organizational factors and networking opportunities.

CONCLUSION

After analyzing hundreds of papers and books by using a meta-analysis technique, this study revealed that supply chain management suffers from a lack of strategies for many aspects of real-world supply chain activity. Existing supply-related strategies are very primitive and incomplete. Real-world activities in modern supply chains are complicated and multidimensional; consequently, supply chain strategies should reflect and manage these realities. This study aims to reduce the existing shortcomings in current supply chain strategies by proposing the taxonomy of supply chain strategies.

The taxonomy of supply chain strategies emerges as a result of combining detailed types of collaboration and integration with supply locations. The taxonomy includes 32 strategies, half of which are 'domestic', either local or national, and the other half 'foreign', with a combination of regional and worldwide development strategies. The strategy screening process is introduced to assist managers to choose the most appropriate strategy or strategies among the existing 32 strategies in the taxonomy of supply chain strategies. In the strategy screening process, the four qualifying criteria are objectives, resources, capabilities, and environment that act as step one, two, three, and four, respectively.

Strategies for Effective Worldwide Supply Chains**REFERENCES**

- Blackman, I. D., Holland, C. P., & Westcott, T. (2013). Motorola's global financial supply chain strategy. *Supply Chain Management: An International Journal*, *18*(2), 132–147. doi:10.1108/13598541311318782
- Blatt, R. (2009). Tough love: How communal schemas and contracting practices build relational capital in entrepreneurial teams. *Academy of Management Review*, *34*(3), 533–551. doi:10.5465/AMR.2009.40633298
- Bode, C., Wagner, S. M., Petersen, K. J., & Ellram, L. M. (2011). Understanding responses to supply chain distributions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, *54*(4), 833–856. doi:10.5465/AMJ.2011.64870145
- Bonardi, J. P., Hillman, A. J., & Keim, G. D. (2005). The attractiveness of political markets: Implications for firm strategy. *Academy of Management Review*, *30*(2), 397–413. doi:10.5465/AMR.2005.16387895
- Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to Meta Analysis*. Sussex, England: Wiley-Blackwell. doi:10.1002/9780470743386
- Brandon-Jones, E., Squire, B., Autry, C. W., & Petersen, K. J. (2014). A contingent resource-based perspective of supply chain resilience and robustness. *Journal of Supply Chain Management*, *50*(3), 55–73.
- Cooper, H. (2009). *Research synthesis and meta-analysis: A step-by-step approach* (4th ed.). Thousand Oaks, CA: Sage Publication. doi:10.4135/9781483348858.n11
- Cordon, C., Seifert, R. W., & Lang, G. (2013). LEGO: Consolidating distribution (Abridged). *Supply Chain Forum: An International Journal*, *14*(1), 42-49.
- Cumming, G. (2011). *Understanding the new statistics: Effect sizes, confidence intervals, and Meta-analysis*. New York: Routledge.
- Dittmann, J.P. (2012). *Supply chain transformation: Building and executing an integrated supply chain strategy*. New York: McGraw-Hill Professional.
- Ellram, L. M., & Cooper, M. C. (2014). Supply chain management: It's all about the journey, not the destination. *Journal of Supply Chain Management*, *50*(1), 8–20. doi:10.1111/jscm.12043
- Fan, C., Olorunniwo, F. O., Jolayem, J., & Li, X. (2013). A characterization of lower-tier supplier visibility practices in supplier relationship management. *Supply Chain Forum: An International Journal*, *14*(1), 2-14.
- Felea, M., & Albastroiu, I. (2013). Managing supply chain risks. *Supply Chain Management Journal*, *4*(2), 1–11.
- Fisher, M. L. (1997). What is the right supply chain for your product? *Harvard Business Review*, March-April, 105–116.
- Frazelle, E. (2001). *Supply chain strategy: the logistics of supply chain management*. New York: McGraw-Hill Professional.

Strategies for Effective Worldwide Supply Chains

- Frederico, G. F., & Martins, R. A. (2014). Performance measurement systems for supply chain management: How to manage its maturity. *International Journal of Supply Chain Management*, 3(2), 24–30.
- Gavetti, G., & Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45(1), 113–137. doi:10.2307/2666981
- Giri, S., & Rai, S. S. (2013). Dynamics of garment supply chain. *International Journal of Managing Value and Supply Chains*, 4(4), 29–42. doi:10.5121/ijmvsc.2013.4403
- Hines, T. (2013). *Supply chain strategies: demand driven and customer focused* (2nd ed.). Oxford, England: Routledge.
- Kleinbaum, A. M. (2012). Organizational misfits and the origins of brokerage in intrafirm networks. *Administrative Science Quarterly*, 57(3), 407–452. doi:10.1177/0001839212461141
- Kull, T. J., Ellis, S. C., & Narasimhan, R. (2013). Reducing behavioral constraints to supplier integration: A socio-technical systems perspective. *Journal of Supply Chain Management*, 49(1), 64–86. doi:10.1111/jscm.12002
- Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, 44(3), 105–119. doi:10.2307/41166135
- Levy, D. L. (2008). Political contestation in global production networks. *Academy of Management Review*, 33(4), 943–963. doi:10.5465/AMR.2008.34422006
- Lo, S. M., & Power, D. (2010). An empirical investigation of the relationship between product nature and supply chain strategy. *Supply Chain Management: An International Journal*, 15(2), 139–153. doi:10.1108/13598541011028741
- MacKay, R. B., & Chia, R. (2013). Choice, change, and unintended consequences in strategic change: A process understanding of the rise and fall of Northco Automotive. *Academy of Management Journal*, 56(1), 208–230. doi:10.5465/amj.2010.0734
- Minea, M., & Surugiu, M. C. (2013). Travel information systems in metropolitan supply chains. *Supply Chain Management Journal*, 4(2), 12–22.
- Monin, P., Noorderhaven, N., Vaara, E., & Kroon, D. (2013). Giving sense to and making sense of justice in postmerger integration. *Academy of Management Journal*, 56(1), 256–284. doi:10.5465/amj.2010.0727
- Oliveira, A., & Gimeno, A. (2014). *Supply chain management strategy: using SCM to create greater corporate efficiency and profits*. Upper Saddle River, NJ: Pearson FT Press.
- Partida, B. (2013). Supply chain talent development is a work in progress. *Supply Chain Management Review*, September/October, 55-57.
- Perez-Franco, R. (2014). Is your supply chain strategy holding back innovation? *Supply Chain Management Review*, July/August, 8-9.
- Pickett, D. (2013). A blueprint for supply chain. *Supply Chain Management Review*, September/October, 30-39.

Strategies for Effective Worldwide Supply Chains

- Piskorski, M. J. (2014). Finn Brunton: Spam: A shadow history of the Internet. *Administrative Science Quarterly*, 59(3), 29–30. doi:10.1177/0001839213518029
- Popa, V., & Barna, M. (2013). The financial supply chain management. *Supply Chain Management Journal*, 4(1), 8–25.
- Riemann, U. (2013). Value-chain oriented identification of indicators to establish a comprehensive process improvement framework. *International Journal of Managing Value and Supply Chains*, 4(3), 55–67. doi:10.5121/ijmvsc.2013.4306
- Sher, M. M., & Kim, S. L. (2014). Supply chain coordination with quantity discount for seasonal demand. *International Journal of Supply Chain Management*, 3(3), 7–15.
- Singh, U. S., & Mishra, U. S. (2014). Supply chain management through vertical coordination in vegetable industry. *International Journal of Supply Chain Management*, 3(3), 148–154.
- Subramanian, N., & Rahman, S. (2013). Supply chain complexity and strategy. In U. Ramanathan & R. Ramanathan (Eds.), *Supply chain strategies, issues and models* (pp. 1–28). London: Springer.
- Sultan, A., & Saurabh, D. (2013). Achieving sustainable development through value chain. *International Journal of Managing Value and Supply Chains*, 4(2), 39–46. doi:10.5121/ijmvsc.2013.4204
- Sun, S. Y., Hsu, M. H., & Hwang, W. J. (2009). The impact of alignment between supply chain strategy and environmental uncertainty on SCM performance. *Supply Chain Management: An International Journal*, 14(3), 201–212. doi:10.1108/13598540910954548
- Swart, W., Hall, C., & Chen, H. (2012). Human performance in supply chain management. *Supply Chain Forum: An International Journal*, 13(2), 10–20.
- World Economic Forum. (2008). *Global risks 2008*. Geneva: World Economic Forum.

ADDITIONAL READING

- Aboutalebi, R., & Tan, H. (2014). A hybrid model for international strategy implementation. *Proceeding of the 56th annual conference of Academy of International Business (AIB)*, Vancouver, Canada. AIB Conference Proceedings.
- Bai, C., & Sarkis, J. (2014). Determining and applying sustainable supplier key performance indicators. *Supply Chain Management: An International Journal*, 19(3), 275–291. doi:10.1108/SCM-12-2013-0441
- Beske, P., & Seuring, S. (2014). Putting sustainability into supply chain management. *Supply Chain Management: An International Journal*, 19(3), 322–331. doi:10.1108/SCM-12-2013-0432
- Bode, C., Hubner, D., & Wagner, S. M. (2014). Managing financially distressed suppliers: An exploratory study. *Journal of Supply Chain Management*, 50(4), 24–43. doi:10.1111/jscm.12036
- Cai, S., & Yang, Z. (2014). The Role of the Guanxi institution in skill acquisition between firms: A study of Chinese firms. *Journal of Supply Chain Management*, 50(4), 3–23. doi:10.1111/jscm.12035

Strategies for Effective Worldwide Supply Chains

- Carnovale, S., & Yenyurt, S. (2014). The role of ego networks in manufacturing joint venture formations. *Journal of Supply Chain Management*, 50(2), 1–17. doi:10.1111/jscm.12015
- Chopra, S., & Meindl, P. (2012). *Supply chain management* (5th ed.). Essex, England: Pearson Education.
- Esper, T. L., & Crook, T. R. (2014). Supply chain resources: Advancing theoretical foundations and constructs. *Journal of Supply Chain Management*, 50(3), 3–5.
- Fischl, M., Scherrer-Rathje, M., & Friedli, T. (2014). Digging deeper into supply risk: A systematic literature review on price risks. *Supply Chain Management: An International Journal*, 19(5/6), 480–503. doi:10.1108/SCM-12-2013-0474
- Gligor, D. M. (2014). The role of demand management in achieving supply chain agility. *Supply Chain Management: An International Journal*, 19(5/6), 577–591. doi:10.1108/SCM-10-2013-0363
- Gold, S. (2014). Supply chain management as Lakatosian research program. *Supply Chain Management: An International Journal*, 19(1), 1–9. doi:10.1108/SCM-05-2013-0168
- Heizer, J., & Render, B. (2013). *Operations management: sustainability and supply chain management* (11th ed.). Harlow, UK: Pearson.
- Holmstrom, J., & Partanen, J. (2014). Digital manufacturing-driven transformations of service supply chains for complex products. *Supply Chain Management: An International Journal*, 19(4), 421–430. doi:10.1108/SCM-10-2013-0387
- Krajewski, L. J., Ritzman, L. P., & Malhotra, M. K. (2012). *Operations management: processes and supply chains*. Harlow, UK: Pearson Education.
- Marley, K., Ward, P. T., & Hill, J. A. (2014). Mitigating supply chain disruptions – a normal accident perspective. *Supply Chain Management: An International Journal*, 19(2), 142–152. doi:10.1108/SCM-03-2013-0083
- Moxham, C., & Kauppi, K. (2014). Using organisational theories to further our understanding of socially sustainable supply chains: The case of fair trade. *Supply Chain Management: An International Journal*, 19(4), 413–420. doi:10.1108/SCM-09-2013-0332
- Niranjan, T. T., Rao, S., Sengupta, S., & Wanger, S. M. (2014). Existence and extent of operations and supply management departmental thought worlds: An empirical study. *Journal of Supply Chain Management*, 50(4), 76–95. doi:10.1111/jscm.12056
- Pagell, M., & Shevchenko, A. (2014). Why research in sustainable supply chain management should have no future. *Journal of Supply Chain Management*, 50(1), 44–55. doi:10.1111/jscm.12037
- Porter, M. E. (1985). *Competitive advantage: creating and sustaining superior performance*. New York: Free Press.
- Ringsberg, H. (2014). Perspectives on food traceability: A systematic literature review. *Supply Chain Management: An International Journal*, 19(5/6), 558–576. doi:10.1108/SCM-01-2014-0026

Strategies for Effective Worldwide Supply Chains

Selviaridis, K., & Norrman, A. (2014). Performance-based contracting in service supply chains: A service provider risk perspective. *Supply Chain Management: An International Journal*, 19(2), 153–172. doi:10.1108/SCM-06-2013-0216

Skilton, P. F. (2014). Value creation, value capture, and supply chain structure: Understanding resource-based advantage in a project-based industry. *Journal of Supply Chain Management*, 50(3), 74–93.

Slack, N., Brandon-Jones, A., & Johnston, R. (2013). *Operations management* (7th ed.). Harlow, UK: Pearson.

Wallenburg, C. M., & Schaffler, T. (2014). The interplay of relational governance and formal control in horizontal alliances: A social contract perspective. *Journal of Supply Chain Management*, 50(2), 41–58. doi:10.1111/jscm.12041

Weele, A. J. (2014). The future of purchasing and supply management research: About relevance and rigor. *Journal of Supply Chain Management*, 50(1), 56–72. doi:10.1111/jscm.12042

Yan, T., & Dooley, K. (2014). Buyer-supplier collaboration quality in new product development projects. *Journal of Supply Chain Management*, 50(2), 59–83. doi:10.1111/jscm.12032

Zimmermann, F., & Foerstl, K. (2014). A meta-analysis of the purchasing and supply management practice-performance link. *Journal of Supply Chain Management*, 50(3), 37–54.

KEY TERMS AND DEFINITIONS

Backward Horizontal: A strategy for collaborating or integrating with other similar options.

Collaboration Strategy: A strategy for doing business with other supply-chain-related but ownership-independent organizations.

Domestic Supply Chain: A supply chain inside one country.

Downward Vertical: A strategy for collaboration or integration with producers, distributors or retailers.

Foreign Supply Chain: An international supply chain outside a country.

Forward Horizontal: A strategy for collaboration or integration with substitute option.

Integration Strategy: A strategy for doing trade with those supply-chain-related organizations that are partly or fully owned.

Upward Vertical: A strategy for collaborating or integrating with suppliers.

Chapter 2

High Level Inventory Network Modeling Approaches

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ABSTRACT

Over the last several decades, practitioners have used the Square Root of N (SQRTN) and the Portfolio Effect models to develop estimates of the change in finished goods inventory investment that will result from potential consolidations of existing supply chain networks. The relative simplicity of these two models has made them commonly used tools of consultants and practitioners. However, what is often overlooked or ignored in practice is that these models may or may not provide accurate projections, and that there are limitations to the range of problems which these models can address. In this paper, we evaluate the accuracy of projections made by the SQRTN and portfolio effect models under a variety of network conditions, and we provide guidance on when and how practitioners can both use and supplement these models. Our evaluations are based on the results of simulation studies which we conducted for this paper as well as many years of inventory management practice in private industry.

INTRODUCTION

The ability to rapidly estimate the implications of potential supply chain infrastructure and policy alternatives on inventory investment requirements represents an important decision support capability to have readily available within a firm. For example, inventory investment is an important component (and cost) of most manufacturing and distribution network strategic studies. At the same time, our observation is that in practice, inventory investment often receives the least “rigorous modeling” attention of the typical major cost components of large-scale network studies. Other key cost components of manufacturing

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and distribution network studies such as one-time location, start-up and closing costs, the optimal level of automation and other technologies to employ, fixed and variable production and warehousing costs, and freight, duties and transport related costs often receive more intense analysis – particularly in studies performed by industry practitioners and consultants¹.

The purpose of this chapter is to present and evaluate from a practitioner's perspective some simple rules of thumb for inventory modeling approaches that one can employ in network studies – *based on the authors' experience in private industry*. These approaches consist of a combination of statistically based methods as well as practical techniques to complement the statistical models.

Another contribution or objective of this chapter is to provide guidance to practitioners on the relative accuracy of some commonly used inventory models. We will offer this perspective through a series of simple illustrative inventory modeling simulations.

Over the last several decades, a significant body of research has developed on two related inventory models; namely, the *square root of N* model (Maister, 1976) and the *portfolio effect* model (Zinn, Levy, & Bowersox, 1989). A key contribution of these two models is that they are cleverly simple (i.e., require minimal inputs), yet when used appropriately, they can provide reasonable “high level” estimates of potential finished goods inventory investment changes resulting from network infrastructure and/or policy changes. The relative simplicity of these two models has made them commonly used tools of consultants and practitioners. This is particularly the case with the square root of N model, which as is well known, and as we will illustrate shortly is extraordinarily straightforward. *However, what is often overlooked or ignored in practice is that there are significant limitations to the range of problems to which one can apply the square root of N model*. In this chapter, we will illustrate some straightforward examples of when to use the square root of N (SQRTN) model or the portfolio effect model, and when more sophisticated models should be considered².

The remainder of this chapter is organized as follows. The next section provides a short review of selected literature on inventory modeling. Following, we will introduce the SQRTN model and the original portfolio effect model to provide context for the rest of the chapter. In the next section, we then review key distribution network attributes and firm specific inventory planning process attributes that one should weigh in determining the appropriate inventory modeling approach. This will lead to a discussion of when to employ certain “complementary” non-statistical inventory analysis techniques that go hand-in-hand with the use of the SQRTN and portfolio effect models. We will then provide illustrative examples of when and how to use the SQRTN model and the portfolio effect models. The chapter concludes with a description of how to put these statistical and non-statistical techniques together to generate an overall distribution network inventory evaluation.

LITERATURE REVIEW

The SQRTN model dates back over 35 years ago to Maister (1976) who noted that his work, for the first time, provided a model based on a mathematical proof which could estimate the impact on inventory investment of consolidating multiple field warehouses into one central facility serving an entire market area. Maister pointed out that others (e.g., Brown, 1962; Heskett, Ivie, & Glaskowsy, 1974; Starr & Miller, 1962); had previously discussed the impact of consolidating warehouses, but had not offered mathematical verification of this impact. As discussed shortly, Maister articulated that the “total inventory in a system is proportional to the square root of the number of locations at which a product is stocked”.

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In 1989, Zinn, Levy, and Bowersox put forward a more general model that they termed the “portfolio effect” model. Noting the need for an inventory centralization model that did not have the restrictive assumptions of the SQRTN model, Zinn et. al. created a model based upon two key variables: (1) the sales correlation of past sales between stocking locations (i.e., the correlation coefficient), and (2) the relative sizes of the standard deviations of sales of individual stocking locations. The authors termed the second variable the “Magnitude” effect as we will review later. Briefly the portfolio effect model eliminated the need for certain key assumptions found in the SQRTN model such as the restriction that the demands of each stocking location be uncorrelated and that all stocking locations have the identical demand variability.

Thus, the portfolio effect model offered additional flexibility in that it can “validly” (from a mathematical perspective) address a wider range of distribution network operating environments than can the SQRTN model. In fact, the SQRTN model represents a sub-case of the portfolio effect model as we will review later. Subsequent to the publication of the original portfolio effect model, Ronen (1990) and Zinn, Levy, and Bowersox (1990) engaged in an interesting dialogue regarding the validity of this model. This dialogue revolved around the question of whether the original portfolio effect model assumed that the distribution stocking locations replenished their inventories based upon the traditional EOQ model or upon the rule that order quantities should equal demand during lead time. Ronen believed that Zinn, Levy, and Bowersox had assumed an EOQ-based replenishment environment (under which he suggested that the portfolio effect model did not properly hold), while Zinn et. al. countered that they had assumed an “order quantity equal to demand during lead time” replenishment environment (under which their portfolio effect model was valid). The interested reader is referred to these articles for additional perspective on the attributes of inventory centralization models.

Tallon (1993) and Evers and Beier (1993) independently both further enhanced the flexibility of the portfolio effect model by developing augmented formulations addressing the “supply side” assumptions or restrictions of the portfolio effect model. Specifically, the original portfolio effect model of Zinn et. al. (1989) assumed that there exists no lead time variability in replenishing stocking locations and that each stocking location has the same average replenishment lead time. Tallon’s and the Evers’/Beier’s respective expansions on the original portfolio effect model facilitated the elimination of these supply side constraints. Additionally, Evers and Beier (1993) offered another significant advancement by developing a formulation that could evaluate the impact on safety stock inventory requirements of network consolidations of n stocking locations to m stocking locations, where $n > m > 1$; and where the proportion of total demand shifted from n to m could be explicitly modeled by location.

Thus, the Evers and Beier model explicitly captures the relative percentage of overall demand for an item across a network that each individual distribution center (DC) currently serves, and that each remaining DC is projected to serve in a consolidated network. Evers (1995) and Evers and Beier (1998) subsequently expanded upon their 1993 paper. Evers (1995) examined a method to incorporate cycle stocks into network inventory consolidation models, and Evers and Beier (1998) explored in more detail the impact of supply lead times on inventory consolidation models.

Mahmoud (1992) also expanded on the original portfolio effect model addressing several topics including: (1) developing a portfolio quantity effect model to directly measure the “quantity” reduction in safety stock (rather than the percent reduction); (2) developing an optimization-based portfolio cost effect model; and (3) evaluating a strategy of multiple “sub-consolidations” on a larger stocking network rather than centralizing to one, single network location. Tyagi and Das (1998) also explored strategies for optimally consolidating inventory maintained at n stocking locations to a subset of m stocking locations.

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In particular, they show how a version of the portfolio effect model can address a situation where the demand variance across the n locations significantly differs. More recently, Wanke (2008) and Wanke and Saliby (2009) evaluated how to determine when the consolidation effects of pooling will be most beneficial.

The preceding overview represents just a small sample of the inventory consolidation modeling literature. Additionally, there exists a large body of related work in such areas as the ‘commonality’ literature which addresses the impact of component standardization on total inventory investment (see e.g., Eppen [1979], Baker et. al. [1986], Collier [1982], and McClain [1984] for some of the foundation literature in this area).

Square Root of N Rule

Maister (1976) asserted that the centralization of inventory from n stocking locations to 1 location could reduce both safety stock and cycle stock. This is true under certain conditions.³ However, Zinn, Levy, and Bowersox (1989) and others have noted that if a firm determines its replenishment order quantities by setting order size equal to demand during lead time, cycle stock does not change when multiple inventory locations are consolidated to one. Therefore, we focus now on applying the SQRTN model to safety stock which is the more traditional inventory component that planners attempt to reduce through network consolidation efforts.

Table 1 provides some standard notation utilized to facilitate our review of the SQRTN model and other models considered later in this chapter.

The tenet that centralization of stocking locations reduces the required inventory investment in safety stock needed to maintain a particular fill rate rests on the principal that centralization diminishes the overall variability of demand (or in actuality, the overall level of forecast error). Consolidation of stocking locations essentially decreases demand variability⁴ (the driver of safety stock requirements) by “pooling” the “non-forecasted demand variability” that would otherwise occur at individual locations. This “pooling” effect acts to “smooth” the variability of demand and forecast error. For example, assume that one central warehouse replaces R regional warehouses of a decentralized network. The standard deviation of demand during lead time (i.e., the measure of demand variability) at this one central stocking location will equal the square root of the sum of the R individual variances of demand at the R stocking locations of the regional network that it (the central warehouse) replaced.⁵

Table 1. Notation

| |
|---|
| <p>r represents an individual regional (or de-centralized) warehouse in a network of stocking locations, $r=1,2,\dots,R$.</p> <p>R represents the total number of warehouse stocking locations of a de-centralized warehouse network.</p> <p>C represents the single “centralized” warehouse that serves the demand of an entire network of customers. Note there are two basic network scenarios: (1) R regional warehouses serve the total demand on a network of customers, and (2) one central warehouse C serves the total demand on the same network.</p> <p>j represents a product that is inventoried, $j=1,2,\dots,J$.</p> <p>dr_j represents the demand for a product j at a stocking location r.</p> <p>D_j represents the total demand for a product j on a network. By definition the demand at central location C for a product j is D_j, or alternatively in the case of a decentralized network $\sum_{r=1}^R dr_j = D_j$.</p> |
|---|

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The importance of this smoothing effect associated with centralization becomes clear when one reviews the classical approach for setting and maintaining a safety stock inventory to protect against stocking out during replenishment lead time. To simplify the illustration, we assume there is no variability in replenishment lead times for supplying an item at stocking locations. Under these assumptions, the classic formula to calculate the safety stock required to provide a desired item fill rate for a product j is:

$$ss_j = k \sigma d_j \quad (1)$$

where:

ss_j = the safety stock inventory quantity for product j

k = a safety factor established by management to yield a desired fill rate. See Brown (1967) for a detailed explanation of this safety factor.

σd_j = standard deviation of demand for product j .

Thus, the smaller the standard deviation of demand for product j (or in practice the smaller the forecast error), the lower is the safety stock required to assure any fill rate for that product.⁶

Figure 1 puts this “smoothing impact” of inventory centralization in perspective through an illustrative example. This figure shows the average results of 54 separate simulations of network demand and replenishment for an item for 250 business days on: (1) a regional network of 3 DCs, and (2) a national network of 1 central DC. For these 54 simulations, the average safety stock inventory requirements of the national one DC network were substantially lower (42.3%) than those required to provide the identical fill rate using a 3 DC regional network. This is identical to the 42.3% reduction that the SQRTN model projects.⁷

Figure 1. Illustrative example of total safety stock requirements for an item on a centralized and a decentralized network

A. Background Assumptions And Data

1. A 3 regional DC (RDC) network or 1 central DC (CDC) serve the same total demand and market area (i.e., two scenarios)
2. The supply replenishment lead time is the same for the 3 RDCs and the CDC (e.g., 5 days).
3. There is no variability in replenishment lead time.
4. The RDCs and CDC are replenished at the same frequency (e.g., once per week)
5. The desired line item fill rate is 97.72%
6. The safety factor (k) to provide a 97.72% fill rate is 2.0

B. Sales And Inventory Data In Units

[The following table shows average results of 54 separate simulations of network demand and replenishment for 250 business days, where daily demands between 0 and 100 with a normal distribution were randomly generated]

| Measure | On Decentralized, Regional Network | | | | Centralized | RDC Total - CDC |
|------------------------------|------------------------------------|------|------|-----------|-------------|-----------------|
| | RDC1 | RDC2 | RDC3 | RDC Total | CDC | |
| Safety Stock Required | 57.4 | 57.4 | 57.5 | 172.3 | 99.4 | 72.9 (42.3%) |
| Average Daily Sales | 50.0 | 50.0 | 49.6 | 149.6 | 149.6 | 0 |

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Based upon Equation [1], one can observe that the ratio of the safety stock for a product j (and for all J products) in a decentralized network of R locations to the safety stock of a centralized network is:

$$\frac{\sum_{r=1}^R k\sigma d_{rj}}{k\sigma D_{Cj}} = \frac{k\sum_{r=1}^R \sigma d_{rj}}{k\sigma D_{Cj}} = \frac{\sum_{r=1}^R \sigma d_{rj}}{\sigma D_{Cj}} \quad (2)$$

where:

σd_{rj} = standard deviation of demand at regional stocking location r for product j

σD_{Cj} = standard deviation of demand at central stocking location C for product j

With some simple algebraic manipulation, and with the assumptions made in Table 2, Maister (1976) shows that Equation [2] implies the following ratio:

$$\frac{\text{decentralized safety stock for a product } j}{\text{centralized safety stock for a product } j} = \sqrt{R} \quad (3)$$

where: R equals the number of decentralized stocking locations.

This allows one to estimate the safety stock requirements for a product j in a potential “centralized” network based on the current safety stock requirements of a decentralized network as follows:

$$ss_{Cj} = \frac{1}{\sqrt{R}} \left(\sum_{r=1}^R ss_{rj} \right) \quad (4)$$

where:

ss_{Cj} = the safety stock inventory quantity of product j at central stocking location C

ss_{rj} = the safety stock inventory quantity of product j at regional location r , and ss_{rj} is

known for all R locations (i.e., ss_{Cj} is the only unknown in Equation [4])

In practice, we have observed that this oftentimes further leads to the following estimate of the impact of consolidation on the safety stock of an entire decentralized network.⁸

$$ss_{CJ} = \frac{1}{\sqrt{R}} \left(\sum_{r=1}^R \sum_{j=1}^J ss_{rj} \right) \quad (5)$$

where:

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ss_{Cj} = the total safety stock inventory quantity of all J products inventoried at central stocking location C

Equation (5), which is not a valid formula, represents the case where the SQRTN model is applied to the total safety stock inventory of *all items* in a network. Although the authors have frequently observed the SQRTN model applied directly to all items in a network as one single group, the correct use of this model requires that one apply it at the *individual item level* (i.e., item by item, one at a time). To correctly obtain a projection of the impact on total safety stock inventory necessitates that one sum the individual evaluations of each item.

We close our brief review of the SQRTN model with Table 2, which summarizes many of the key assumptions of this model. Although the SQRTN model remains a useful rough estimation tool, the rather unrealistic assumptions found in Table 2 illustrate why researchers have developed less “limiting” models such as the original portfolio effect model and its various extensions. These relatively restrictive assumptions also illustrate why it is critical to consider the characteristics and attributes of a firm’s network and inventory planning process before utilizing either the SQRTN or portfolio effect models to evaluate the potential inventory impact of network consolidation for a firm.

The Portfolio Effect Model

Zinn, Levy, and Bowersox (1989) developed the “portfolio effect” model in an effort to provide an “inventory centralization” estimation model that did not have the substantial restrictions of the SQRTN model. Zinn et. al. proposed that “the percent reduction in aggregate safety stock made possible by centralization of inventories be defined as the Portfolio Effect (PE)”. Thus, the portfolio effect model calculates a percent decrease in safety stock that one can then apply to determine a unit or dollar decrease in inventory. Formally, Zinn et. al. define the portfolio effect for any product j as follows:

$$PE_j = 1 - \frac{ss_{Cj}}{\sum_{r=1}^R ss_{rj}}, \text{ for } 0 < PE_j \leq 1 \quad (6)$$

where:

Table 2. Assumptions of the square root law when applied to safety stock

1. No transshipments between facilities, either before or after consolidation, occur.
2. All facilities, both before and after consolidation, use the safety-factor ($k\sigma$) approach to setting safety stock.
3. Lead times and demands are independent and identically distributed random variables.
4. Lead times and demand are independent of each other.
5. Average total system demand remains the same after consolidation.
6. All facilities, both before and after consolidation, have the same safety stock multiple.
7. Variance of lead time is zero for all facilities, both before and after consolidation.
8. All facilities, both before and after consolidation, have the same average lead time.
9. Demands at decentralized facilities are uncorrelated.
10. All decentralized facilities have the same variance of demand.

Source: Evers and Beier (1993)

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ss_{Cj} = the safety stock inventory quantity for a product j when inventory is consolidated at a central location C .

ss_{rj} = the safety stock inventory quantity for a product j at decentralized location r .

The calculation of the portfolio effect for any product $j \in J$ depends upon two variables: (1) the correlation of historical sales between two stocking locations, and (2) the “magnitude” defined as the quotient of the standard deviation of sales of two stocking locations.

To formulate the PE model, recall Equation [1] which defines the safety stock requirements of a product j at a warehouse r as:

$ss_{rj} = k\sigma d_{rj}$, where k is a managerially defined safety factor.

Assuming that k is the same for all potential stocking locations (an assumption of both the square root of N and PE models), Zinn et. al (1989) note that the portfolio effect of consolidating a product j from two locations into one is measured as:

$$PE_j = 1 - \frac{\sigma D_{Cj}}{\sigma d_{1j} + \sigma d_{2j}} \quad (7)$$

where:

σD_{Cj} = standard deviation of network-wide demand (D) for product j at central location C .

σd_{1j} = standard deviation of demand for product j at regional location 1.

σd_{2j} = standard deviation of demand for product j at regional location 2.

Unlike the SQRTN model, the calculation of the standard deviation of demand at a centralized location C in the portfolio effect model includes a term to evaluate the *correlation* of sales between the two decentralized stocking locations ($r = 1,2$ in this example).⁹ Thus, the numerator of Equation [7] σD_{Cj} , is calculated as:

$$\sigma D_{Cj} = \sqrt{\sum_{r=1}^R \sigma d_{rj}^2 + 2(\sum_{r < r'} \sigma d_{rj} \sigma d_{r'j} \rho_{rr'j})} \quad (8)$$

or for the case of two locations,

$$\sigma D_{Cj} = \sqrt{\sigma d_{1j}^2 + \sigma d_{2j}^2 + 2(\sigma d_{1j} \sigma d_{2j} \rho_{12j})} \quad (9)$$

where $\rho_{rr'j}$ is the correlation coefficient of sales between two decentralized locations r and r' for product j .

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Zinn et. al. (1989) define magnitude as the quotient of the standard deviation of demand for a product j at two locations r and r' , or

$$M_{rr'} = \frac{\sigma d_{r'j}}{\sigma d_{rj}}, \text{ for } \sigma d_{r'j} > \sigma d_{rj} \text{ and } \sigma d_{rj} \neq 0 \quad (10)$$

or for the case of two locations

$$M_{12j} = \frac{\sigma d_{1j}}{\sigma d_{2j}}, \text{ for } \sigma d_{1j} > \sigma d_{2j} \text{ and } \sigma d_{2j} \neq 0 \quad (11)$$

Substituting Equations [9] and [11] into [7], for the two location case, yields the following formulation for the two location PE model for product j :¹⁰

$$PE_j = 1 - \frac{\sqrt{M_j^2 + 1 + 2M_j\rho_{12j}}}{M_j + 1} \quad (12)$$

Zinn et.al. (1989) show that one can easily extend the two location formulation (Equation 12) to a multiple location case (e.g., three or more regional DCs), and the reader is referred to these authors for additional background on the PE model.

Briefly, the contributions of the PE model include that it can evaluate the impact of sales correlation between decentralized DCs, as well as the impact of differences in the variability of demand of decentralized DCs, in calculating the potential reduction in safety stock that would result from a centralization of inventory. Zinn et. al. (1989) illustrate that the more positive the correlation of sales between two stocking locations, the lower is the portfolio effect; while conversely, the more negative the demand correlation between two locations, the greater is the portfolio effect. Further, they demonstrate that the impact of “magnitude” on the PE decreases substantially as the sales correlation becomes more positive, while magnitude has an increasingly large impact on the PE as the sales correlation becomes more negative. Finally, it is important to note that while the PE model offers significant flexibility (and fewer restrictions) relative to the SQRTN model, it still does not address “differences” between stocking locations on the “supply side” that can heavily influence safety stock requirements (i.e., lead-time variability). This limitation spawned several enhancements to the original PE model that address supply side issues.

Specifically, Evers and Beier (1993) and Tallon (1993) both developed versions of the original PE model which incorporate supply lead-time variability explicitly into the PE model. The reader interested in the technical details of these models is referred to the 1993 articles by Tallon and by Evers and Beier, respectively, as well as additional articles by Evers (1995), and Evers and Beier (1998). Briefly, the Evers and Beier (1993) PE model can explicitly address a wider range of supply side variabilities. Table 4 (in a later section) offers a bullet list overview of the supply side capabilities and characteristics of both of these PE models. Because the Evers and Beier model can accurately capture a broader array of supply side factors and characteristics, we focus more on the Evers and Beier model (rather than the Tallon model) in our later section on numerical experiments.

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We have now reviewed two well-known models which can project the potential reduction in safely stock inventory resulting from a network consolidation. Before evaluating the accuracy of these models in numerical simulations, we now review other factors that one must consider in assessing the applicability and potential accuracy of an inventory modeling analysis. In considering these “other” factors, again it is important to keep in mind that the SQRTN and PE models are designed to evaluate the impact of inventory consolidation (or pooling) at the individual item level. In other words, it is not technically correct to apply these models to more than one item at a time. If a firm has 1,000 items in its DC network, then proper application of these models would require that each of the 1,000 items be modeled individually (i.e., one at a time). In practice, the authors’ observation is that for understandable, practical reasons this limitation is never adhered to, and instead these models are typically applied to large numbers of items in one single aggregated analysis.

Distribution Network and Firm Planning Process Attributes

The characteristics and parameters of a firm’s manufacturing and distribution network, as well as the attributes of its distribution network planning process can significantly influence the determination of the most appropriate network inventory modeling approach. In this section, we consider some of the key planning process and network infrastructure attributes that may dictate the appropriate modeling approach.

To illustrate how a firm’s planning process can affect the approach and even the validity of an inventory modeling project, assume that we wish to evaluate the potential inventory investment impact of consolidating an existing four distribution center (DC) “make-to-stock” consumer products network to a one DC network. Assume further that the consolidated network would serve the same market area and provide the same inventory line item fill rate as the current four DC network. At first glance, it appears the SQRTN rule represents a good analytic approach to utilize. However, to ascertain if this is really true, we should at the minimum answer the questions posed in Table 3, and likely more questions.

Let’s now briefly consider each of these illustrative questions and planning attributes.

Q1: The SQRTN rule assumes that a firm sets its safety stock targets based upon classic statistical methods, as previously illustrated. Under this planning approach, and subject to its assumptions, the SQRTN rule can produce an approximation of the impact on safety stock of a consolidation from multiple stocking DCs to one DC. However, many firms employ less rigorous, non-statistical methods to plan their safety stock and overall inventory targets. One common industry practice consists of specifying a “weeks of inventory” target for finished goods (e.g., setting a target to always have 10 weeks of inventory of each item). Weeks of inventory is typically calculated based upon either *historical sales averages* (i.e., what is 10 weeks of supply based on historical selling

Table 3. Planning process questions and attributes

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|--|
| <ol style="list-style-type: none"> 1. Is the firm’s process for setting safety stock targets compatible with the SQRTN model? 2. How do the firm’s actual inventory levels compare to its targets? 3. Are there a substantial number of items in inventory that either sell very slowly or are essentially obsolete (even if not formally discontinued)? 4. Does the firm operate in a true “make-to-stock” environment, or is inventory reserved and allocated to key customers well in advance of actual order shipment? |
|--|

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rates) or *forward coverage* (i.e., what is 10 weeks of supply based on the current forecast for an item). When one establishes inventory targets based on weeks of supply, a distribution network will have the identical inventory target level regardless of whether it has one national DC, or two, ten or more DCs that are finished goods stocking locations. This results because the calculation of the total network inventory target is simply -- $(\text{number of weeks' inventory target} / 52) \times (\text{national annual demand})$. This national target is then just proportioned among the total stocking locations based upon their respective proportions of total national demand. Equivalently, one can make this calculation at the individual stocking location level based upon the total demand served by each respective DC. *This “weeks supply” inventory target is thus totally independent of the number of stocking locations a network has.* Therefore, if a firm uses this approach to plan its inventory, one cannot employ the SQRTN rule, the portfolio effect model, or any other statistical inventory model to estimate the impact of changing a network’s number of stocking locations on inventory investment requirements.¹¹

- Q2:** The question of how a firm’s actual inventory levels compare to its target inventory levels also requires evaluation when determining the applicability of models such as the SQRTN and the portfolio effect model. To illustrate the relevance of this question, consider a firm expanding a one DC network to a two DC network (i.e., a potential decentralization decision). Further, assume the not too uncommon situation that the firm’s actual inventory levels significantly exceed the firm’s inventory targets that a statistical inventory model indicates are required to provide a desired fill rate. This may be a result of poor planning capabilities or other factors. Now assume that the firm embarks on a rigorous inventory initiative designed to reduce its finished goods inventory dramatically. In practice, a scenario could unfold where a firm both expands its DC network (from 1 location to 2 locations), while at the same time it lowers its total inventory investment, and still maintains a desired fill rate. In evaluating such a scenario, one must determine if it is appropriate to use a statistical model for predictive inventory investment purposes. Clearly from a theoretical and “opportunity cost” perspective, it is important to recognize that expanding to two DCs from one DC will increase the inventory investment requirements necessary to yield the identical fill rate. However, in practice, one may decide that a firm’s actual inventory will decrease because the current level of inventory in the one DC network exceeds the true requirements needed to deliver the fill rate desired in the two DC scenario. In such a situation, one must decide whether it is appropriate to present an organization with theoretical modeling results, practical results based on the current status of the firm’s inventory, or perhaps a mix of both.
- Q3:** Whether a firm has a substantial portion of its inventory tied up in very slow moving or perhaps even dead/obsolete inventory can also influence the decision as to the best supply chain inventory modeling approach. It is an obvious point that if an item in inventory has no recent active sales (e.g., an item that has not sold even a unit over the previous 12 months) then consolidating a network (e.g., from 3 locations to 1) will not reduce the inventory level of this particular item. *Thus, even in situations where a statistical inventory model represents an appropriate tool to estimate potential changes in inventory investment requirements, one generally must employ complementary non-statistical techniques to determine which items lend themselves to statistical models.* A standard approach in the situation described here is to first evaluate the total inventory in a network by item. This evaluation should identify both non-selling and very slow selling items. One should then eliminate most or all of these items from the statistical inventory analysis, and treat this lump

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of non-selling inventory outside of the statistical model. Experience suggests that this type of pre-processing of network inventory data is often overlooked in practice. When this pre-processing step is skipped, it can lead to over-estimates of the potential inventory investment savings that may result from consolidating the number of locations in a network.

Q4: The question of whether a firm allows inventory to be reserved or allocated in advance for certain customers also influences how effective or ineffective a role inventory models such as the SQRTN can play. Consider a manufacturing firm that uses inventory “reservation” in advance as a standard business practice. In this example “inventory reservation” means that for certain key customers (or perhaps a key business channel), a firm reserves inventory in advance for their orders. This may mean, for example, that finished goods inventory is tagged on the warehouse floor days or weeks in advance and set aside for particular customers’ orders, while other customers’ orders are filled on a first come first serve basis from the non-reserved inventory.

Briefly, if a firm uses a “reservation” approach, a standard statistical model will not necessarily develop accurate or valid safety stock targets. Specifically, if the model assumes a “make to stock” environment rather than a “reserved” environment, then the safety stock target will be incorrect. The SQRTN model (and the portfolio effect model) assume a make-to-stock environment.

This sample of inventory planning process questions and attributes has illustrated some of the issues to consider before applying the SQRTN or similar models to obtain projections of potential inventory changes on a network. In summary, one must be careful to ascertain that the application of such models has a reasonable statistical basis for the particular network under study. With this background, we will now examine several examples of how and when to use the SQRTN and portfolio effect models, and then present numerical simulation results. Later, we discuss several non-statistical techniques and methodologies that practitioners can and should use to complement statistical inventory modeling efforts.

Illustrative Applications of the Square Root of N and Portfolio Effect Models

In this section, we illustrate several hypothetical cases where it would be appropriate to utilize the SQRTN, or one of the portfolio effect models. There are several assumptions that will be commonly made for any model and the cases that follow. These assumptions include:

1. The DCs stock and supply a common set of items. Any consolidation model obviously only applies to items that are commonly stocked at all DCs. (Note that there can be additional items that are stocked by a subset of the total DCs or even one DC. These items must be treated separately).
2. The inventory items that the models evaluate are “active” items. By this, we mean that obsolete inventory items have been identified and treated separately from those items that our models will evaluate (see the previous discussion of planning process questions and attributes).

Subject to these assumptions, we now consider several inventory cases. Table 4 describes these cases and the appropriate model to address each case. We leave it to the reader to review this figure which sets the stage for the numerical simulation presented in the next section.

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Table 4. Models for alternative inventory consolidation cases

| Inventory Consolidation Case: | Demand Characteristics | Supply Characteristics | Model To Apply |
|--|--|---|---|
| <i>2 or more regional DCs consolidated to 1 national DC</i> | <ul style="list-style-type: none"> • Demands at each DC are uncorrelated • DCs have same variability of demand | <ul style="list-style-type: none"> • Each DC has the same replenishment lead-time • There is no variability in replenishment lead-time at each DC | Square Root of N (Maister, 1976) |
| <i>2 or more regional DCs consolidated to 1 national DC</i> | <ul style="list-style-type: none"> • Demands at DCs have some correlation • The variability of demand differs at each DC | <ul style="list-style-type: none"> • Each DC has the same replenishment lead-time • There is no variability in replenishment lead-time at each DC | Portfolio Effect (Zinn et.al., 1989) |
| <i>2 or more regional DCs consolidated to 1 national DC</i> | <ul style="list-style-type: none"> • Demands at DCs have some correlation • The variability of demand differs at each DC | There is (or can be) variability in the replenishment lead-time at each DC | Portfolio Effect Enhanced To Capture Supply Variance (Evers and Beier, 1993), or (Tallon, 1993) |
| <i>3 or more regional DCs consolidated to 2 or more DCs (i.e., some consolidation occurs, but not to just 1 DC), or all regional DCs consolidated to 1 national DC</i> | <ul style="list-style-type: none"> • Demands at DCs have some correlation • The variability of demand differs at each DC | <ul style="list-style-type: none"> • There is (or can be) variability in the replenishment lead-time at each DC • There is a significant difference between the average replenishment lead-time and/or variability in lead-time between the national DC and the 2 or more regional DCs • 1 or more DCs have different line item fill rate targets (i.e., different safety factors) | Portfolio Effect Enhanced To Capture Supply Variance And Local Consolidations (Evers and Beier, 1993) |

Model Simulations

To develop a perspective on how accurate (i.e., reliable) SQRTN and portfolio effect-based projections are, we apply the models in Table 4 to several network inventory consolidation problems patterned upon real world data. Additionally, we conduct actual simulations of these network consolidation scenarios. These simulations measure the actual impact on inventory investment requirements of several network consolidations. We then compare SQRTN and portfolio model-based projections of the change in inventory resulting from these inventory consolidations against actual simulations to measure the accuracy of the inventory model-based projections.

Network Consolidation Scenarios

To facilitate our numerical illustrations, we define several small regional inventory networks serving a national market (e.g., the US). These regional networks have the following attributes:

- In different scenarios, there are 4, 3 or 2 regional distribution centers (RDCs), each of which serves a sub-region of the national market.
- Each RDC serves the customers in its service region exclusively.
- There are no transshipments between RDCs.

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Additionally, we make the following assumptions which apply to the RDC networks and the centralized (CDC) network that result from the consolidation scenarios to be defined shortly.

- Average total network demand is the same for the RDC network and the centralized (CDC) network.
- Each DC stocks the same 10 active items (i.e., the RDCs and CDC stock the identical products).
- Average daily demand on the network ranges from 500 units for the lowest sales item to 1400 units for the highest sale item.
- The demands at each DC have varying levels of correlation.
- The variability of demand for each item at each DC can differ.
- Inventories at each DC are established based on the statistical safety factor method.
- The supply replenishment lead-time and the variability of these lead-times can vary by DC.
- Lead-times and demands are independent and identically distributed random variables.

To model inventory requirements for this network correctly, we need data on several of the variables just referenced (e.g., supply lead-time) for each item at each DC. Appendix 2 provides more details on these data requirements and the parameter values used. Table 5 describes the network consolidation scenarios that we evaluate using the SQRTN model, two portfolio effect models, and the RDC and CDC mathematical simulation models.

RESULTS

The tables in this section display the results obtained from modeling experiments run where we assume that a firm consolidates each of the RDC network scenarios in Table 5 to a single, centralized DC (i.e.,

Table 5. Description of regional DC (RDC) scenarios

| Scenario | # of RDCs | Percent of Demand Served by: | | | |
|----------|-----------|------------------------------|-------|-------|-------|
| | | RDC 1 | RDC 2 | RDC 3 | RDC 4 |
| 1 | 4 | 25 | 25 | 25 | 25 |
| 2 | 4 | 50 | 17 | 17 | 16 |
| 3 | 4 | 35 | 35 | 15 | 15 |
| 4 | 3 | 34 | 33 | 33 | -- |
| 5 | 3 | 60 | 20 | 20 | -- |
| 6 | 3 | 40 | 30 | 20 | -- |
| 7 | 2 | 50 | 50 | -- | -- |
| 8 | 2 | 75 | 25 | -- | -- |
| 9 | 2 | 60 | 40 | -- | -- |

■ In each scenario, the RDCs are consolidated to one national CDC.
 ■ In scenarios 1, 4 and 7, the magnitude (i.e., the quotient of the standard deviations of demand) between all RDCs are equal.
 ■ In scenarios 2, 3, 5, 6, 8 and 9, the RDC or RDCs serving the larger percent of total network demand also have larger standard deviations of demand than the RDCs serving a smaller portion of total demand. (i.e., The *magnitudes* between all RDCs are not equal.) In scenario 1, 4, and 7, the magnitudes between RDCs are identical.

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a CDC replaces the RDC network). To conduct these experiments, we developed two simulation models (one for the RDC network and one for CDC network), and we employed the following inventory models:

1. The SQRTN model (Maister, 1976)
2. The original portfolio effect model (Zinn, Levy, & Bowersox, 1989)
3. The portfolio effect model enhanced to include supply lead time and variability (Evers & Beier, 1993)

We simulated daily sales and stock replenishments over 250 days (i.e., about one year of business days) at each DC on the RDC network, and at the CDC. We assumed that each RDC and the CDC had item level fill rate targets of 97.72%. Briefly, our research methodology consisted of the following steps at a high level:

1. For each scenario, run the RDC simulation model to determine the safety stock requirements (in units) of each individual RDC and the RDC network in total.
2. Employ each of the three models (i.e., the SQRTN model, the original portfolio effect model, and the Evers and Beier enhanced version of the original PE model) to develop three separate projections of how the safety stock requirements of the RDC network would change if the RDC network was consolidated to one national CDC. (i.e., Use each of the three models to project how the RDC safety stock requirements determined in step 1 would change if the RDC network was consolidated to a CDC network.)
3. Run the CDC simulation model to determine the actual safety stock requirements necessary for the CDC (which would replace the RDC network).
4. Compare the change in safety stock (resulting from consolidating to a CDC network from an RDC network) predicted by each of the three models in step 2 to the actual change that would occur to determine how accurate each of the three models were. The actual change in safety stock requirements is the difference between the results generated by the RDC simulation model and the CDC simulation model. Then changes predicted by each of the three inventory models are compared to this actual change – to determine the relative accuracy of the three inventory models.
5. For each scenario, we completed six separate simulations based on six different randomly generated seeds, each of which generated the data necessary for the RDC and CDC simulations.¹² All results shown in the tables represent the averages of the six RDC and CDC simulations run for each scenario and the six model projections generated for each scenario.¹³ The summary results of analysis of variance (ANOVA) are reported in Appendix 3.

We begin our experiments with an illustration in Tables 6, 7, and 8 of how two “demand related” factors can affect the accuracy of the SQRTN model. These two factors are: (1) the *magnitude* (i.e., the ratio of the standard deviations of demand for an item at two RDCs¹⁴); and (2) the demand coefficient of variation (COV) for an item between RDCs which is set to either 0.20 (low) or 0.50 (medium to high) per Cachon and Tierwiesch (2013). The COV of demand at a DC is the ratio of the standard deviation of demand to the mean demand for an item (i.e., the standard deviation/mean.) Thus, the COV of demand is a measure of the relative variability of demand. Note that there is no “replenishment supply” variability in these initial experiments (i.e., the assumed supply lead time was 5 days and the standard deviation of supply lead time was 0 for each DC).

High Level Inventory Network Modeling Approaches*Table 6. Illustration of “Magnitude” impact on SQRTN model accuracy*

| Scenario | Total Safety Stock (SS) on Regional Network Based on Actual Simulation (units) | Projected total SS (in units) on Consolidated Network Based on: | | Projected Percent Change in Total SS on Consolidated Network Based on: | | Over (Under) Estimate by SQRTN Model |
|----------|--|---|----------------|--|-------------------|--------------------------------------|
| | | Sq Rt N: Maister | Actual Simul'n | Sq Rt N: Maister | Actual Simulation | Model – Actual Simulation |
| 1 | 8,646 | 4,323 | 4,323 | 50% | 50% | 0% |
| 2 | 4,304 | 2,152 | 2,469 | 50% | 43% | 7% |
| 3 | 4,308 | 2,154 | 2,310 | 50% | 46% | 4% |
| 4 | 8,643 | 4,990 | 4,972 | 42% | 42% | 0% |
| 5 | 4,300 | 2,482 | 2,830 | 42% | 34% | 8% |
| 6 | 3,877 | 2,238 | 2,304 | 42% | 41% | 1% |
| 7 | 8,570 | 6,060 | 6,043 | 29% | 29% | 0% |
| 8 | 4,276 | 3,023 | 3,369 | 29% | 21% | 8% |
| 9 | 4,281 | 3,027 | 3,076 | 29% | 28% | 1% |

■ Demand coefficient of variation of 0.20 at each DC.
 ■ Each number (i.e., unit or percent) represents the average for the 6 simulations run (using 6 different seeds) for each individual scenario.
 ■ The three 0% estimate errors in the last column are non-zero but each rounds to 0%.

Table 7. Illustration of “Demand Correlation” impact on SQRTN model accuracy

| Scenario | Demand Correlation | Total Safety Stock on Regional Network Based on Actual Simulation (units) | Projected total SS (in units) on Consolidated Network Based on: | | Projected Percent Change in Total SS on Consolidated Network Based On: | | Over (Under) Estimate by SQRTN Model |
|----------|--------------------|---|---|-------------------|--|-------------------|--------------------------------------|
| | | | Sq Rt N: Maister | Actual Simulation | Sq Rt N: Maister | Actual Simulation | Model – Actual Simulation |
| 1 | -1.0 | 8,661 | 4,331 | 0 | 50% | 100% | (50%) |
| 1 | -0.5 | 8,659 | 4,330 | 3,061 | 50% | 65% | (15%) |
| 1 | 0.0 | 8,651 | 4,325 | 4,321 | 50% | 50% | 0% |
| 1 | 0.5 | 8,634 | 4,317 | 5,294 | 50% | 39% | 11% |
| 1 | 1.0 | 8,663 | 4,331 | 6,149 | 50% | 29% | 21% |
| 7 | -1.0 | 8,532 | 6,033 | 0 | 29% | 100% | (71%) |
| 7 | -0.5 | 8,577 | 6,065 | 4,297 | 29% | 50% | (21%) |
| 7 | 0.0 | 8,581 | 6,068 | 6,059 | 29% | 29% | 0% |
| 7 | 0.5 | 8,491 | 6,004 | 7,345 | 29% | 13% | 16% |
| 7 | 1.0 | 8,532 | 6,033 | 8,532 | 29% | 0% | 29% |

■ Demand coefficient of variation of 0.20 at each DC.
 ■ In scenario 1, the demand correlations (e.g. -1.0 for the first experiment) were set between RDCs 1 and 2, and RDCs 3 and 4. All other correlations were randomly distributed closely around 0.0.
 ■ In scenario 7, the demand correlations were between RDCs 1 and 2 – the only RDCs in scenario 7.
 ■ Each number (i.e., unit or percent) represents the average for the 6 simulations run (using 6 different seeds) for each individual scenario.
 ■ The two 0% estimate errors in the last column are non-zero but each rounds to 0%.

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Table 8. Illustration of “combined magnitude and demand correlation” impact on SQRTN model accuracy

| Demand Correlation | Scenarios With Minimum and Maximum Overestimates | Scenario With Minimum and Maximum Underestimates | Range of Over or (Under) Estimates | |
|--------------------|--|--|------------------------------------|---------------------------|
| | | | COV = .20 | COV = .50 |
| -1.0 | No Overestimates | All from 5 to 7* | (13%) to (71%) | (13%) to (64%) |
| -0.5 | No Overestimates | All from 5 to 7* | (2%) to (21%) | (2%) to (21%) |
| 0.0 | 9, 6, 3, 2, 5, 8 | 1, 4, 7** | 1% to 8% & (.1%) to (.2%) | 1% to 8% & (.1%) to (.4%) |
| 0.5 | All from 4 to 8*** | No underestimates | 9% to 19% | 9% to 19% |
| 1.0 | All from 4 to 9*** | No underestimates | 17% to 29% | 17% to 29% |

* The SQRTN model produced underestimates for all scenarios ranging from scenario 5 (smallest underestimate) to scenario 7 (largest underestimate)

** Recall that in scenarios 1, 4, and 7, the RDCs all have equal mean and standard deviations of demand.

*** The SQRTN model produced overestimates for all scenarios ranging from scenario 4 (smallest overestimate) to scenario 8 (largest overestimate)

Table 6 shows that in 6 of the 9 scenarios, the SQRTN model *overestimates* the actual reduction in safety stock that would be achieved by consolidating from an RDC network to a CDC. While the overestimates are relatively small, ranging from 1% to 8%, the only deviation from the extremely restrictive (and unrealistic) assumptions of the SQRTN model for these experiments is that the RDCs do not have the same demand variance. Note that in scenarios 1, 4 and 7, each RDC serves the same proportion of total network demand (and each RDC has the same variance of demand). In these scenarios, the SQRTN model accurately projects the reduction in safety stock requirements which would result from an RDC network consolidation to one centralized CDC. However, as soon as the RDCs have unequal demand variances (i.e., unequal standard deviations), the accuracy of the SQRTN model degrades.

Table 7 illustrates how different levels of *demand correlation* between the same item at two or more DCs can impact the accuracy of the SQRTN model. Recall that a key assumption of the SQRTN model is that demands at decentralized facilities are uncorrelated. In Table 7, we evaluate the accuracy of the SQRTN model for different levels of demand correlation between individual items ranging from perfectly negative correlation (-1.0) to perfectly positive correlation (1.0). We focused on scenarios 1 and 7 in these experiments because each RDC serves the same proportion of total network demand (25% in scenario 1, and 50% in scenario 7) and each RDC has the identical demand variance. Thus, scenarios 1 and 7, adhere strictly to the assumptions of the SQRTN model with the exception that demands are correlated between RDCs 1 and 2, and between RDCs 3 and 4 (in scenario 1); and between RDCs 1 and 2 (in scenario 7).

The SQRTN model significantly underestimates the reduction in safety stock from a potential RDC consolidation when highly negative demand correlations exist, while the model significantly overestimates the reduction in safety stock when demands are highly positively correlated. For example, Table 7 reveals that in scenarios 1 and 7 the SQRTN model underestimated the potential reduction in safety stock by 50% and 71%, respectively, when demands are perfectly negatively correlated. Conversely, the SQRTN model overestimates the potential reduction by 21% and 29% when demands are perfectly positively correlated. In practice (e.g., in the consumer products industry) firms very rarely have RDC networks where demands are close to perfectly negatively or positively correlated. However, it is not unusual to

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observe significant positive or negative demand correlations in the shipping patterns of RDCs for firms in industries such as consumer products. Thus, it is important to note that positive demand correlations between items at RDCs can lead to substantial overestimates of safety stock reductions by the SQRTN model, while negative demand correlations can lead to substantial underestimates.¹⁵

Table 8 presents experiments where both “magnitude” and “demand correlation” could impact the results obtained. To develop this table, we ran experiments for all 9 scenarios (Table 5) and for demand correlations of -1.0, -0.5, 0, 0.5 and 1.0. Additionally, we evaluated another demand side factor that could impact the change in safety stock requirements (and the accuracy of inventory model projections) on an actual RDC consolidation; namely, the coefficient of variation (COV) of demand. For the experiments in Table 8, we used COVs of 0.20 and 0.50, which represent opposite cases of relatively low variability (0.20) and medium to approaching high variability (0.50) per Cachon and Tierwiesch (2013).

A review of Table 8 shows that depending upon the magnitude relationships and the demand correlation relationships between items at RDCs, the SQRTN model overestimated the reduction in safety stock from RDC consolidations scenarios by as much as 29%, but conversely, underestimated this potential reduction by up to 71%.¹⁶ For all the scenarios we modeled with demand correlations between -0.5 and 0.5 (a more likely range in the real world than -1.0 to 1.0), underestimates of safety stock reduction ranged as high as 21%, while overestimates ranged up to 19%. Again, it is important to note these results reflect experiments which only varied demand relationships at the RDCs. The variability of supply lead time remained constant in the experiments displayed in Tables 6, 7 and 8.

We next ran many simulations in which we relaxed the assumption that supply lead times would remain constant. For example, we generated a series of simulations where we assumed the average lead time for each item at each RDC and CDC was 5 days and the standard deviation of lead time was 1 day.¹⁷ For these set of simulations, we focused on scenarios 1, 2, 3, 7, and 8. Scenarios 1, 2, and 3 (4 RDCs to 1 CDC) represent situations where the RDCs are equal in demand served (Scenario 1), there is one large RDC and three smaller RDCs (Scenario 2), and there are two medium sized and two smaller RDCs (Scenario 3). Scenarios 7 and 8 (2 RDCs to 1 CDC) represent cases with two equal sized RDCs (Scenario 7), and one large and one small RDC (Scenario 8). Because these simulations had both demand and supply side variability, we employed the Evers and Beier model (1993), as well as the SQRTN model and the original PE model (Zinn et. al., 1989) to project the safety stock inventory impact of these consolidation scenarios. Tables 9 and 10 present summary results of these simulations.

Before commenting on the results in Tables 9 and 10, we present a second set of results in Tables 11 and 12, and then we discuss these results together.

The simulations in Tables 11 and 12 differ from those of Tables 9 and 10 in that we allowed the CDC to have different average supply replenishment lead times and different lead time standard deviations than the RDCs in these runs. Specifically, we simulated scenarios where the average and standard deviations of lead times at the CDC compared to the RDCs were as follows:

1. CDC's and RDCs' average and standard deviations of lead time are equal,
2. CDC has 1 day lower lead time standard deviation,
3. CDC has 1 day shorter average lead time, and
4. CDC has 1 day lower lead time standard deviation and 1 day shorter average lead time.

Tables 11 and 12 present results for scenarios 1 and 2 respectively [i.e., (1) four equal sized RDCs and (2) one larger RDC and three smaller RDCs].

High Level Inventory Network Modeling Approaches*Table 9. Illustration of “supply side variability” impact on inventory models’ accuracy (where the RDCs and CDC have same supply lead times and variability)*

| Demand Correlation | Scenario | Inventory Models’ Over (Under) Estimate of Safety Stock Reduction: (model-actual) / (actual) | | |
|--|----------|--|----------------------------------|---|
| | | SQRTN Model (Maister) | Original PE Model (Zinn et. al.) | PE Model with Supply Side Extension (Evers & Beier)** |
| -0.5 | 1 | 42% | 56% | (0.6%) & 0.6% |
| | 2 | 43% | 46% | (0.5%) & 0.5% |
| | 3 | 42% | 54% | (0.6%) & 0.6% |
| | 7 | 22% | 43% | (0.4%) & 0.5% |
| | 8 | 24% | 29% | (0.3%) & 0.3% |
| 0.0 | 1 | 43% | 43% | (0.5%) & 0.5% |
| | 2 | 44% | 36% | (0.4%) & 0.4% |
| | 3 | 43% | 40% | (0.5%) & 0.5% |
| | 7 | 25% | 25% | (0.3%) & 0.3% |
| | 8 | 26% | 18% | (0.2%) & 0.2% |
| 0.5 | 1 | 44% | 33% | (0.4%) & 0.4% |
| | 2 | 45% | 28% | (0.3%) & 0.3% |
| | 3 | 45% | 29% | (0.3%) & 0.3% |
| | 7 | 27% | 11% | (0.1%) & 0.2% |
| | 8 | 28% | 8% | (0.1%) & 0.1% |
| Mean Absolute Error | | 36% | 33% | 0.4% |
| Minimum Absolute Error | | 22% | 8% | 0.1% |
| Maximum Absolute Error | | 45% | 56% | 0.6% |
| <ul style="list-style-type: none"> • Demand coefficient of variation = 0.20 at each DC; average lead time = 5 days; standard deviation of lead time = 1 day • Each individual percent represents the average for the 6 simulations run (using 6 different seeds) for each model for each individual scenario. The summary mean, minimum and maximum absolute percents are based on the 15 averages shown in the body of the table. These 15 averages are derived from 90 individual simulations. • ** the first percent is the “average” and the second percent is the “absolute average” of the 6 simulation runs for each scenario. Both are shown because for some scenarios, the 6 individual Evers and Beier model projections generated both over and under estimates – thus the “average” for some scenarios is affected by positive and negative numbers offsetting each other. The Maister and Zinn et. al. models produced all overestimates or all underestimates for any individual scenario. Thus, calculations of absolute averages for individual scenarios is not necessary for these models. One decimal is shown for the Evers and Beier model to clarify that the model estimate was not identical to the actual result. | | | | |

Summary Comments: Tables 9, 10, 11, and 12

1. A review of Tables 9, 10, 11 and 12 clearly demonstrates that the Evers and Beier (EB) PE model generates significantly more accurate estimates of the potential reduction in safety stock inventory from a network consolidation, than does either the SQRTN model or the original Zinn, Levy and Bowersox (ZLB) PE model. The mean absolute error of the EB model was 0.4% and 1.2%, respectively, in the simulations of Tables 9 and 11; while the SQRTN (36% and 23%) and ZLB (33% and 24%) models had significantly higher error rates. Perhaps more importantly, the EB model consistently generated accurate projections, while the other two models’ accuracy varied greatly from run to run, depending upon the network attributes.

High Level Inventory Network Modeling Approaches*Table 10. Illustration of “supply side variability” impact on inventory models’ accuracy for networks with different COV of demands (where the RDCs and CDC have same supply lead times and variability)*

| Measure of Error | COV | Inventory Models’ Over (Under) Estimate of Safety Stock Reduction | | |
|------------------------|------|---|----------------------------------|---|
| | | SQRTN Model (Maister) | Original PE Model (Zinn et. al.) | PE Models with SS Extension (Evers and Beier) |
| Mean Absolute Error | 0.20 | 36% | 33% | 0.4% |
| | 0.50 | 23% | 20% | 0.5% |
| Minimum Absolute Error | 0.20 | 22% | 8% | 0.1% |
| | 0.50 | 6% | 5% | 0.3% |
| Maximum Absolute Error | 0.20 | 45% | 56% | 0.6% |
| | 0.50 | 33% | 36% | 0.7% |

The percents shown are based on the 15 averages (derived from 90 total simulations) for networks with COV = 0.20 and COV = 0.50 (i.e., 180 simulations in total).

- These results were anticipated because the EB model is the only model that explicitly evaluates the impact of supply side lead times and variances. Nevertheless, these results provide valuable perspective on the relative accuracy of these models, as well as the relative consistency of each model’s projections.
- A review of Tables 10 and 12 illustrates that the EB model also generated much more accurate results than the SQRTN and ZLB models for networks with a COV = 0.50, as well as for networks with COV = 0.20, as previously observed in Tables 9 and 10. Thus, the EB model demonstrated a capability to generate accurate predictions under a wide variety of demand variability conditions.¹⁸
- There is a tendency for the SQRTN and ZLB models to overestimate the potential reduction in safety stock that will be achieved by consolidating a RDC network to a centralized network in scenarios where the average supply lead time and standard deviation remains the same before and after network consolidation.¹⁹
- Because the SQRTN model does not recognize the impact of demand correlations between products, the relative percentage by which the SQRTN model “overestimates” the potential safety stock reduction from consolidation decreases when the RDCs have negatively correlated demands. This relative “decrease” becomes more evident as the demand coefficient of variation in a network increases (i.e., as the variability of demand increases).
- Conversely, and as expected, the presence of positive demand correlation between products at RDCs causes the SQRTN model to overestimate the potential for safety stock reduction resulting from centralization by an even greater amount than would otherwise occur. Again this impact becomes much more pronounced as the demand coefficient of variation in a network increases.
- When the CDC has a lower variance in supply lead times than the RDCs, and/or a shorter average supply lead time than the RDCs; the SQRTN and PE models do not overestimate potential safety stock reductions by as great an amount as they would otherwise. This occurs simply because these two models don’t recognize the dampening effects on safety stock requirements of shorter and/or more consistent supply lead times. This non-visibility to supply side dynamics mitigates the seeming natural tendency of the SQRTN or PE models to overestimate safety stock reduction opportunities. To be clear, this is not a positive or beneficial attribute of these two models, but rather a “happenstance” situation to be aware of.

High Level Inventory Network Modeling Approaches*Table 11. Illustration of “supply side variability” impact on inventory models’ accuracy (where RDCs and CDC have unequal supply lead times and variability)*

| Demand Correlation | Scenario | Std Dev & Avg LT at RDCs (days) | Std Dev & Avg LT at CDC (days) | Inventory Models’ Over (Under) Estimate of Safety Stock Reduction: (model- actual) / (actual) | | |
|--|----------|---------------------------------|--------------------------------|---|----------------------------------|---|
| | | | | SQRTN Model (Maister) | Original PE Model (Zinn et. al.) | PE Model with Supply Side Extension (Evers and Beier) |
| -0.5 | 1 | 1 & 5 | 1 & 5 | 42% | 56% | (0.6%) |
| | 2 | 1 & 5 | 1 & 5 | 43% | 46% | (0.5%) |
| | 1 | 2 & 5 | 1 & 5 | 1% | 16% | 1.9% |
| | 2 | 2 & 5 | 1 & 5 | 2% | 5% | 2.0% |
| | 1 | 1 & 5 | 1 & 4 | 42% | 56% | (0.6%) |
| | 2 | 1 & 5 | 1 & 4 | 42% | 45% | (0.5%) |
| | 1 | 2 & 5 | 1 & 4 | 1% | 16% | 1.9% |
| | 2 | 2 & 5 | 1 & 4 | 2% | 5% | 1.9% |
| 0.0 | 1 | 1 & 5 | 1 & 5 | 43% | 43% | (0.5%) |
| | 2 | 1 & 5 | 1 & 5 | 44% | 36% | (0.4%) |
| | 1 | 2 & 5 | 1 & 5 | 2% | 2% | 2.0% |
| | 2 | 2 & 5 | 1 & 5 | 2% | (5%) | 2.0% |
| | 1 | 1 & 5 | 1 & 4 | 43% | 43% | (0.5)% |
| | 2 | 1 & 5 | 1 & 4 | 43% | 35% | (0.5)% |
| | 1 | 2 & 5 | 1 & 4 | 2% | 2% | 2.0% |
| | 2 | 2 & 5 | 1 & 4 | 2% | (6%) | 2.0% |
| 0.5 | 1 | 1 & 5 | 1 & 5 | 44% | 33% | (0.4%) |
| | 2 | 1 & 5 | 1 & 5 | 45% | 28% | (0.3%) |
| | 1 | 2 & 5 | 1 & 5 | 3% | (9%) | 2.1% |
| | 2 | 2 & 5 | 1 & 5 | 3% | (14%) | 2.1% |
| | 1 | 1 & 5 | 1 & 4 | 44% | 32% | (0.4%) |
| | 2 | 1 & 5 | 1 & 4 | 44% | 27% | (0.4%) |
| | 1 | 2 & 5 | 1 & 4 | 2% | (9%) | 2.0% |
| | 2 | 2 & 5 | 1 & 4 | 3% | (14%) | 2.1% |
| Mean Absolute Error | | | | 23% | 24% | 1.2% |
| Minimum Absolute Error | | | | 1% | 2% | 0.3% |
| Maximum Absolute Error | | | | 45% | 56% | 2.1% |
| <ul style="list-style-type: none"> ■ Simulated Coefficient of Variation = 0.20 at each DC; std dev = standard deviation; LT = lead time ■ Each percent represents the average for the 6 simulations run (using 6 different seeds) for each model for each individual scenario ■ The summary mean, minimum and maximum absolute percents are based on the 24 averages shown in the body of the table. The 24 averages are derived from 144 individual simulations. ■ Each of the three models produced all overestimates or all underestimates for any individual scenario. | | | | | | |

High Level Inventory Network Modeling Approaches*Table 12. Illustration of “supply side variability” impact on inventory models’ accuracy (where RDCs and CDC have unequal supply lead times and variability)*

| Measure of Error | COV | Inventory Models’ Over (Under) Estimate of Safety Stock Reduction | | |
|------------------------|------|---|----------------------------------|--|
| | | SQRTN Model (Maister) | Original PE Model (Zinn et. al.) | PE Models with Supply Side Extension (Evers and Beier) |
| Mean Absolute Error | 0.20 | 23% | 24% | 1.2% |
| | 0.50 | 14% | 15% | 1.0% |
| Minimum Absolute Error | 0.20 | 1% | 2% | 0.3% |
| | 0.50 | 0% | 0% | 0.3% |
| Maximum Absolute Error | 0.20 | 45% | 56% | 2.1% |
| | 0.50 | 33% | 36% | 1.6% |

The percents shown are based on the 24 averages (derived from 144 total simulations) for networks with COV = 0.20 and COV = 0.50 (i.e., 288 simulations in total).

Practical Implications, Conclusions, and Future Research

These simulation results illustrate that practitioners need to exercise caution when applying the SQRTN rule, as well as the original portfolio effect model (Zinn et. al., 1989), to develop projections of the potential reduction in safety stock inventory that would result from an inventory network consolidation effort. On the other hand, these tests, conducted at the item level, did not yield such wildly inaccurate projections as to suggest that practitioners should never use the SQRTN or portfolio effect models to generate high level, “ballpark” inventory projections. What is clear is that the utilization of a portfolio effect model enhanced to account for the supply side components of safety stock requirements (i.e., Evers & Beier, 1993) will substantially upgrade the accuracy of inventory projections.

What remains unanswered by this research (and will be the subject of future research) is how significantly the accuracy of projections by any of the models tested here degrades when practitioners apply these models to a firm’s total inventory as one lump or group of items. All of the models we tested are designed to project inventory requirements at the individual, item level. In practice, as previously noted, the authors have frequently observed the SQRTN model in particular applied at the total firm inventory level, rather than applied item by item. This practice is very understandable given that many firms have hundreds to tens of thousands of unique items which they produce and/or sell. Our working hypothesis (and unsubstantiated initial conjecture) is that when one applies these inventory models to a large group of items simultaneously, it will be highly situational and difficult to predict how much additional inaccuracy this may introduce into an analysis. What is clear, however, is that a practitioner must conduct a rigorous non-modeling pre-processing analysis at the item level regardless of if, and how inventory models are applied at the item or group level. Appendix 1 describes several complementary non-statistical inventory modeling techniques that we recommend for both pre-processing item level analyses and for use as a standard business practice.

REFERENCES

APICS. (1998). *APICS Dictionary*. Falls Church, VA: APICS.

High Level Inventory Network Modeling Approaches

- Baker, K. R., Magazine, M. J., & Nuttle, H. L. W. (1986). The Effect Of Commonality On Safety Stock In A Simple Inventory Model. *Management Science*, 32(8), 982–988. doi:10.1287/mnsc.32.8.982
- Brown, R. G. (1967). *Decision Rules For Inventory Management*. New York: Holt, Rinehardt, Winston.
- Cachon, G., & Terwiesch, C. (2013). *Matching Supply With Demand*. New York: McGraw-Hill Irwin.
- Collier, D. A. (1982). Aggregate Safety Stock Levels and Component Part Commonality. *Management Science*, 28(11), 1296–1303. doi:10.1287/mnsc.28.11.1296
- Eppen, G. D. (1979). Effects of Centralization on Expected Costs in A Multi-Location Newsboy Problem. *Management Science*, 25(5), 498–501. doi:10.1287/mnsc.25.5.498
- Evers, P. T. (1995). Expanding the Square Root Law: An Analysis of Both Safety and Cycle Stocks. *Logistics and Transportation Review*, 31(1), 1–20.
- Evers, P. T. (1998). Operational Aspects of Inventory Consolidation Making. *Journal of Business Logistics*, 19(1), 173–189.
- Evers, P. T., & Beier, F. J. (1993). The Portfolio Effect and Multiple Consolidation Points: A Critical Assessment of the Square Root Law. *Journal of Business Logistics*, 14(2), 109–125.
- Heskett, J. L., Glaskowsky, N. A., & Ivie, R. M. (1974). *Business Logistics*. New York: Ronald Press.
- Mahmoud, M. M. (1992). Optimal Inventory Consolidation Schemes: A Portfolio Effect Analysis. *Journal Of Business Logistics*, 13(1), 193–214.
- Maister, D. H. (1976). Centralization of Inventories and the Square Root Law. *International Journal of Physical Distribution*, 6(3), 124–134. doi:10.1108/eb014366
- McClain, J. O., Maxwell, W. L., Muckstadt, J. A., Thomas, L. J., & Weiss, E. N. (1984). Comment On Aggregate Safety Stock Levels and Component Part Commonality. *Management Science*, 30(6), 772–773. doi:10.1287/mnsc.30.6.772
- Miller, T. C. (2002). *Hierarchical Operations And Supply Chain Planning*. London: Springer-Verlag. doi:10.1007/978-1-4471-0305-9
- Ronen, D. (1990). Inventory Centralization/Decentralization – The Square Root Law Revisited Again. *Journal of Business Logistics*, 11(2), 129–138.
- Starr, M. K., & Miller, D. W. (1962). *Inventory Control: Theory and Practice*. Englewood Cliffs, NJ: Prentice Hall.
- Tallon, W. J. (1993). The Impact of Inventory Centralization on Aggregate Safety Stock: The Variable Supply Lead Time Case. *Journal of Business Logistics*, 14(1), 185–203.
- Tyagi, R., & Das, C. (1998). Extension of the Square Root Law for Safety Stock to Demands with Unequal Variances. *Journal of Business Logistics*, 19(2), 197–204.
- Wanke, P. F. (2009). Consolidation Effects and Inventory Portfolios. *Transportation Research Part E, Logistics and Transportation Review*, 45(1), 107–124. doi:10.1016/j.tre.2008.03.003

High Level Inventory Network Modeling Approaches

Wanke, P. F., & Saliby, E. (2009). Consolidation effects: Whether and how inventories should be pooled. *Transportation Research Part E, Logistics and Transportation Review*, 45(5), 678–692. doi:10.1016/j.tre.2009.01.006

Zinn, W., Levy, M., & Bowersox, D. J. (1989). Measuring the Effect of Inventory Centralization/Decentralization on Aggregate Safety Stock: The Square Root Law Revisited. *Journal of Business Logistics*, 10(1), 1–14.

ENDNOTES

- ¹ This statement is based solely on the authors' observations.
- ² For the remainder of this chapter, we will use SQRTN as an abbreviation for the square root of N.
- ³ Maister's argument that the centralization of inventories can reduce cycle stock rests on the assumption that inventories in a network are managed based on the EOQ model, or some similar lot sizing formula.
- ⁴ More properly, we should say "non-forecast" variability in demand. If there is variability in demand, but the demand variability can be forecast with 100% accuracy, then there is no need for safety stock even though there is variability of demand.
- ⁵ Assuming there is no correlation of sales demand between the individual stocking locations.
- ⁶ For purposes of this chapter, we will use the APICS definition of fill rate. For fill rate, the APICS Dictionary (9th edition) is as follows: "Fill rate"-Syn: customer service ratio. And for "Customer Service Ratio" the APICS definition is: A measure of delivery performance of finished goods, usually expressed as a percentage. In a make-to-stock company, this percentage usually represents the number of items or dollars (on one or more customer orders) that were shipped on schedule for a specific time period, compared with the total that were supposed to be shipped in that time period.
- ⁷ Note the assumptions made for these simulations were compatible with the SQRTN model; and therefore, it was expected that simulation results would closely match the SQRTN projections.
- ⁸ Further, we have also frequently observed analyses where the analyst multiplies the *total inventory* (rather than just the safety stock inventory) of a decentralized network by $\frac{1}{\sqrt{R}}$ to estimate the potential inventory decrease that might occur under a centralized network.
- ⁹ Recall that the SQRTN model assumes that demands at decentralized facilities are uncorrelated.
- ¹⁰ For purposes of brevity, the algebraic manipulation that yields [12] is not shown.
- ¹¹ It is important to recognize that a "weeks supply planning approach" does have some serious deficiencies and implicit costs which often don't receive explicit recognition. In particular, inventory line item fill rates can vary dramatically, depending upon the number of stocking locations, when one employs a weeks of supply planning approach. For example, it may turn out that "10 weeks of inventory supply" will yield a 99.5% line item fill rate if one national DC serves a network. As the number of stocking DCs increases on a network, this same total "10 weeks of inventory supply" will yield corresponding lower line item fill rates with each incremental stocking location (i.e., 2 DCs will have a lower total fill rate than 1 DC, 3 DCs will have a lower fill rate than 2 DCs, and so

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- on). Our experience suggests that firms often do not explicitly recognize this fallacy in a “weeks supply” inventory planning methodology.
- 12 i.e., daily demand data, or daily demand and supply lead-time data depending upon the data needed for a particular simulation.
- 13 i.e., the averages for the six RDC simulations and the six CDC simulations based on randomly generated sample data; and the averages for the six inventory model projections based on the population parameters for each inventory model run in a particular experiment.
- 14 Refer to our discussion of magnitude earlier in the chapter.
- 15 Negative (or positive) demand correlations respectively increase (or decrease) the reductions in safety stock possible when networks are consolidated. Thus, because the SQRTN model assumes that demands between DCs are not correlated; it follows that we would observe these patterns of underestimates (or overestimates) by the SQRTN model under conditions of negative (or positive) demand correlations.
- 16 As previously noted, for the range of scenarios, we used two different sets of demand coefficients of variation ($COV = .20$ and $COV = .50$). There were no significant differences for $COV = .20$ and $COV = .50$ for the results shown in Tables 6, 7 and 8. Therefore, we show results just for $COV = .20$.
- 17 These are the assumed “population parameters” for the simulation.
- 18 Tables 10 and 12 display summary results for the 15 and 24 respective averages, minimum absolute errors and maximum absolute errors computed from individual simulations of network scenarios based on networks with $COV = 0.20$ and $COV = 0.50$. For purpose of brevity, we only present the summary results of the $COV = 0.50$ simulations.
- 19 This tendency manifested itself in all scenarios where average CDC lead time, as well as the standard deviation, was equal to the RDCs’ average lead time and standard deviation.

*High Level Inventory Network Modeling Approaches***APPENDIX 1****Complementary Non-Statistical Inventory Modeling Techniques**

In this appendix, we present several illustrative non-statistical modeling techniques to complement and/or supplement a mathematical model-based network inventory analysis. These techniques can provide substantial insights just on their own merit, and they also can form the basis for standardized inventory reporting that a manager may wish to maintain for general network monitoring purposes.

T1: Perhaps the most fundamental analysis that any inventory network evaluation should include consists of classifying all inventory items into ABC categories that indicate the relative importance of individual items in inventory. Formally, an ABC system represents a ranking of the finished goods end items or sku's in inventory based on one or more measurement criteria. Criteria for establishing ABC rankings abound, however, the most common measures include:

- Sales value (i.e., total dollar sales)
- Total unit sales
- Total inventory investment value (at cost)
- Frequency of sales, purchase or shipment
- Total profit contribution, and
- Total inventory storage space (e.g., cube) or pallet locations occupied

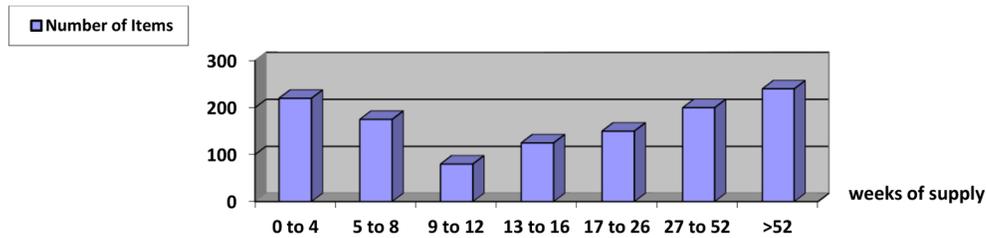
There exist numerous measures used to rank inventory because the appropriate measure may vary depending upon the particular application. For example, while total sales dollar value probably represents the most common measure used, a warehouse planner will also want to hierarchically rank inventory based upon the total storage and frequency of replenishment requirements placed upon distribution centers by individual items.

For purposes of an inventory network consolidation or expansion study, the “C” items in inventory (i.e., the slow-movers) represent a critical category. Often, one must segregate the “C” items further to understand what items within this classification represent essentially “dead items” (i.e., items where inventory exists but there have been no sales for a recent representative period – the last 12 months), and what items may have a dramatically excessive levels of inventory even if the particular items do have some sales. “Dead” items and items with highly excessive levels of inventory (e.g., an item with an inventory level equivalent to three years of sales) represent items whose overall inventory level on a network will not necessarily decrease, if for example, a network is consolidated to a fewer number of locations from a larger number of locations. ABC and related analyses will identify these items.

In practice, one frequently finds that many firms have widely varying weeks of supply of inventory by item across their network. Sometimes this occurs by design; however, often this situation evolves over time for numerous reasons such as poor tracking of inventory by planners, unsuccessful promotions and unexpectedly short product life-cycles. Regardless, a regular review of the weeks of inventory in a supply chain can provide important monitoring information for a firm's inventory planners. Figure 2 illustrates an inventory classification scheme based upon weeks of supply in inventory. Note this figure displays the number of items within established weeks of supply intervals (e.g., between 5 and 8 weeks),

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Figure 2. Number of items in network by weeks of supply



| Weeks of Supply → | 0 to 4 | 5 to 8 | 9 to 12 | 13 to 16 | 17 to 26 | 27 to 52 | >52 |
|-------------------------------------|--------|--------|---------|----------|----------|----------|-------|
| At Cost (\$ Millions) | \$120 | \$100 | \$25 | \$50 | \$75 | \$100 | \$125 |
| Cumulative Investment (\$ Millions) | \$120 | \$220 | \$245 | \$295 | \$370 | \$470 | \$595 |
| Cumulative Items | 220 | 395 | 475 | 600 | 750 | 950 | 1190 |

as well as the total inventory investment represented by the items in an interval. This figure portrays just one simple example of the numerous “stratification” schemes commonly used by practitioners to monitor inventory.

In summary, using ABC inventory and “weeks supply” type analyses, one should determine what items in inventory cannot be modeled using statistical models such as the SQRTN or portfolio model. Then one must determine from a practical standpoint how the inventory levels in these items that cannot be modeled may change, if they change at all, as a result of a contraction or expansion in inventory stocking locations. One can then apply the appropriate mathematical inventory model to those remaining items that represent good candidates for these methods.

T2: Because the SQRTN model is such a simple model and requires such minimal data development, it is very appealing to use. However, the SQRTN model assumes that all facilities (before and after consolidation) have: (1) the same replenishment lead-time, (2) no variance in their respective lead-times, (3) equal variances of demand, and (4) no correlation between the demand for a product at the regional DCs. The portfolio effect model and its various extensions address all these factors explicitly. In practice, therefore, it becomes important to consider the differences in the average lead-times, the variability of lead-times, the variability of demands and the correlation of demand across all locations of a network, before employing the SQRTN model. If these factors differ significantly by DC, then one must attach a great deal of caution to any modeling results generated by the square root of N model.

T3: Unplanned “transshipments” between DCs on a network represent another factor to consider in evaluating the potential impact of a network consolidation or expansion on inventory investment and related costs. The existing level of unplanned transshipments on a network can provide a valuable, informal indication of the capability of a firm to effectively manage a multiple stocking location network. For example, if unplanned transshipments between current stocking DCs represents a

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significant percent of total network shipments outbound from the DCs (e.g., 25% or more), this may indicate that the firm does not do a good job of deploying the right inventory in the right locations at the right time. This requires much more validation than such a simple analysis, however, the implications – if true – can be significant. For example, assume that a firm has three DC stocking locations and is considering expanding to four or five DCs to serve the region currently handled by three DCs. A high level of unplanned transshipments in the current three DC network likely forebodes that a larger network may experience an even higher level of unplanned transshipments. This leads to additional transportation costs (often not properly quantified). Further, one way a firm compensates for an inability to deploy the right inventory at the right location at the right time is to build additional buffer or safety inventory. In such an environment, the authors' past experience suggests that the "increased" level of actual total safety stock and inventory in an expanded network (e.g., a four or five DC network in this example) will exceed the level of inventory that a statistical model indicates the "expanded" network will require. Conversely, again in this type of environment, experience suggests that the inventory "decrease" resulting from consolidating such a network (e.g., from three DCs to two DCs) will exceed the "decrease" predicted by a statistical model.

APPENDIX 2

Data for Inventory Network Simulations

Descriptions of the data we utilized for our simulation experiments is scattered throughout the chapter as needed to explain the results shown in specific tables (e.g., see Tables 5, 8, 11 and 12). In this appendix, we provide a brief summary of the data. The reader interested in additional details should contact the authors directly.

Summary of Simulation Data Used In Forecast Experiments

We developed our simulation data based upon the authors' previous experience of well over ten years working with sales and shipment data for several consumer product firms. Briefly, we made the following network, demand and supply assumptions:

Summary Network Assumptions

1. There are four regional DCs (RDCs).
2. There is one national DC (CDC).
3. Total network demand is equal for all scenarios.
4. To compare the actual safety stock requirements of various regional network configurations to the safety stock requirements of one national DC (CDC), we assumed both networks have to serve the same total demand and provide the identical fill rate.

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Summary Demand Assumptions

5. There are ten products stocked and sold on this network.
6. The average daily total demand (in units) for each item is as follows:
 - #1 = 1000, #2 = 500, #3 = 600, #4 = 700, #5 = 800, #6 = 900, #7 = 1100, #8 = 1200, #9 = 1300, #10 = 1400
7. The demand correlation between the regional DCs can vary from 1.0 to -1.0 (and the specific assumptions for individual experiments are shown in the body of the paper).
8. The demand coefficient of variation (i.e., the standard deviation of demand / mean demand) can range as high as 0.50 in some experiments. The actual demand coefficient of variation is noted for individual experiments.

Summary Supply Assumptions

9. For some scenarios the average replenishment (supply) lead-time was assumed to be identical and constant at all DCs (i.e., the RDCs and the CDC); while for other scenarios replenishment lead times could both be different and could vary by DC. The supply assumptions are described for all individual results shown in the body of the paper.

High Level Inventory Network Modeling Approaches**APPENDIX 3****Illustrative ANOVA Tests***Table 13. Illustrative ANOVA test results*

| Table | Number of Simulations | Description of Results |
|--|-----------------------|---|
| Table 6 | 108 | <ul style="list-style-type: none"> • SQRTN significantly overestimated the safety stock savings ($p\text{-value} = 0.0$) by an average of 3%. • The magnitude had a highly statistically significant impact ($p\text{-value} = 0.0$) on the accuracy (i.e. projected safety stock savings) of the SQRTN model's inventory projections. [i.e., presence of unequal magnitudes caused accuracy of SQRTN model's projections to overestimate by a large amount.] • The demand variability and number of RDCs did not significantly affect SQRTN's accuracy (The $p\text{-value}$ of demand variability was .68 while the $p\text{-value}$ of the number of RDCs was 0.63) |
| Table 7 | 120 | <ul style="list-style-type: none"> • Factor of demand correlation had a highly statistically significant impact ($p\text{-value} = 0.0$) on the accuracy of the SQRTN model's inventory projections. [i.e., presence of negative or positive demand correlations between RDCs caused accuracy of SQRTN model's projections to deteriorate.] |
| Table 8 | 432 | <ul style="list-style-type: none"> • Factors of demand correlation and magnitude had statistically significant impact on the accuracy of the SQRTN model's inventory projections ($p\text{-values} = 0.0$). • The demand variability did not significantly affect SQRTN's accuracy (The $p\text{-value}$ of demand variability was .406) |
| Tables 9 and 10 | 180 | <ul style="list-style-type: none"> • SQRTN and ZLB significantly overestimated the safety stock savings ($p\text{-value} = 0.0$). EB's projected safety stock savings was not statistically different from the actual safety stock savings. • SQRTN significantly overestimated more than ZLB ($p\text{-value} = 0.0$). |
| Tables 11 and 12 | 288 | <ul style="list-style-type: none"> • Models do not overestimate the safety stock savings as much with lower variance in supply lead times and/or a shorter average supply lead time |
| ANOVA tests were actually completed on 1,108 simulations in Tables 6 through 12. | | |

For completeness, we performed ANOVA tests on the sample data created by all the simulations run to generate the results in Tables 6 through 12. Because this was not the primary thrust of our research, for illustrative purposes, we report just a small sample of our results here for Tables 6 through 12. This subject will be the focus of a future paper and additional research.

Chapter 3

Fostering Supply Chain Management in Global Business

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ABSTRACT

This chapter reviews the perspectives of fostering supply chain management (SCM) in global business, thus describing the theoretical and practical concept of SCM; the applications of SCM; fostering SCM through knowledge management (KM) in global business; the strategic success factors of SCM; and the significance of SCM in global business. The utilization of SCM is necessary for modern organizations that seek to serve suppliers and customers, increase business performance, strengthen competitiveness, and achieve continuous success in global business. Therefore, it is essential for modern organizations to examine their SCM applications, develop a strategic plan to regularly check their practical advancements, and immediately respond to the SCM needs of customers in global business. Applying SCM will extremely improve organizational performance and reach business goals in global business.

INTRODUCTION

Supply chain management (SCM) has both theoretical and managerial implications, and is positively related to organization's orientation, recognizing the way that the organization integrates supply chain implications throughout decisions that the organization makes (Ellram & Cooper, 2014). As the industrial environment becomes more competitive, SCM has attained growing attention from practical and academic societies as an essential discipline (Shafieezadeh & Sadegheih, 2014).

SCM is quickly growing as both a strategic initiative and an academic discipline (Richey, Roath, Whipple, & Fawcett, 2010). SCM is a coordinated system in moving products or services from supplier to customer (Saberi, Nookabadi, & Hejazi, 2012), and is an ongoing process requiring continuous efforts to obtain the desired results (Siddiqui, Haleem, & Sharma, 2012). Supply chains and SCM are the significant areas of business practices that overlap with the discipline and practice of marketing and marketing management (Mentzer & Gundlach, 2010).

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The strength of this chapter is on the thorough literature consolidation of SCM in global business. The extant literature of SCM in global business provides a contribution to practitioners and researchers by describing a comprehensive view of the functional applications of SCM in global business to appeal to different segments of SCM in global business in order to maximize the business impact of SCM in global business.

BACKGROUND

The concept of SCM was introduced in the early 1980s (Harland, 1996), and is understood to be a set of practices for managing and coordinating the transformational activities from raw material suppliers to ultimate customers (Heikkila, 2002). Over the past two decades, the scope of some key subjects in operations management has extended beyond the single company to include supply chain partners and their interactions (Thomé, Scavarda, Pires, Ceryno, & Klingebiel, 2014). The subject of supply chain design has also attracted wide attention in the operations research and management science community (Zhang, Luo, & Huang, 2013).

The integration of key business processes within and across companies that add value for customers and other stakeholders can be called SCM (Bechtel & Jayaram, 1997). SCM can be defined as the integration of business processes, through upstream and downstream linkages, that produce value in the hands of the final customer (Christopher & Ryals, 1999). SCM improves competitiveness of the supply chain through the long-term customers to supply chain relationships and a cooperative approach to business processes (Om, Lee, & Chang, 2007).

FOSTERING SUPPLY CHAIN MANAGEMENT IN GLOBAL BUSINESS

This section describes the theoretical and practical concept of SCM; the applications of SCM; fostering SCM through KM in global business; the strategic success factors of SCM; and the significance of SCM in global business.

Concept of Supply Chain Management

Rapid technology development, globalization, and customers' varied expectations are changing the type of markets' competitions from competitive independent firms to competitive supply chains (CSCs) (Xiao & Yang, 2008; Zhang, 2006). Efficient coordination of individual firms in the form of supply chain requires better management of material flow throughout their network structure (Farahani, Rezapour, Drezner, & Fallah, 2014). SCM is considered a pipeline of physical and informational flows between suppliers and customers (Lu, Trappey, Chen, & Chang, 2013), and is not only a linear structure but actually a network (Bhaskar & Lallement, 2008).

The nature of supply chain networks is that they are a complicated network structure consists of suppliers, manufacturers, warehouses, and retailers organized to produce and distribute merchandise at the right quantities, to the right locations, and at the right time, in order to minimize total costs while satisfying service level requirements (Simchi-Levi, Kaminsky, & Simchi-Levi, 2003). Supply chain

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network design (SCND) determines the structure of supply chain and affects its costs and performance (Farahani et al., 2014). The strategic and costly SCND decision has the most significant impact on return on investment (ROI) of the supply chain (Simchi-Levi & Kaminsky, 2004).

The well-managed supply chains yield the reduced costs, and improve information flow, production, products, and customer service (Pil & Fujimoto, 2007; Womack & Jones, 1996). Supply chains strategies work best when they are market-specific (Christopher & Towill, 2002). Contemporary supply chain network management can be defined as an integration of key business processes from end users through original suppliers for effectively providing various forms of products and adds value to customers and other stakeholders (Wu & Chuang, 2009).

Supply chain practically shapes competitive management prospect (Christopher, 2012). SCM is considered as a long-term oriented, inter-firm arrangement, involving cooperative relationships (Das, 2006; Grant & Baden-Fuller, 2004). Stable supply chain processes in a dynamic environment support enterprise competitiveness (Ivanov & Sokolov, 2012). Reducing cost of operations, improving inventory, lead times and customer satisfaction, increasing flexibility and cross-functional communication, and remaining competitive appear to be the most important objectives to implement SCM strategies (Tummala, Phillips, & Johnson, 2006).

One of the main research issues in SCM is to improve the global efficiency of supply chains (Ahn & Lee, 2004), and creates value from cost and working capital (Brandenburg & Seuring, 2011). Supply chain orientation is essential to accomplish customers' requirements (Min, Mentzer, & Ladd, 2007). Supply chains and modern industries are the examples of socio-economic systems affecting a country's economy (Shoushtari, 2013). Recent trends toward outsourcing and global sourcing have created more complex supply chains (Mena, Humphries, & Choi, 2013). Organizations launch strategic supply chain initiatives through project implementation (Mathieu & Pal, 2011).

SCM is a highly integrative discipline which is jointly connected with key management functions such as strategic management, marketing, and finance (Kaufmann & Saw, 2014). Organizations integrate sustainability in their SCM practices (Wolf, 2011). Small and medium-sized enterprises (SMEs) are facing customers in a global marketplace with increasing performance demands in terms of delivery consistency and reduction of lead times (Soderberg & Bengtsson, 2010). SCM must adopt different and more innovative strategies that support a better response to customer needs in an uncertain environment (Carvalho, Azevedo, & Cruz-Machado, 2012).

Effective SCM requires the integration of various business functions, organizational units, and channel partners such that each has a well-defined role in accomplishing SCM objectives (Manuj & Sahin, 2011). Supply chain integration is broadly conceptualized as an aggregation consisting of supplier integration, internal integration, and customer integration (Mackelprang, Robinson, Bernardes, & Webb, 2014). The practical integrations of business functions and SCM channels are important toward achieving overall SCM objectives (Sahin & Robinson, 2005).

The dynamic nature of supply chains with their multiplicity of organizations, processes, and flows yield highly complex, multifaceted, and large-scale systems, referring to supply chain complexity (Choi & Hong, 2002). Manuj and Sahin (2011) stated that the degree of complexity is derived from the structural properties of system determined by a variety of elements defining the supply chains and their interactions (i.e., the number of participants, facilities, products, transportation links, and information flows).

Supply chains must satisfy the demands and needs of their stakeholders (Pagell & Shevchenko, 2014). The functional roles within business organizations have changed as SCM has evolved in importance within modern organizations (Zacharia, Sanders, & Fugate, 2014). The highly complex supply chains,

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due to the vastness of data, decision variables, intricate interrelationships among variables and system constraints, and performance trade-offs present many challenges for management in arriving at effective business decisions (Manuj & Sahin, 2011).

Supply chains are the adaptive systems (Choi, Dooley, & Rungtusanatham, 2001; Wycisk, McKelvey, & Hulsmann, 2008), and their efficient management poses many challenges for business professionals (Ellinger, Ellinger, & Keller, 2002). SCM promises competitive advantages for industrial organizations (Arbjørn, de Haas, & Munksgaard, 2013), and focuses on the management of exchange flows across the organizational members of supply chain (Esper, Defee, & Mentzer, 2010). Defee and Stank (2005) reviewed the extant supply chain structure literature and proposed five structural elements and five external contingency factors necessary to develop a complete supply chain strategy-structure-performance theoretical model.

Structural dimensions include information integration, communications, standardization, decision-making authority, and rewards. Three of the structural elements in the proposed model are empirically tested and validated (Defee, Stank, Esper, & Mentzer, 2009). Structural elements developed by organizations are the results of organizational design activities. The structures developed by the supply chain-oriented organizations promote cross-functional thinking, communication, and information sharing (Esper et al., 2010). Eliminating non-value added steps in distribution channels simplifies supply chain processes, reduces costs, and diminishes managerial complexity (Manuj & Sahin, 2011).

SCM is a human-centric phenomenon (Myers, Griffith, Daugherty, & Lusch, 2004). Over 90 percent of logistics activities occur outside direct supervision (Bowersox, Closs, & Stank, 2000), exhibiting the importance of effective people to supply chain excellence. Although financial, equipment, technological and market-based resources are necessary for effective SCM, the individuals who accomplish organizational tasks are critical for effective functioning and exploitation of each of these resource categories (Richey, Tokman, & Wheeler, 2006).

Different relational approaches for interorganizational interplay, namely cooperation, coordination, and collaboration have been taken up to enhance the performance of supply chain (Kim & Netessine, 2013; Liu & Zhang, 2013; Yu & Nagurney, 2013). Collaboration is considered a driving force necessary for effective SCM (Horvath, 2001), and is an interdependent relationship in which parties closely work with each other to create beneficial outcomes (Sinkovics & Roath, 2004). Collaboration should be developed across functional areas inside the organizations, with the goal of creating the more integrated internal operations (Kahn & Mentzer, 1996). Effective intra-organizational collaboration is strongly associated with external collaboration (Gimenez & Ventura, 2003).

Applications of Supply Chain Management

Recent years have seen a growing interest among both academics and practitioners in the field of SCM (Chen, Shen, & Feng, 2014). Supply chain is a complex network of business entities involved in the upstream and downstream flows of products and/or services, along with the related finances and information (Beamon, 1998; Lambert, Cooper, & Pagh, 1998). SCM involves the coordination of the flows within and across companies in the supply chain with the aim of reducing costs, improving customer satisfaction and gaining competitive advantage for both independent companies and the supply chain as a whole (Cooper & Ellram, 1993; Cooper, Lambert, & Pagh, 1997).

Supply chains are complex, expensive systems where the inherent risks of costly mismanagement of a globally connected and affected, typically poorly communicating, and organizational network are

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relatively high (Marsillac & Roh, 2014). Mentzer et al. (2001) stated that SCM proceeds and develops through the systematic and strategic coordination of business functions and tactics within and across businesses, with an overall goal of improving the long-term profitability of all involved.

SCM is considered the integration of a firm's business processes with the objective of replacing a single isolated operational unit with a whole supply chain spanning raw material suppliers to the ultimate customer (Frohlich & Westbrook, 2001; Heikkila, 2002). SCM execution within organizations is understood as the firm's internal and external integration of business processes with suppliers and customers to create value and to improve the total performance of the supply chain (Cooper et al., 1997; Lambert et al., 1998). In many corporations, management has reached the conclusion that optimizing the product flows cannot be achieved without applying a systematic approach to the business (Fu, Ionescu, Aghezzaf, & De Keyser, 2014).

Performance of supply chain depends on the effectiveness of communication and coordination (Chen & Huang, 2007). Developing performance measurement model is a critical task for supply chain and its members in order to examine their current status and identify improvement opportunities for steering their future direction (Lin & Li, 2010). Performance evaluation is necessary for effective SCM (Yang, Wu, Liang, Bi, & Wu, 2011). Measuring supply chain performance is one of the main indicators of business success (Oztemel & Tekez, 2009).

Supply chain complexity is widely recognized as a key issue confronting supply chain managers and executives (Choi & Krause, 2006). Supply chain complexity can weaken brand image, lower brand loyalty, stagnate category management, and disturb channel trade relations (Quelch & Kenny, 1994), and reduce supply chain adaptability (Masson, Iosif, MacKerron, & Fernie, 2007). Supply chain complexity drivers (i.e., the number of suppliers, the number of customers, the number of interactions, the conflicting policies, and the demand amplification) play a significant role in dealing with complexity of the different types of supply chains (Serdarasan, 2013).

Brewer and Speh (2000) stated that the measures such as logistics service quality (Mentzer, Flint, & Kent, 1999), the perfect customer order (Novack & Thomas, 2004), and the balanced scorecard (BSC) practically exhibit supply chain performance from a customer's perspective. Organizations place great emphasis on both supply chains and BSC to develop effective measures to evaluate organizational performance (Chang, Hung, Wong, & Lee, 2013). Supply chain measures facilitate operational integration and focus on monitoring supply chain performance (Esper et al., 2010). This is especially important considering the perceptual gaps that often exist between an organizational view of their performance and the perceptions of other supply chain entities (Forslund, 2006), the historical lack of emphasis on service elements of supply chain performance (Novack, Rinehart, & Langley, 1996), and the increased emphasis on the holistic supply chain (Mentzer et al., 2001).

The Supply Chain Operations Reference (SCOR) model, published in 1996 by the Supply Chain Council (SCC), is based on the concepts of business process reengineering, benchmarking, and process measurement (Jalalvand, Teimoury, Makui, Aryanezhad, & Jolai, 2011). The SCOR model provides a process-oriented language, which helps supply chain partners to communicate with each other (Lockamy & McCormack, 2004). The SCOR model spans customer interactions, physical material transactions, and market interactions from supplier's supplier to customer's customer. The SCOR model is organized around the five processes (i.e., plan, source, make, deliver, and return). Five performance attributes of SCOR model (i.e., reliability, responsiveness, agility, cost, and asset management) are the standard characteristics to describe supply chain, evaluated against other supply chains (Jalalvand et al., 2011).

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Brewer and Speh (2000) indicated that the measures of supply chain favorably facilitate learning and innovation in modern business. Considering strategic emphasis on supporting supply chain operations for competitive advantage, learning and innovation are the key areas to measure in the supply chain-oriented organizations (Esper et al., 2010). Measures such as new product development cycle time and process improvement rates are important (Brewer & Speh, 2000). Lambert and Pohlen (2001) emphasized the importance of connecting supply chain initiatives to economic value and profit and loss statements. Lambert and Pohlen (2001) facilitated the use of non-financial measures to align the behavior of supply chain-related operational personnel with strategic goals.

From the global supply chain contexts, non-financial measures include a valuable focus on integration with suppliers and customers to support collaborative supply chain strategies and initiatives (Esper et al., 2010). In addition, non-financial measures such as the perfect customer order place emphasis on internal integration by adopting a measure of operational performance (Novack & Thomas, 2004). Enterprise value chains must develop and support a broader sustainability perspective to ensure that its customer, business, supply chain, community, and environmental relationships remain viable (Closs, Speier, & Meacham, 2011).

SCM-related processes are the business practices that integrate or coordinate different key business areas within the firm and between a firm's suppliers and customers. SCM-related processes generate a flow of products, services and related information and create value for customers as well as improving the total performance of supply chain (Das, Narasimhan, & Talluri, 2006; Martinez-Sanchez, Vela-Jimenez, Perez-Perez, & de-Luis-Carnicer, 2009). The success of global manufacturing activities often hinges on a manufacturing firm's flexibility in terms of its ability to adapt its supply chain to dynamic changes in customer needs and preferences (Roh, Hong, & Min, 2014).

SCM processes can be subdivided into eight areas: customer relationship management (CRM); customer service management; demand management; order fulfillment; manufacturing flow management; supplier relationship management; product development and commercialization; and returns management (Croxtton, Garcia-Dastugue, Lambert, & Rogers, 2001; Lambert, Garcia-Dastugue, & Croxtton, 2005). Customer and supplier integration efforts affect operational performance (Devaraj, Krajewski, & Wei, 2007; Robb, Bin, & Tiru, 2008). Swink et al. (2007) hypothesized the impact of strategic customer integration and strategic supplier integration on manufacturing competitive priorities and business performance.

The most accepted methods of addressing operations strategy are related to the use of competitive priorities (Ward, McCreery, Ritzman, & Sharma, 1998). Hayes and Wheelwright (1984) defined competitive priority as the strategic preferences or dimensions from which a company chooses to compete. Although competitive priorities have their basis in the manufacturing area, similar competitive dimensions can be extended to SCM (Pagell & Krause, 2002). Quality, delivery, flexibility, and cost are the most competitive priorities (Narasimhan & Jayaram, 1998; Pagell & Krause, 2002).

Fostering Supply Chain Management through Knowledge Management in Global Business

Knowledge Management (KM) is a strategy for reducing supply chain decision-making complexity (Manuj & Sahin, 2011). With the rapid changes and pressure of global competition, knowledge has become as the key factor of business success to achieve the competitive advantage (Cheng, Yeh, & Tu,

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2008; Tesang, 2009). Knowledge adds value to an organization through its contribution to products, processes and people, while KM transforms information, data and intellectual assets into enduring value by identifying useful knowledge for management actions (Goh, 2006).

KM consists of processes that facilitate the application and development of organizational knowledge, in order to create value and to increase and sustain competitive advantage (Zhao, Pablo, & Qi, 2012). KM is recognized as an important source of competitive advantage and hence there has been increasing academic and practitioner interest in understanding and isolating the factors that contribute to effective knowledge transfer between supply chain actors (He, Ghobadin, & Galllear, 2013).

The KM adoption in supply chain enables a collaborative environment that enables the chain to be more adaptive and responsive to achieve an improved strategic competitive position in the market place (Patil & Kant, 2014). KM among supply chain members can provide a guarantee for the supply chain members to access the external knowledge, but also it is helpful to improve overall competitiveness of the entire supply chain (Zhengyi & Ronghua, 2005). The role of intellectual property and CRM system is vital to foster exploitation of knowledge learning in supply chain (Lancioni & Chandran, 2009).

KM leads to the increased job performance in global business (Kasemsap, 2013a). KM, knowledge-sharing behavior, and organizational learning, are potentially correlated with organizational performance (Kasemsap, 2013b). KM, organizational culture, and organizational climate lead to increased organizational performance in modern organizations (Kasemsap, 2014a). Social media typically allows technological access to the data and video information for potential consumers in the knowledge-based organizations (Kasemsap, 2014b). Kasemsap (2014c) indicated that KM, strategic orientation, and organizational innovation are practically related to improved organizational performance.

Knowledge-sharing behavior positively mediates the relationships between organizational learning and organizational innovation and between KM and organizational innovation in modern organizations (Kasemsap, 2014d). Leaders of global businesses should organize information and communication technology (ICT) skills for organizational employees to enlarge their knowledge in the digital age (Kasemsap, 2014e). Academic efforts to promote social networks should be routinely executed to minimize the lack of knowledge (Kasemsap, 2014f). Organizational culture, organizational learning, and KM are effectively correlated with job satisfaction (Kasemsap, 2014g). Firms should recognize the importance of perception of learning and need to put more efforts in building up the perception of learning mechanisms to promote their perceived training transfer and achieve business goals (Kasemsap, 2014h).

Performance management practices positively mediate the relationships between leadership style and organizational performance and between organizational culture and organizational performance (Kasemsap, 2014i). Human resource management, organizational learning, and KM capability lead to improved organizational performance in global business (Kasemsap, 2015a). Using data mining methods for business intelligence makes it easier for the users to promote its overall contribution to the KM process (Kasemsap, 2015b). Data mining has been found as a potential tool to extract knowledge (Kundu, Jain, Kumar, & Chandra, 2015).

Organizations aiming to improve business performance within enterprise architecture should create and develop information technology (IT), technical alignment, and information system capabilities, and IS effectiveness (Kasemsap, 2015c). The use of IT systems and social networks can deal with the heterogeneity of information and knowledge flow within supply chain (Pedroso & Nakano, 2009; Shih,

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Hsu, Zhu, & Balasubramanian, 2012; Wong & Wong, 2011). Technological infrastructure has both direct and indirect effects on organizational performance (Wong & Wong, 2011). A high level of implication makes the transfer of knowledge within and outside the borders of the firm very challenging (Simonin, 2004; Wagner & Buko, 2005).

Supply chain partners find it very useful to share decision knowledge on a timely basis. Corporate culture is the main hurdle for KM perspective (Shih et al., 2012). The deep organization structure hierarchy seems to hinder the upward flow of communication and stops the vertical sharing of knowledge (Aziz & Sparrow, 2011; Kasper, Muhlbacher, & Muller, 2008). The attitude toward the learning and sharing of new knowledge is one of the important barriers preventing the building of a knowledge-creation in modern organizations (Vithessonthi, 2008). The lack of information provision and empowerment of the partner's decision-making are the weakest variables of KM adoption in supply chain (Samuel, Goury, Gunasekaran, & Spalanzani, 2011).

A crucial issue with managing knowledge transfer to the supply chain partners centrally is that communication barriers and tensions may arise between those responsible for inter-organizational knowledge transfer and other involved departments (Hutzschenreuter & Horstkotte, 2010). Strategic alliances among supply chain partners can have a positive impact on the performances and succulents of a supportive culture and flexible structure of organizations that encourage sharing of knowledge from different perspectives (Dyer & Nobeoka, 2000; Wong & Wong, 2011). Group-based knowledge flow (GKF) mining methods can enhance organizational learning and facilitate KM, sharing, and reuse in an environment where collaboration and teamwork are essential (Liu & Li, 2011).

The role of positive leadership is vital in overcoming the hurdle of insufficient fund, lack of culture, lack of strategic planning, improper organization structure unidirectional knowledge flow (Bandyopadhyay & Pathak, 2007; Shih et al., 2012). Esper et al. (2010) suggested the development of learning capabilities and transformational leadership styles to facilitate the creation of supply chain ideas. The mutual learning is essential to increase the competence of supply chain partners, and presented a model for effective knowledge sharing among supply chain partners (Wang, Fergusson, & Perry, 2008). The flow of knowledge increased when supply chain actors had limited alternatives and when the more powerful actor exercised restraint in the use of power (He et al., 2013).

Strategic Success Factors of Supply Chain Management

Building Customer-Supplier Relationships

Developing partnerships is one of the most important steps in building and maintaining customer-supplier relationships (Tummala et al., 2006). Supply chain initiatives that seek to incorporate all suppliers as strategic partners, should first examine which suppliers hold especially strategic significance (Tummala et al., 2006). Effective SCM practices rely on teamwork and continuous improvement (Shadur & Bamber, 1994). Supply chain collaboration with strategic suppliers effectively increases a firm's responsiveness to market changes (Holweg, Disney, Holmstrom, & Smaros, 2005). This increased responsiveness is due to supply chain collaboration that increases customization capability and the extent of knowledge sharing and communication (Rahman, Brookes, & Bennett, 2009). Collaboration requires high trust among employees and with suppliers (Basu & Miroshnik, 1999).

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Implementing Information and Communication Technology

ICT is a very important strategic factor in managing supply chains; it acts as the disseminator and enabler for process and product communication along with reducing paperwork and lead times (Handfield & Nichols, 1999). ICT also provides numerous opportunities for a company to streamline communication and improve supplier/customer response deficiencies (Tummala et al., 2006). E-collaboration for systems facilitates Internet-based coordination of decisions across all members of the supply chain to identify, analyze, and transform useful information into reusable knowledge which can be used to make decisions with extensive impact along with the supply chain (Johnson & Whang, 2002).

In 1990s, electronic data interchange (EDI) was established between Walmart and its suppliers such as Procter & Gamble (P&G) and Johnson and Johnson, to share point-of-sales data (Li & Zhang, 2015). The use of IT such as EDI makes the information flow across the supply chain smooth and transparent (Roh et al., 2014). The multi-agent system is helpful to address the problem of sharing tacit knowledge in supply chain (Al-Mutawah, Lee, & Cheung, 2009; Wu, 2001).

The semantic Web can be addressed the problem of managing knowledge heterogeneity in the context of interoperability among multi-entities in supply chain (Huang & Lin, 2010). The knowledge-based customization approach for supply chain integration bridge information gaps and allows information sharing within the supply chain network (Cheung, Kwok, & Heung, 2012).

Re-Engineering Material Flows

Many practitioners of SCM have recognized that managing the flow of materials across the supply chain is one of the important strategic success factors (Tummala et al., 2006). This is because the costs involved of providing end customers and supply chain member organizations with the materials required, in the right quantities, in the desired form, with the appropriate documentation, at the desired location, at the right time, and at the lowest possible cost are very high (Tummala et al., 2006).

Creating Corporate Culture

The most important prerequisite for change is corporate culture and commitment that should be reinforced by all the supply chain members (Tan, Kannan, & Handfield, 1998). Without the commitment and involvement by senior and middle managers, it is difficult to establish the change management process and forging necessary relationships between customers and suppliers (Monczka & Morgan, 1996). Customers and suppliers should participate in joint planning of processes and products (Monczka & Morgan, 1996).

Identifying Performance Measurements

An important issue in measuring supply chain performance is the lack of holistic measures spanning all members (Holmberg, 2000; Lambert & Pohlen, 2001). The most effective relationships exist where supply chain partners have been made aware of what performance standards they are being held accountable for (Stuart & McCutcheon, 2000). Selecting performance measures is intended to make sure companies accomplish the specific goals that they set. These characteristics incorporate the primary requirements that organizations need to continually address, evaluate and benchmark them against when desiring to constantly improve supply chain performance (Tummala et al., 2006).

Fostering Supply Chain Management in Global Business

Significance of Supply Chain Management in Global Business

Global manufacturers must define business priorities, design their supply chains, and review facility location decisions when there are major changes in global and regional business environments (Skinner, 1996). Most of the extant SCM literature has focused on the improvement of operational efficiency in sourcing, manufacturing, and logistics through the utilization of mathematical and simulation models (Min & Zhou, 2002). The practical field of SCM is constantly changing, as the competitiveness of international companies is more and more dependent on their capability to produce and deliver customized products and services fast and efficiently all over the world (Halldorsson, Kotzab, Mikkola, & Skjøtt-Larsen, 2007).

An increasing percentage of the value creation takes place outside the boundaries of the individual firm (Bruce, Daly, & Towers, 2004). This induces higher complexity and diversity into management decisions regarding the structure of the operations, the positioning of activities and processes, the role and power of the participants, and the most efficient forms of collaboration between all members in a transformation chain between production and consumption (Halldorsson et al., 2007).

Collaboration with suppliers deepens suppliers' insights into customer value and makes it possible to embark on co-innovation in terms of components (Flint, Blocker, & Boutin, 2011). Close collaboration with suppliers tends to precipitate the development of innovative products (Youn, Yang, & Roh, 2012). Strong ties with suppliers generate benefits for trading partners. For example, traditional Japanese supplier relationships in the automotive industry generated competitive advantage over their United States counterparts in the 1970s (Hoyt & Huq, 2000).

A focal company in a given supply chain needs to encourage the early involvement of its suppliers in new, innovative product design and development (Roh et al., 2014). Crafting inter-firm linkages may not be recommendable (Perrons & Platts, 2005). Curry and Kenney (1999) stated that failure to deliver the right components at the right time may cause bottlenecks that can affect the entire supply chain. In the personal computer industry, supplier alliances and the exchange of timely and accurate information are critical to improve delivery (Handfield, Krause, Scannell, & Moczka, 2000; Heide & Stump, 1995).

In the IT industry, Mendelson (2000) found that information awareness between trading partners in the supply chain is related to effective response and cost efficiency. Supplier alliances can increase flexibility in the fast-paced industry of personal computers (Curry & Kenney, 1999). In order to decrease inventory and cut overall costs in the supply chain, personal computer assemblers found that strong relationships with their major partners downstream in the supply chain can be effective (Curry & Kenney, 1999).

FUTURE RESEARCH DIRECTIONS

The strength of this chapter is on the thorough literature consolidation of SCM in global business. The extant literature on SCM in global business provides a contribution to practitioners and researchers by describing a comprehensive view of the functional applications of SCM in global business to appeal to different segments of SCM in global business in order to maximize the business impact of SCM in global business. The classification of the prevailing literature in the domain of SCM in global business will provide the potential opportunities for future research. Future research direction should broaden the perspectives in the implementation of SCM in the knowledge-based organizations.

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Practitioners and researchers should identify the applicability of a more multidisciplinary approach toward research activities in implementing SCM in global business with KM-related variables (i.e., knowledge-sharing behavior, knowledge creation, organizational learning, learning orientation, and motivation to learn). It will be useful to bring additional disciplines together (i.e., strategic management, marketing, finance, and human resources) to support a more holistic examination of SCM in global business in order to combine or transfer existing theories and approaches to inquiry in this area.

CONCLUSION

This chapter reviewed the perspectives of fostering SCM in global business, thus describing the theoretical and practical concept of SCM; the applications of SCM; fostering SCM through KM in global business; the strategic success factors of SCM; and the significance of SCM in global business. Fostering SCM capabilities requires employees and management team who are flexible in their roles, have a broad set of manufacturing skills, adaptable to reorganization, able to work in boundary-spanning responsibilities and are innovative. Utilizing KM helps the supply chain-related organizations practically improve the efficiency and effectiveness in the information age.

The utilization of SCM is necessary for modern organizations that seek to serve suppliers and customers, increase business performance, strengthen competitiveness, and achieve continuous success in global business. Therefore, it is essential for modern organizations to examine their SCM applications, develop a strategic plan to regularly check their practical advancements, and immediately respond to the SCM needs of customers in global business. Applying SCM will effectively enhance organizational performance and gain sustainable competitive advantage in global business.

REFERENCES

- Ahn, H. J., & Lee, H. (2004). An agent-based dynamic information network for supply chain management. *BT Technology Journal*, 22(2), 18–27. doi:10.1023/B:BTTJ.0000033467.83300.c0
- Al-Mutawah, K., Lee, V., & Cheung, Y. (2009). A new multi-agent system framework for tacit knowledge management in manufacturing supply chains. *Journal of Intelligent Manufacturing*, 20(5), 593–610. doi:10.1007/s10845-008-0142-0
- Arlbjørn, J. S., de Haas, H., & Munksgaard, K. B. (2013). Exploring supply chain innovation. *Logistics Research*, 3(1), 3–18. doi:10.1007/s12159-010-0044-3
- Aziz, N., & Sparrow, J. (2011). Patterns of gaining and sharing of knowledge about customers: A study of an express parcel delivery company. *Knowledge Management Research and Practice*, 9(1), 29–47. doi:10.1057/kmrp.2011.3
- Bandyopadhyay, S., & Pathak, P. (2007). Knowledge sharing and cooperation in outsourcing projects: A game theoretical analysis. *Decision Support Systems*, 43(2), 349–358. doi:10.1016/j.dss.2006.10.006

Fostering Supply Chain Management in Global Business

- Basu, D. R., & Miroshnik, V. (1999). Strategic human resource management of Japanese Multinationals: A case study of Japanese multinational companies in the UK. *Journal of Management Development*, 18(9), 714–732. doi:10.1108/02621719910300775
- Beamon, B. M. (1998). Supply chain design and analysis: Models and methods. *International Journal of Production Economics*, 55(3), 281–294. doi:10.1016/S0925-5273(98)00079-6
- Bechtel, C., & Jayaram, J. (1997). Supply chain management: A strategic perspective. *International Journal of Logistics Management*, 8(1), 15–34. doi:10.1108/09574099710805565
- Bhaskar, V., & Lallement, P. (2008). Activity routing in a distributed supply chain: Performance evaluation with two inputs. *Journal of Network and Computer Applications*, 31(4), 402–428. doi:10.1016/j.jnca.2008.02.001
- Bowersox, D. J., Closs, D. J., & Stank, T. P. (2000). Ten mega-trends that will revolutionize supply chain logistics. *Journal of Business Logistics*, 21(2), 1–15.
- Brandenburg, M., & Seuring, S. (2011). Impacts of supply chain management on company value: Benchmarking companies from the fast moving consumer goods industry. *Logistics Research*, 3(4), 233–248. doi:10.1007/s12159-011-0056-7
- Brewer, P. C., & Speh, T. W. (2000). Using the balanced scorecard to measure supply chain performance. *Journal of Business Logistics*, 21(1), 75–95.
- Bruce, M., Daly, L., & Towers, N. (2004). Lean or agile: A solution for supply chain management in the textiles and clothing industry? *International Journal of Operations & Production Management*, 24(1–2), 151–170. doi:10.1108/01443570410514867
- Carvalho, H., Azevedo, S., & Cruz-Machado, V. (2012). Agile and resilient approaches to supply chain management: Influence on performance and competitiveness. *Logistics Research*, 4(1–2), 49–62. doi:10.1007/s12159-012-0064-2
- Chang, H. H., Hung, C. J., Wong, K. H., & Lee, C. H. (2013). Using the balanced scorecard on supply chain integration performance: A case study of service businesses. *Service Business*, 7(4), 539–561. doi:10.1007/s11628-012-0175-5
- Chen, K., Shen, J., & Feng, M. (2014). Disruptions management of a supply chain under strategic subsidy policy for the demand-stimulating inventory. *Computers & Industrial Engineering*, 76, 169–182. doi:10.1016/j.cie.2014.07.030
- Chen, S. J., & Huang, E. (2007). A systematic approach for supply chain improvement using design structure matrix. *Journal of Intelligent Manufacturing*, 18(2), 285–299. doi:10.1007/s10845-007-0022-z
- Cheng, J., Yeh, C., & Tu, C. (2008). Trust and knowledge sharing in green supply chains. *Supply Chain Management: An International Journal*, 13(4), 283–295. doi:10.1108/13598540810882170
- Cheung, C. F., Kwok, S. K., & Heung, C. M. (2012). A knowledge-based customization system for supply chain integration. *Expert Systems with Applications*, 39(4), 3906–3924. doi:10.1016/j.eswa.2011.08.096

Fostering Supply Chain Management in Global Business

- Choi, T. Y., Dooley, K. J., & Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: Control versus emergence. *Journal of Operations Management*, 19(3), 351–366. doi:10.1016/S0272-6963(00)00068-1
- Choi, T. Y., & Hong, Y. (2002). Unveiling the structure of supply networks: Case studies in Honda, Acura, and DaimlerChrysler. *Journal of Operations Management*, 20(5), 469–493. doi:10.1016/S0272-6963(02)00025-6
- Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, 24(5), 637–652. doi:10.1016/j.jom.2005.07.002
- Christopher, M. (2012). *Logistics and supply chain management: Creating value-adding networks*. Dorchester, UK: Financial Times Prentice–Hall.
- Christopher, M., & Ryals, L. (1999). Supply chain strategy: Its impact on shareholders' value. *International Journal of Logistics Management*, 10(1), 1–10. doi:10.1108/09574099910805897
- Christopher, M., & Towill, D. R. (2002). Developing market specific supply chain strategies. *International Journal of Logistics Management*, 13(1), 1–14. doi:10.1108/09574090210806324
- Closs, D. J., Speier, C., & Meacham, N. (2011). Sustainability to support end-to-end value chains: The role of supply chain management. *Journal of the Academy of Marketing Science*, 39(1), 101–116. doi:10.1007/s11747-010-0207-4
- Cooper, M. C., & Ellram, L. M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *International Journal of Logistics Management*, 4(2), 13–24. doi:10.1108/09574099310804957
- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *International Journal of Logistics Management*, 8(1), 1–14. doi:10.1108/09574099710805556
- Croxton, K. L., Garcia-Dastugue, S. J., Lambert, D. M., & Rogers, D. S. (2001). The supply chain management processes. *International Journal of Logistics Management*, 12(2), 13–36. doi:10.1108/09574090110806271
- Curry, J., & Kenney, M. (1999). Beating the clock: Corporate response to rapid change in the PC industry. *California Management Review*, 42(1), 8–36. doi:10.2307/41166017
- Das, A., Narasimhan, R., & Talluri, S. (2006). Supplier integration: Finding an optimal configuration. *Journal of Operations Management*, 24(5), 563–582. doi:10.1016/j.jom.2005.09.003
- Das, T. K. (2006). Strategic alliance temporalities and partner opportunism. *British Journal of Management*, 17(1), 1–21. doi:10.1111/j.1467-8551.2006.00482.x
- Defee, C. C., & Stank, T. P. (2005). Applying the strategy-structure-performance paradigm to the supply chain environment. *International Journal of Logistics Management*, 16(1), 28–50. doi:10.1108/09574090510617349
- Defee, C. C., Stank, T. P., Esper, T. L., & Mentzer, J. T. (2009). The role of followers in supply chains. *Journal of Business Logistics*, 30(2), 65–84. doi:10.1002/j.2158-1592.2009.tb00112.x

Fostering Supply Chain Management in Global Business

- Devaraj, S., Krajewski, L., & Wei, J. (2007). Impact of ebusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management*, 25(6), 1199–1216. doi:10.1016/j.jom.2007.01.002
- Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge sharing network: The Toyota case. *Strategic Management Journal*, 21(1), 345–367. doi:10.1002/(SICI)1097-0266(200003)21:3<345::AID-SMJ96>3.0.CO;2-N
- Ellinger, A. E., Ellinger, A. D., & Keller, S. B. (2002). Logistics managers' learning environments and firm performance. *Journal of Business Logistics*, 23(1), 19–37. doi:10.1002/j.2158-1592.2002.tb00014.x
- Ellram, L. M., & Cooper, M. C. (2014). Supply chain management: It's all about the journey, not the destination. *Journal of Supply Chain Management*, 50(1), 8–20. doi:10.1111/jscm.12043
- Esper, T. L., Defee, C. C., & Mentzer, J. T. (2010). A framework of supply chain orientation. *International Journal of Logistics Management*, 21(2), 161–179. doi:10.1108/09574091011071906
- Farahani, R. Z., Rezapour, S., Drezner, T., & Fallah, S. (2014). Competitive supply chain network design: An overview of classifications, models, solution techniques and applications. *Omega: The International Journal of Management Science*, 45, 92–118. doi:10.1016/j.omega.2013.08.006
- Flint, D. J., Blocker, C. P., & Boutin, P. J. Jr. (2011). Customer value anticipation, customer satisfaction and loyalty: An empirical examination. *Industrial Marketing Management*, 40(2), 219–230. doi:10.1016/j.indmarman.2010.06.034
- Forslund, H. (2006). Performance gaps in the dyadic order fulfillment process. *International Journal of Physical Distribution & Logistics Management*, 36(8), 580–595. doi:10.1108/09600030610702871
- Frohlich, M., & Westbrook, R. (2001). Arcs of integration: An international study of supply chain strategies. *Journal of Operations Management*, 19(2), 185–200. doi:10.1016/S0272-6963(00)00055-3
- Fu, D., Ionescu, C. M., Aghezzaf, E. H., & De Keyser, R. (2014). Decentralized and centralized model predictive control to reduce the bullwhip effect in supply chain management. *Computers & Industrial Engineering*, 73, 21–31. doi:10.1016/j.cie.2014.04.003
- Giménez, C., & Ventura, E. (2003). Supply chain management as a competitive advance in the Spanish grocery sector. *International Journal of Logistics Management*, 14(1), 77–88. doi:10.1108/09574090310806558
- Goh, A. (2006). A strategic management framework for leveraging knowledge innovation. *International Journal of the Computer the Internet and Management*, 14(3), 32–49.
- Grant, R. M., & Baden-Fuller, C. (2004). A knowledge-accessing theory of strategic alliances. *Journal of Management Studies*, 41(1), 61–84. doi:10.1111/j.1467-6486.2004.00421.x
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, 21(1/2), 71–87. doi:10.1108/01443570110358468

Fostering Supply Chain Management in Global Business

- Halldorsson, A., Kotzab, H., Mikkola, J. H., & Skjøtt-Larsen, T. (2007). Complementary theories to supply chain management. *Supply Chain Management: An International Journal*, 12(4), 284–296. doi:10.1108/13598540710759808
- Handfield, R. B., Krause, D., Scannell, T., & Moczka, R. M. (2000). Avoid the pitfalls in supplier development. *Sloan Management Review*, 41(2), 37–49.
- Handfield, R. B., & Nichols, E. L. (1999). *Introduction to supply chain management*. Upper Saddle River, NJ: Prentice–Hall.
- Harland, C. M. (1996). Supply chain management: Relationships, chains and networks. *British Journal of Management*, 7(1), 63–80. doi:10.1111/j.1467-8551.1996.tb00148.x
- Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: Competing through manufacturing*. New York: John Wiley & Sons.
- He, Q., Ghobadian, A., & Gallear, D. (2013). Knowledge acquisition in supply chain partnerships: The role of power. *International Journal of Production Economics*, 141(2), 605–618. doi:10.1016/j.ijpe.2012.09.019
- Heide, J., & Stump, R. (1995). Performance implications of buyer-supplier relationships in industrial markets: A transaction cost explanation. *Journal of Business Research*, 32(1), 57–66. doi:10.1016/0148-2963(94)00010-C
- Heikkila, J. (2002). From supply to demand chain management: Efficiency and customer satisfaction. *Journal of Operations Management*, 20(6), 747–767. doi:10.1016/S0272-6963(02)00038-4
- Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*, 30(10), 847–868. doi:10.1108/09600030010351246
- Holweg, M., Disney, S., Holmstrom, J., & Smaros, J. (2005). Supply chain collaboration: Making sense of the strategy continuum. *European Management Journal*, 23(2), 170–181. doi:10.1016/j.emj.2005.02.008
- Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management: An International Journal*, 6(5), 205–207. doi:10.1108/EUM000000006039
- Hoyt, J., & Huq, F. (2000). From arms-length to collaborative relationships in the supply chain. *International Journal of Physical Distribution & Logistics Management*, 30(9), 750–764. doi:10.1108/09600030010351453
- Huang, C. C., & Lin, S. (2010). Sharing knowledge in a supply chain using the semantic web. *Expert Systems with Applications*, 37(4), 3145–3316. doi:10.1016/j.eswa.2009.09.067
- Hutzschenreuter, T., & Horstkotte, J. (2010). Knowledge transfer to partners: A firm level perspective. *Journal of Knowledge Management*, 14(3), 428–448. doi:10.1108/13673271011050148
- Ittner, C., Larcker, D., Nagar, V., & Rajan, M. (1999). Supplier selection, monitoring practices, and firm performance. *Journal of Accounting and Public Policy*, 18(3), 253–281. doi:10.1016/S0278-4254(99)00003-4

Fostering Supply Chain Management in Global Business

- Ivanov, D., & Sokolov, B. (2012). The inter-disciplinary modeling of supply chains in the context of collaborative multi-structural cyber-physical networks. *Journal of Manufacturing Technology Management*, 23(8), 976–997. doi:10.1108/17410381211276835
- Jalalvand, F., Teimoury, E., Makui, A., Aryanezhad, M. B., & Jolai, F. (2011). A method to compare supply chains of an industry. *Supply Chain Management: An International Journal*, 16(2), 82–97. doi:10.1108/13598541111115347
- Kahn, K. B., & Mentzer, J. T. (1996). Logistics and interdepartmental integration. *International Journal of Physical Distribution & Logistics Management*, 26(8), 6–14. doi:10.1108/09600039610182753
- Kasemsap, K. (2013a). Innovative framework: Formation of causal model of organizational culture, organizational climate, knowledge management, and job performance. *Journal of International Business Management & Research*, 4(12), 21–32.
- Kasemsap, K. (2013b). Synthesized framework: Establishing a causal model of organizational learning, knowledge management, knowledge-sharing behavior, and organizational performance. *International Journal of the Computer, the Internet and Management*, 21(2), 29–34.
- Kasemsap, K. (2014a). Unifying a framework of organizational culture, organizational climate, knowledge management, and job performance. In R. Perez-Castillo & M. Piattini (Eds.), *Uncovering essential software artifacts through business process archeology* (pp. 336–362). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4667-4.ch013
- Kasemsap, K. (2014b). The role of social media in the knowledge-based organizations. In I. Lee (Ed.), *Integrating social media into business practice, applications, management, and models* (pp. 254–275). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6182-0.ch013
- Kasemsap, K. (2014c). Strategic innovation management: An integrative framework and causal model of knowledge management, strategic orientation, organizational innovation, and organizational performance. In P. Ordóñez de Pablos & R. Tennyson (Eds.), *Strategic approaches for human capital management and development in a turbulent economy* (pp. 102–116). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4530-1.ch007
- Kasemsap, K. (2014d). The role of knowledge sharing on organisational innovation: An integrated framework. In L. Al-Hakim & C. Jin (Eds.), *Quality innovation: Knowledge, theory, and practices* (pp. 247–271). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4769-5.ch012
- Kasemsap, K. (2014e). The role of social networking in global business environments. In P. Smith & T. Cockburn (Eds.), *Impact of emerging digital technologies on leadership in global business* (pp. 183–201). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6134-9.ch010
- Kasemsap, K. (2014f). The role of social capital in higher education institutions. In N. Baporikar (Ed.), *Handbook of research on higher education in the MENA region: Policy and practice* (pp. 119–147). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6198-1.ch007
- Kasemsap, K. (2014g). The role of knowledge management on job satisfaction: A systematic framework. In B. Tripathy & D. Acharjya (Eds.), *Advances in secure computing, Internet services, and applications* (pp. 104–127). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4940-8.ch006

Fostering Supply Chain Management in Global Business

Kasemsap, K. (2014h). Constructing a unified framework and a causal model of occupational satisfaction, trainee reactions, perception of learning, and perceived training transfer. In S. Hai-Jew (Ed.), *Remote workforce training: Effective technologies and strategies* (pp. 28–52). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-5137-1.ch003

Kasemsap, K. (2014i). The role of performance management practices on organizational performance: A functional framework. In N. Ray & K. Chakraborty (Eds.), *Handbook of research on strategic business infrastructure development and contemporary issues in finance* (pp. 62–85). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-5154-8.ch006

Kasemsap, K. (2015a). Developing a framework of human resource management, organizational learning, knowledge management capability, and organizational performance. In P. Ordoñez de Pablos, L. Turró, R. Tennyson, & J. Zhao (Eds.), *Knowledge management for competitive advantage during economic crisis* (pp. 164–193). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6457-9.ch010

Kasemsap, K. (2015b). The role of data mining for business intelligence in knowledge management. In A. Azevedo & M. Santos (Eds.), *Integration of data mining in business intelligence systems* (pp. 12–33). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6477-7.ch002

Kasemsap, K. (2015c). The role of information system within enterprise architecture and their impact on business performance. In M. Wadhwa & A. Harper (Eds.), *Technology, innovation, and enterprise transformation* (pp. 262–284). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6473-9.ch012

Kasper, H., Muhlbacher, J., & Muller, B. (2008). Intra-organizational knowledge sharing in MNCs depending on the degree of decentralization and communities of practice. *Journal of Global Business and Technology*, 4(1), 59–68.

Kaufmann, L., & Saw, A. A. (2014). Using a multiple-informant approach in SCM research. *International Journal of Physical Distribution & Logistics Management*, 44(6), 511–527. doi:10.1108/IJPDLM-05-2013-0099

Kim, S. H., & Netessine, S. (2013). Collaborative cost reduction and component procurement under information asymmetry. *Management Science*, 59(1), 189–206. doi:10.1287/mnsc.1120.1573

Koh, L., Demirbag, M., Bayraktar, E., Tatoglu, E., & Zaim, S. (2007). The impact of supply chain management practices on performance of SMEs. *Industrial Management & Data Systems*, 107(1), 103–124. doi:10.1108/02635570710719089

Kundu, A., Jain, V., Kumar, S., & Chandra, C. (2015). A journey from normative to behavioral operations in supply chain management: A review using Latent Semantic Analysis. *Expert Systems with Applications*, 42(2), 796–809. doi:10.1016/j.eswa.2014.08.035

Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *International Journal of Logistics Management*, 9(2), 1–19. doi:10.1108/09574099810805807

Lambert, D. M., Garcia-Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of process-oriented supply chain management frameworks. *Journal of Business Logistics*, 26(1), 25–51. doi:10.1002/j.2158-1592.2005.tb00193.x

Fostering Supply Chain Management in Global Business

- Lambert, D. M., & Pohlen, T. L. (2001). Supply chain metrics. *International Journal of Logistics Management*, 12(1), 1–19. doi:10.1108/09574090110806190
- Lancioni, R. A., & Chandran, R. (2009). Managing knowledge in industrial markets: New dimensions and challenges. *Industrial Marketing Management*, 38(2), 148–151. doi:10.1016/j.indmarman.2008.12.002
- Li, T., & Zhang, H. (2015). Information sharing in a supply chain with a make-to-stock manufacturer. *Omega: The International Journal of Management Science*, 50, 115–125. doi:10.1016/j.omega.2014.08.001
- Lin, L. C., & Li, T. S. (2010). An integrated framework for supply chain performance measurement using six-sigma metrics. *Software Quality Journal*, 18(3), 387–406. doi:10.1007/s11219-010-9099-2
- Liu, D.-R., & Lai, C.-H. (2011). Mining group-based knowledge flows for sharing task knowledge. *Decision Support Systems*, 50(2), 370–386. doi:10.1016/j.dss.2010.09.004
- Liu, Q., & Zhang, D. (2013). Dynamic pricing competition with strategic customers under vertical product differentiation. *Management Science*, 59(1), 84–101. doi:10.1287/mnsc.1120.1564
- Lockamy, A. III, & McCormack, K. (2004). Linking SCOR planning practices to supply chain performance; An exploratory study. *International Journal of Operations & Production Management*, 24(12), 1192–1218. doi:10.1108/01443570410569010
- Lu, T. P., Trappey, A. J. C., Chen, Y. K., & Chang, Y. D. (2013). Collaborative design and analysis of supply chain network management key processes model. *Journal of Network and Computer Applications*, 36(6), 1503–1511. doi:10.1016/j.jnca.2013.03.015
- Mackelprang, A. W., Robinson, J. L., Bernardes, E., & Webb, G. S. (2014). The relationship between strategic supply chain integration and performance: A meta-analytic evaluation and implications for supply chain management research. *Journal of Business Logistics*, 35(1), 71–96. doi:10.1111/jbl.12023
- Manuj, I., & Sahin, F. (2011). A model of supply chain and supply chain decision-making complexity. *International Journal of Physical Distribution & Logistics Management*, 41(5), 511–549. doi:10.1108/09600031111138844
- Marsillac, E., & Roh, J. J. (2014). Connecting product design, process and supply chain decisions to strengthen global supply chain capabilities. *International Journal of Production Economics*, 147, 317–329. doi:10.1016/j.ijpe.2013.04.011
- Martinez-Sanchez, A., Vela-Jimenez, M. J., Perez-Perez, M., & de-Luis-Carnicer, P. (2009). Inter-organizational cooperation and environmental change: Moderating effects between flexibility and innovation performance. *British Journal of Management*, 20(4), 537–561. doi:10.1111/j.1467-8551.2008.00605.x
- Masson, R., Iosif, L., MacKerron, G., & Fernie, J. (2007). Managing complexity in agile global fashion industry supply chains. *International Journal of Logistics Management*, 18(2), 238–254. doi:10.1108/09574090710816959
- Mathieu, R. G., & Pal, R. (2011). The selection of supply chain management projects: A case study approach. *Operations Management Research*, 4(3-4), 164–181. doi:10.1007/s12063-011-0058-2

Fostering Supply Chain Management in Global Business

- McGinnis, M. A., & Vallopra, R. (1999). Purchasing and supplier involvement: Issues and insights regarding new product success. *Journal of Supply Chain Management*, 35(3), 4–15. doi:10.1111/j.1745-493X.1999.tb00057.x
- Mena, C., Humphries, A., & Choi, T. Y. (2013). Toward a theory of multi-tier supply chain management. *Journal of Supply Chain Management*, 49(2), 58–77. doi:10.1111/jscm.12003
- Mendelson, H. (2000). Organizational architecture and success in the information technology industry. *Management Science*, 46(4), 513–529. doi:10.1287/mnsc.46.4.513.12060
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Mentzer, J. T., Flint, D. J., & Kent, J. L. (1999). Developing a logistics service quality scale. *Journal of Business Logistics*, 20(1), 9–32.
- Mentzer, J. T., & Gundlach, G. (2010). Exploring the relationship between marketing and supply chain management: Introduction to the special issue. *Journal of the Academy of Marketing Science*, 38(1), 1–4. doi:10.1007/s11747-009-0150-4
- Min, H., & Zhou, G. (2002). Supply chain modeling: Past, present and future. *Computers & Industrial Engineering*, 43(1-2), 231–249. doi:10.1016/S0360-8352(02)00066-9
- Min, S., Mentzer, J. T., & Ladd, R. T. (2007). A market orientation in supply chain management. *Journal of the Academy of Marketing Science*, 35(4), 507–522. doi:10.1007/s11747-007-0020-x
- Monczka, R. M., & Morgan, J. P. (1996). Supplier integration: A new level of supply chain management. *Purchasing*, 120(1), 110–113.
- Myers, M. B., Griffith, D. A., Daugherty, P. J., & Lusch, R. F. (2004). Maximizing the human capital equation in logistics: Education, experience, and skills. *Journal of Business Logistics*, 25(1), 211–232. doi:10.1002/j.2158-1592.2004.tb00175.x
- Narasimhan, R., & Jayaram, J. (1998). Causal linkage in supply chain management: An exploration study of North American manufacturing companies. *Decision Sciences*, 29(3), 579–605. doi:10.1111/j.1540-5915.1998.tb01355.x
- Novack, R. A., Rinehart, L. M., & Langley, C. J. (1996). A comparative assessment of senior and logistics executives' perceptions of logistics value. *Journal of Business Logistics*, 17(1), 135–178.
- Novack, R. A., & Thomas, D. J. (2004). The challenges of implementing the perfect order concept. *Transportation Journal*, 43(1), 5–17.
- Om, K., Lee, J., & Chang, J. (2007). Using supply chain management to enhance industry–university collaborations in IT higher education in Korea. *Scientometrics*, 71(3), 455–471. doi:10.1007/s11192-007-1690-3
- Oztemel, E., & Tekez, E. K. (2009). Interactions of agents in performance based supply chain management. *Journal of Intelligent Manufacturing*, 20(2), 159–167. doi:10.1007/s10845-008-0229-7

Fostering Supply Chain Management in Global Business

- Pagell, M., & Krause, D. (2002). Strategic consensus in the internal supply chain: Exposing the manufacturing-purchasing link. *International Journal of Production Research*, 40(13), 3075–3092. doi:10.1080/00207540210136540
- Pagell, M., & Shevchenko, A. (2014). Why research in sustainable supply chain management should have no future. *Journal of Supply Chain Management*, 50(1), 44–55. doi:10.1111/jscm.12037
- Patil, S. K., & Kant, R. (2014). A fuzzy AHP-TOPSIS framework for ranking the solutions of knowledge management adoption in supply chain to overcome its barriers. *Expert Systems with Applications*, 41(2), 679–693. doi:10.1016/j.eswa.2013.07.093
- Pedroso, M. C., & Nakano, D. (2009). Knowledge and information flows in supply chains: A study on pharmaceutical companies. *International Journal of Production Economics*, 122(1), 376–384. doi:10.1016/j.ijpe.2009.06.012
- Perrons, R., & Platts, K. (2005). Outsourcing strategies for radical innovations: Does industry clock-speed make a difference? *Journal of Manufacturing Technology Management*, 16(8), 842–863. doi:10.1108/17410380510627852
- Pil, F. K., & Fujimoto, T. (2007). Lean and reflective production: The dynamic nature of production models. *International Journal of Production Research*, 45(16), 3741–3761. doi:10.1080/00207540701223659
- Quelch, J. A., & Kenny, D. (1994). Extend profits, not product lines. *Harvard Business Review*, 72(5), 153–160.
- Rahman, A., Brookes, N. J., & Bennett, D. J. (2009). The precursors and impacts of BSR on AMT acquisition and implementation. *IEEE Transactions on Engineering Management*, 56(2), 285–297. doi:10.1109/TEM.2009.2016070
- Rao Tummala, V. M., Phillips, C. L. M., & Johnson, M. (2006). Assessing supply chain management success factors: A case study. *Supply Chain Management: An International Journal*, 11(2), 179–192. doi:10.1108/13598540610652573
- Richey, R. G. Jr, Roath, A. S., Whipple, J. M., & Fawcett, S. E. (2010). Exploring a governance theory of supply chain management: Barriers and facilitators to integration. *Journal of Business Logistics*, 31(1), 237–256. doi:10.1002/j.2158-1592.2010.tb00137.x
- Richey, R. G., Tokman, M., & Wheeler, A. R. (2006). A supply chain manager selection methodology: Empirical test and suggested application. *Journal of Business Logistics*, 27(2), 163–190. doi:10.1002/j.2158-1592.2006.tb00221.x
- Robb, D. J., Xie, B., & Arthanari, T. (2008). Supply chain and operations practice and performance in Chinese furniture manufacturing. *International Journal of Production Economics*, 112(2), 683–699. doi:10.1016/j.ijpe.2007.04.011
- Roh, J., Hong, P., & Min, H. (2014). Implementation of a responsive supply chain strategy in global complexity: The case of manufacturing firms. *International Journal of Production Economics*, 147, 198–210. doi:10.1016/j.ijpe.2013.04.013

Fostering Supply Chain Management in Global Business

- Saberi, S., Shahandeh Nookabadi, A., & Reza Hejazi, S. (2012). Applying agent-based system and negotiation mechanism in improvement of inventory management and customer order fulfillment in multiechelon supply chain. *Arabian Journal for Science and Engineering*, 37(3), 851–861. doi:10.1007/s13369-012-0197-2
- Sahin, F., & Robinson, E. P. Jr. (2005). Information sharing and coordination in make-to-order supply chains. *Journal of Operations Management*, 23(6), 579–598. doi:10.1016/j.jom.2004.08.007
- Samuel, K. E., Goury, M. L., Gunasekaran, A., & Spalanzani, A. (2011). Knowledge management in supply chain: An empirical study from France. *The Journal of Strategic Information Systems*, 20(3), 283–306. doi:10.1016/j.jsis.2010.11.001
- Serdarasan, S. (2013). A review of supply chain complexity drivers. *Computers & Industrial Engineering*, 66(3), 533–540. doi:10.1016/j.cie.2012.12.008
- Shadur, M. A., & Bamber, G. J. (1994). Toward lean management? International transferability of Japanese management strategies to Australia. *The International Executive*, 36(3), 343–364. doi:10.1002/tie.5060360307
- Shafieezadeh, M., & Sadegheih, A. (2014). Developing an integrated inventory management model for multi-item multi-echelon supply chain. *International Journal of Advanced Manufacturing Technology*, 72(5-8), 1099–1119. doi:10.1007/s00170-014-5684-z
- Shih, S. C., Hsu, S., Zhu, Z., & Balasubramanian, S. (2012). Knowledge sharing: A key role in the downstream supply chain. *Information & Management*, 49(2), 70–80. doi:10.1016/j.im.2012.01.001
- Shoushtari, K. D. (2013). Redesigning a large supply chain management system to reduce the government administration: A socio-functional systems approach. *Systemic Practice and Action Research*, 26(2), 195–216. doi:10.1007/s11213-012-9244-x
- Siddiqui, F., Haleem, A., & Sharma, C. (2012). The impact of supply chain management practices in total quality management practices and flexible system practices context: An empirical study in oil and gas industry. *Global Journal of Flexible Systems Management*, 13(1), 11–23. doi:10.1007/s40171-012-0002-9
- Simchi-Levi, D. A., Kaminsky, P. A., & Simchi-Levi, E. (2003). *Designing and managing the supply chain: Concepts, strategies, and case studies*. New York, NY: McGraw-Hill.
- Simonin, B. L. (2004). An empirical investigation of the process of knowledge transfer in international strategic alliances. *Journal of International Business Studies*, 35(5), 407–427. doi:10.1057/palgrave.jibs.8400091
- Sinkovics, R. R., & Roath, A. S. (2004). Strategic orientation, capabilities, and performance in manufacturer: 3PL relationships. *Journal of Business Logistics*, 25(2), 43–64. doi:10.1002/j.2158-1592.2004.tb00181.x
- Skinner, W. (1996). Manufacturing strategy on the “S” curve. *Production and Operations Management*, 5(1), 3–14. doi:10.1111/j.1937-5956.1996.tb00381.x
- Soderberg, L., & Bengtsson, L. (2010). Supply chain management maturity and performance in SMEs. *Operations Management Research*, 3(1), 90–97. doi:10.1007/s12063-010-0030-6

Fostering Supply Chain Management in Global Business

- Spekman, R., Kamauff, J. W. Jr, & Myhr, N. (1998). An empirical investigation into supply chain management. *International Journal of Physical Distribution & Logistics Management*, 28(8), 630–650. doi:10.1108/09600039810247542
- Styles, C., & Ambler, T. (2000). The impact of relational variables on export performance: An empirical investigation in Australia and the UK. *Australian Journal of Management*, 25(3), 261–281. doi:10.1177/031289620002500302
- Swink, M., Narasimhan, R., & Wang, C. (2007). Managing beyond the factory walls: Effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management*, 25(1), 148–164. doi:10.1016/j.jom.2006.02.006
- Tan, K. C., Kannan, V., & Handfield, R. B. (1998). Supply chain management: Supplier performance and firm performance. *International Journal of Purchasing and Materials Management*, 34(3), 2–9.
- Thomé, A. M. T., Scavarda, L. F., Pires, S. R. I., Ceryno, P., & Klingebiel, K. (2014). A multi-tier study on supply chain flexibility in the automotive industry. *International Journal of Production Economics*, 158, 91–105. doi:10.1016/j.ijpe.2014.07.024
- Tseng, M. L. (2009). A causal and effect decision making model of service quality expectation using grey–fuzzy DEMATEL approach. *Expert Systems with Applications*, 36(4), 7738–7748. doi:10.1016/j.eswa.2008.09.011
- Vithessonthi, C. (2008). Social interaction and knowledge sharing behaviour in multinational corporations. *Business Review (Federal Reserve Bank of Philadelphia)*, 10(2), 324–331.
- Wagner, S. M., & Buko, C. (2005). An empirical investigation of knowledge-sharing in networks. *Journal of Supply Chain Management*, 41(4), 17–31. doi:10.1111/j.1745-493X.2005.04104003.x
- Wang, C., Fergusson, C., Perry, D., & Antony, J. (2008). A conceptual case-based model for knowledge sharing among supply chain members. *Business Process Management Journal*, 14(2), 147–165. doi:10.1108/14637150810864907
- Ward, P., McCreery, J., Ritzman, L., & Sharma, D. (1998). Competitive priorities in operations management. *Decision Sciences*, 29(4), 1035–1046. doi:10.1111/j.1540-5915.1998.tb00886.x
- Wiengarten, F., Humphreys, P., Cao, G., Fynes, B., & McKittrick, A. (2010). Collaborative supply chain practices and performance: Exploring the key role of information quality. *Supply Chain Management: An International Journal*, 15(6), 463–473. doi:10.1108/13598541011080446
- Wolf, J. (2011). Sustainable supply chain management integration: A qualitative analysis of the German manufacturing industry. *Journal of Business Ethics*, 102(2), 221–235. doi:10.1007/s10551-011-0806-0
- Womack, J. P., & Jones, D. T. (1996). *Lean thinking*. New York, NY: Simon Schuster.
- Wong, W. P., & Wong, P. S. (2011). Supply chain management, knowledge management capability, and their linkages towards firm performance. *Business Process Management Journal*, 17(6), 940–964. doi:10.1108/14637151111182701

Fostering Supply Chain Management in Global Business

Wu, D. J. (2001). Software agents for knowledge management: Coordination in multi-agent supply chains and auctions. *Expert Systems with Applications*, 20(1), 51–64. doi:10.1016/S0957-4174(00)00048-8

Wu, I. L., & Chuang, C. H. (2009). Analyzing contextual antecedents for the stage-based diffusion of electronic supply chain management. *Electronic Commerce Research and Applications*, 8(6), 302–314. doi:10.1016/j.elerap.2009.04.013

Wycisk, C., McKelvey, B., & Hulsmann, M. (2008). Smart parts, supply networks as complex adaptive systems: Analysis and implications. *International Journal of Physical Distribution & Logistics Management*, 38(2), 108–125. doi:10.1108/09600030810861198

Xiao, T., & Yang, D. (2008). Price and service competition of supply chains with risk-averse retailers under demand uncertainty. *International Journal of Production Economics*, 114(1), 187–200. doi:10.1016/j.ijpe.2008.01.006

Yang, F., Wu, D., Liang, L., Bi, G., & Wu, D. D. (2011). Supply chain DEA: Production possibility set and performance evaluation model. *Annals of Operations Research*, 185(1), 195–211. doi:10.1007/s10479-008-0511-2

Youn, S., Yang, M. G., & Roh, J. J. (2012). Extending the efficient and responsive supply chains framework to the green context. *Benchmarking: An International Journal*, 19(4–5), 463–480.

Yu, M., & Nagurney, A. (2013). Competitive food supply chain networks with application to fresh produce. *European Journal of Operational Research*, 224(2), 273–282. doi:10.1016/j.ejor.2012.07.033

Zacharia, Z. G., Sanders, N. R., & Fugate, B. S. (2014). Evolving functional perspectives within supply chain management. *Journal of Supply Chain Management*, 50(1), 73–88. doi:10.1111/jscm.12022

Zhang, A., Luo, H., & Huang, G. Q. (2013). A bi-objective model for supply chain design of dispersed manufacturing in China. *International Journal of Production Economics*, 146(1), 48–58. doi:10.1016/j.ijpe.2012.12.008

Zhang, D. A. (2006). Network economic model for supply chain versus supply chain competing. *Omega: The International Journal of Management Science*, 34(3), 283–295. doi:10.1016/j.omega.2004.11.001

Zhao, J., Pablo, P., & Qi, Z. (2012). Enterprise knowledge management model based on China's practice and case study. *Computers in Human Behavior*, 28(2), 324–330. doi:10.1016/j.chb.2011.10.001

Zhengyi, Y., & Ronghua, J. (2005). Artificial neural network and its application in the performance evaluation enterprise knowledge management research. *Guangxi Social Sciences*, 126(12), 58–61.

ADDITIONAL READING

Albino, V., Dangelico, R. M., & Pontrandolfo, P. (2012). Do inter-organizational collaborations enhance a firm's environmental performance? A study of the largest US companies. *Journal of Cleaner Production*, 37, 304–315. doi:10.1016/j.jclepro.2012.07.033

Fostering Supply Chain Management in Global Business

- Alessandri, A., Gaggero, M., & Tonelli, F. (2011). Min–Max and predictive control for the management of distribution in supply chains. *IEEE Transactions on Control Systems Technology*, 19(5), 1075–1089. doi:10.1109/TCST.2010.2076283
- Arkan, A., & Hejazi, S. R. (2012). Coordinating orders in a two echelon supply chain with controllable lead time and ordering cost using the credit period. *Computers & Industrial Engineering*, 62(1), 56–69. doi:10.1016/j.cie.2011.08.016
- Baykasoglu, A., Kaplanoglu, V., Durmusoglu, Z., & Sahin, C. (2013). Integrating fuzzy DEMATEL and fuzzy hierarchical TOPSIS methods for truck selection. *Expert Systems with Applications*, 40(3), 899–907. doi:10.1016/j.eswa.2012.05.046
- Boufferos, X., Vickery, S. K., & Droge, C. (2012). The effects of strategic supplier selection on buyer competitive performance in matched domains: Does supplier integration mediate the relationships? *Journal of Supply Chain Management*, 48(2), 93–115. doi:10.1111/j.1745-493X.2012.03263.x
- Buyukozkan, G., & Cifci, G. (2012). A combined fuzzy AHP and fuzzy TOPSIS based strategic analysis of electronic service quality in healthcare industry. *Expert Systems with Applications*, 39(3), 2341–2354. doi:10.1016/j.eswa.2011.08.061
- Chavez, R., Fynes, B., Gimenez, C., & Wiengarten, F. (2012). Assessing the effect of industry clock-speed on the supply chain management practice–performance relationship. *Supply Chain Management: An International Journal*, 17(3), 235–248. doi:10.1108/13598541211227081
- Clifford Defee, C., & Fugate, B. S. (2010). Changing perspective of capabilities in the dynamic supply chain era. *The International Journal of Logistics Management*, 21(2), 180–206. doi:10.1108/09574091011071915
- Corso, M., Dogan, S. F., Mogre, R., & Perego, A. (2010). The role of knowledge management in supply chains, evidence from the Italian food industry. *International Journal of Networking and Virtual Organisations*, 7(3), 163–183. doi:10.1504/IJNVO.2010.031216
- de Brito, M. P., & van der Laan, E. (2010). Supply chain management and sustainability: Procrastinating integration into mainstream research. *Sustainability*, 2(4), 859–870. doi:10.3390/su2040859
- Dobrzykowski, D., Saboori Deilami, V., Hong, P., & Kim, S.-C. (2014). A structured analysis of operations and supply chain management research in healthcare (1982–2011). *International Journal of Production Economics*, 147, 514–530. doi:10.1016/j.ijpe.2013.04.055
- Droge, C., Vickery, S. K., & Jacobs, M. A. (2012). Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study. *International Journal of Production Economics*, 137(2), 250–262. doi:10.1016/j.ijpe.2012.02.005
- Gold, S., Seuring, S., & Beske, P. (2010). The constructs of sustainable supply chain management: A content analysis based on published case studies. *Progress in Industrial Ecology – International Journal (Toronto, Ont.)*, 7(2), 114–137.
- Govindan, K., Diabat, A., & Popiuc, M. N. (2012). Contract analysis: A performance measures and profit evaluation within two-echelon supply chains. *Computers & Industrial Engineering*, 63(1), 58–74. doi:10.1016/j.cie.2012.01.010

Fostering Supply Chain Management in Global Business

- Hong, P., Dobrzykowski, D., & Vonderembse, M. (2010). Effective integration of e-technologies and lean practices: Supply chain performance in product and service focused firms. *Benchmarking: An International Journal*, 17(4), 561–592. doi:10.1108/14635771011060594
- Huang, S., Yang, C., & Zhang, X. (2012). Pricing and production decisions in dual-channel supply chains with demand disruptions. *Computers & Industrial Engineering*, 62(1), 70–83. doi:10.1016/j.cie.2011.08.017
- Ivanov, D., Sokolov, B., & Kaeschel, J. (2011). Integrated supply chain planning based on a combined application of operations research and optimal control. *Central European Journal of Operations Research*, 19(3), 299–317. doi:10.1007/s10100-010-0185-0
- Khajavi, S. H., Partanen, J., & Holmstrom, J. (2014). Additive manufacturing in the spare parts supply chain. *Computers in Industry*, 65(1), 50–63. doi:10.1016/j.compind.2013.07.008
- Klassen, R. D., & Vereecke, A. (2012). Social issues in supply chains: Capabilities link responsibility, risk (opportunity), and performance. *International Journal of Production Economics*, 140(1), 103–115. doi:10.1016/j.ijpe.2012.01.021
- Kotzab, H., Teller, C., Grant, D. B., & Sparks, L. (2011). Antecedents for the adoption and execution of supply chain management. *Supply Chain Management: An International Journal*, 16(4), 231–245.
- Kravari, K., Bassiliades, N., & Boley, H. (2012). Cross-community interoperation between
- Kravari, K., Bassiliades, N., & Boley, H. (2012, August). Cross-community interoperation between knowledge-based multi-agent systems: A study on EMERALD and rule responder. *Expert Systems with Applications*, 39(10), 9571–9587. doi:10.1016/j.eswa.2012.02.160
- Kristianto, Y., Gunasekaran, A., Helo, P., & Sandhu, M. (2012). A decision support system for integrating manufacturing and product design into the reconfiguration of the supply chain networks. *Decision Support Systems*, 52(4), 790–801. doi:10.1016/j.dss.2011.11.014
- Kumar, S., Kadow, B. B., & Lamkin, M. K. (2011). Challenges with the introduction of radio-frequency identification systems into a manufacturer's supply chain: A pilot study. *Enterprise Information Systems*, 5(2), 235–253. doi:10.1080/17517575.2010.536262
- Lavie, D., & Drori, I. (2012). Collaborating for knowledge creation and application: The case of nano-technology research programs. *Organization Science*, 23(3), 704–724. doi:10.1287/orsc.1110.0656
- Lorentz, H., Toyli, J., Solakivi, T., & Ojala, L. (2013). Priorities and determinants for supply Chain management skills development in manufacturing firms. *Supply Chain Management: An International Journal*, 18(4), 358–375. doi:10.1108/SCM-03-2012-0111
- Marra, M., Ho, W., & Edwards, J. S. (2012). Supply chain knowledge management: A literature review. *Expert Systems with Applications*, 39(5), 6103–6110. doi:10.1016/j.eswa.2011.11.035
- Niemi, P., Huiskonen, J., & Karkkainen, H. (2010). Supply chain development as a knowledge development task. *International Journal of Networking and Virtual Organizations*, 7(2–3), 132. doi:10.1504/IJNVO.2010.031214

Fostering Supply Chain Management in Global Business

- Park, J. Y., Im, K. S., & Kim, J. S. (2011). The role of IT human capability in the knowledge transfer process in IT outsourcing context. *Information & Management*, 48(1), 53–61. doi:10.1016/j.im.2011.01.001
- Pietrobelli, C., & Rabellotti, R. (2011). Global value chains meet innovation systems: Are there learning opportunities for developing countries? *World Development*, 39(7), 1261–1269. doi:10.1016/j.worlddev.2010.05.013
- Pillai, K. G., & Min, S. (2010). A firm's capability to calibrate supply chain knowledge: Antecedents and consequences. *Industrial Marketing Management*, 39(8), 1365–1375. doi:10.1016/j.indmarman.2010.04.002
- Roh, J. J., Min, H., & Hong, P. (2011). A co-ordination theory approach to restructuring the supply chain: An empirical study from the focal company perspective. *International Journal of Production Research*, 49(15), 4517–4541. doi:10.1080/00207543.2010.497506
- Sambasivan, M., Siew-Phaik, L., Abidin Mohamed, Z., & Choy Leong, Y. (2013). Factors influencing strategic alliance outcomes in a manufacturing supply chain: Role of alliance motives, interdependence, asset specificity and relational capital. *International Journal of Production Economics*, 141(1), 339–351. doi:10.1016/j.ijpe.2012.08.016
- Samvedi, A., Jain, V., & Chan, F. T. S. (2013). Quantifying risks in a supply chain through integration of fuzzy AHP and fuzzy TOPSIS. *International Journal of Production Research*, 51(8), 2433–2442. doi:10.1080/00207543.2012.741330
- Seifert, R. W., & Langenberg, K. U. (2011). Managing business dynamics with adaptive supply chain portfolios. *European Journal of Operational Research*, 215(3), 551–562. doi:10.1016/j.ejor.2011.06.026
- Seuring, S. (2011). Supply chain management for sustainable products: Insights from research applying mixed-methodologies. *Business Strategy and the Environment*, 20(7), 471–484. doi:10.1002/bse.702
- Shaw, S., Grant, D., & Mangan, J. (2010). Developing environmental supply chain performance measures. *Benchmarking: An International Journal*, 17(3), 320–339. doi:10.1108/14635771011049326
- Stock, J. R., Boyer, S. L., & Harmon, T. (2010). Research opportunities in supply chain management. *Journal of the Academy of Marketing Science*, 38(1), 32–41. doi:10.1007/s11747-009-0136-2
- Subramanian, K., Rawlings, J. B., Maravelias, C. T., Flores-Cerrillo, J., & Megan, J. L. (2013). Integration of control theory and scheduling methods for supply chain management. *Computers & Chemical Engineering*, 51, 4–20. doi:10.1016/j.compchemeng.2012.06.012
- Tangpong, C. (2011). Content analytic approach to measuring constructs in operations and supply chain management. *Journal of Operations Management*, 29(6), 627–638. doi:10.1016/j.jom.2010.08.001
- Xia, Y., Xiao, T., & Zhang, G. P. (2013). Distribution channel strategies for a manufacturer with complementary products. *Decision Sciences*, 44(1), 39–56. doi:10.1111/j.1540-5915.2012.00381.x
- Zdravkovic, M., Panetto, H., Trajanovic, M., & Aubry, A. (2011). An approach for formalising the supply chain operations. *Enterprise Information Systems*, 5(4), 401–421. doi:10.1080/17517575.2011.593104

Fostering Supply Chain Management in Global Business

Zhang, A., & Huang, G. Q. (2012). Impacts of business environment changes on global manufacturing outsourcing in China. *Supply Chain Management: An International Journal*, 17(2), 138–151. doi:10.1108/13598541211212889

Zhang, J., Gou, Q., Liang, L., & Huang, Z. (2013). Supply chain coordination through cooperative advertising with reference price effect. *Omega*, 41(2), 345–353. doi:10.1016/j.omega.2012.03.009

KEY TERMS AND DEFINITIONS

Business: An organization or economic system where goods and services are exchanged for one another or for money.

Competitive Advantage: A superiority gained by an organization when it can provide the same value as its competitors but at a lower price, or can charge higher prices by providing greater value through differentiation.

Innovation: The process of translating an idea or invention into a good or service that creates value or for which customers will pay.

Knowledge Management: The strategies and processes designed to identify, capture, structure, value, leverage, and share an organization's intellectual assets to enhance its performance and competitiveness.

Logistics: The planning, execution, and control of the procurement, movement, and stationing of personnel, material, and other resources to achieve the objectives of a campaign, plan, project, or strategy.

Organizational Performance: An analysis of a company's performance as compared to goals and objectives.

Supply Chain Management: The management of material and information flow in a supply chain to provide the highest degree of customer satisfaction at the lowest possible cost.

Supply Chain: The entire network of entities, directly or indirectly interlinked and interdependent in serving the same customer.

Chapter 4

A “Flying High, Landing Soft” Platform for Supplier Diversity

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ABSTRACT

Diversity management has emerged as a unique agenda of today’s corporations in the global economy. One important area of corporate diversity management is supplier diversity, which is an inclusive growth program designed to help develop under-represented businesses into competitive suppliers of corporations. A major challenge of supplier diversity is that many minority suppliers lack the capability to deliver products which the corporate buyers need. Another major challenge is that few minority suppliers have the ability to participate in the global markets opportunities. We address these two problems by proposing an innovative “Flying High, Landing Soft” platform for international education in supplier diversity to help multinationals manage their global supplier diversity.

INTRODUCTION

Diversity management has emerged as a unique agenda of today’s corporations in the global economy. One important area of corporate diversity management is supplier diversity (SD), which is an inclusive growth program designed to help develop under-represented businesses into competitive suppliers of corporations (Ram, et al., 2002). SD is operated within the constraints of government and regulatory policies (Ram & Smallbone, 2003). There are established standards constantly used to benchmark the corporate SD programs (Moore, 2010). As such, SD is a source of competitive advantage for corporations (Adobor & McMullen, 2007) and a typical corporation’s SD program is strategically monitored by sophisticated procedures embedded in its supply chains and has intense out-reach activities with minority business enterprises (MBE) (Shah & Ram, 2006).

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BACKGROUND

The SD programs are very important in the USA as it is evidenced by the establishment of the first MBE Office by President Nixon in the 1970s. Through working closely with the National Minority Supplier Development Council, today the MBE Office has helped more than 16,000 MBEs connected with 3,500 corporate members. The SD program is also gaining its popularity globally. For example, Minority Supplier Development in China was established in 2009 as an effective way to address the rising inequality in China. MBE capability development is an important research area in SD (Krause, et.al., 1999; Hong & Snell, 2013), including achievement and constructive culture styles for the effectiveness of supplier diversity (Whitfield & Landeros, 2006); contextual differences in countries driving organizations to engage in supplier diversity (Worthington, et al., 2008); relationship and cultural economic details (Arnseth, 2012); and relationship between MBEs and corporations (Ndinguri, et al., 2013).

CHALLENGES

A major challenge of capability development is that many minority suppliers lack the capability to deliver products which corporate buyers need (Shah & Ram, 2006). Another major challenge is that few minority suppliers have the ability to participate in the global markets opportunities. We address these two problems by proposing an innovative “Flying High, Landing Soft” platform for international education in supplier diversity to help multinationals manage their global supplier diversity. First, we plan to develop a “Flying High” platform of five-level course modules to empower small, minority and women-owned businesses with resources in the emerging markets, such as China, so that they can become reliable and sustainable suppliers of large corporations. Second, we plan to develop a five-step “Landing Soft” platform to enable capable minority suppliers to participate in the international markets opportunities.

THE “FLYING HIGH, LANDING SOFT” PLATFORM

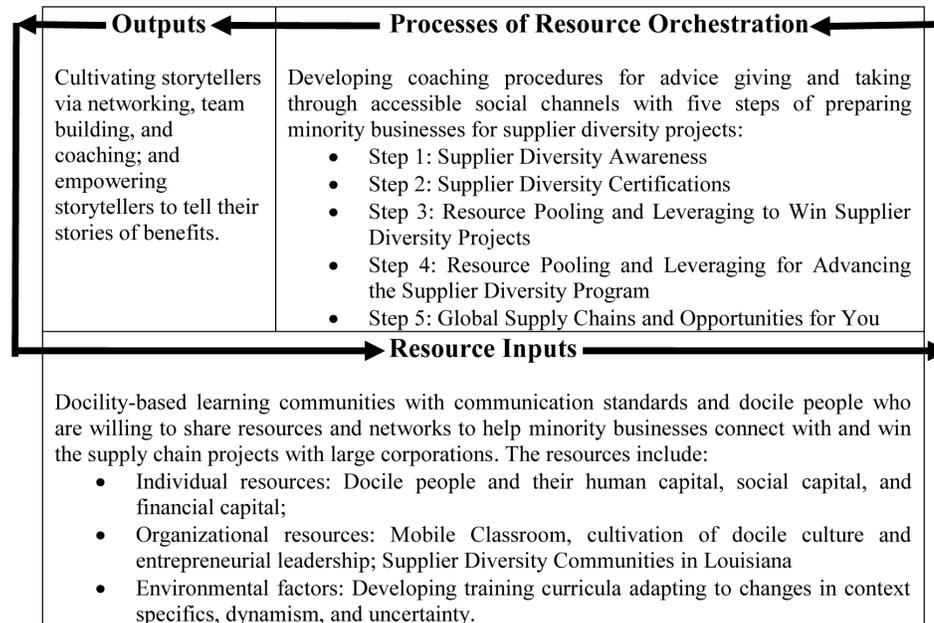
The “Flying High, Landing Soft” platform, having two components “Landing Soft” and “Flying High,” is grounded in the theory of Input-Process-Output Model of Strategic Entrepreneurship (Hitt et al. 2011; Sirmon et al. 2011) and docility-based distributed cognition (Simon 1993; Secchi 2010). The framework has four major components: (1) docility-based learning communities with shareable networked resources as the inputs; (2) processes of resource orchestration with accessible social channels and effective coaching; (3) cultivating/advancing storytellers with effective storytelling of how they developed their businesses successfully as the outputs; and (4) fostering a virtuous cycle of continuous improvement of the platform by feeding back to the communities and enriching the networked resources.

The “Flying High” Platform

The “Flying High” platform, depicted in Table 1, consists of four basic elements: resource inputs, processes of resource orchestration, cultivating storytellers, and enriching the resource inputs with effective storytelling. The resource inputs is grounded in: (1) the innovative Mobile Classroom approach, originally developed by Louisiana Business & Technology Center at LSU with partners to effectively

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Table 1. The “Flying High” platform for international education in supplier diversity



provide critically needed business counseling and related assistance for women- and minority-owned businesses in Louisiana hardest hit by the 2005 hurricanes (MC, 2014); and (2) frequent collaborative engagements with Supplier Diversity Communities in Louisiana, such as Louisiana Minority Supplier Development Council, Women’s Business Enterprise Council South, Hispanic Chamber of Commerce of Louisiana, Corporate Supplier Diversity decision makers in Louisiana, and success storytellers and their networks.

The processes of resource orchestration in Table 1 draw upon the recent work of Sirmon et al. (2011). The processes consist of structuring the resource inputs into portfolios, bundling resource portfolios into capabilities, and leveraging the capabilities to create value for shareholders. There are five steps:

Step 1: Supplier Diversity Awareness, led by the Mobile Classroom team, supplier diversity certification team, and invited guests including success storytellers cultivated from the program; topics include benefits of getting certified, success stories, key success factors, access to public and private resources, networking with industry leaders, and collaborative learning teams and projects.

Step 2: Supplier Diversity Certifications, led by the supplier diversity certification team and invited guests including success storytellers cultivated from the program; topics include the certification process, key success factors to get certified, and collaborative learning teams and projects.

Step 3: Resource Pooling and Leveraging to Win Supplier Diversity Projects, led by the supplier diversity business team, emerging markets specialists, and invited guests including success storytellers cultivated from the program; topic include key success factors, overview of financial statements and information for decision making, income statement, balance sheet and statement of cash flows/ financial analysis in preparation for growth, finance essentials for growth, access to capital equity,

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dealing with customers and suppliers, access to public and private resources, access to competitive suppliers in emerging markets, networking with industry leaders, and collaborative learning teams and projects.

Step 4: Resource Pooling and Leveraging for Advancing the Supplier Diversity Program, led by the supplier diversity business team, international specialists, and invited guests including success storytellers cultivated from the program; topics include your business strategy, marketing strategy for growth, strategic growth, key success factors, access to public and private resources, access to international resources, and collaborative learning teams and projects.

Step 5: Global Supply Chains and Opportunities for You, led by the supplier diversity business team, global supply chain specialists, and invited guests including success storytellers cultivated from the program; topics include your economic future, growing through innovation and globalization, key success factors, access to public and private resources, and networking with industry leaders in global supply chains, and collaborative learning teams and projects.

A major objective of the platform is to cultivate success storytellers in each of the five steps of supplier diversity through networking, team building, and coaching. Effective storytelling will add value to the resource inputs and foster a virtuous cycle of continuous improvement of the “Flying High” platform by feeding back to the communities and enriching the networked resources.

The “Landing Soft” Platform

Soft landings (Chen, et. al., 2011), originally developed by the National Business Incubation Association (NBIA, 2014), is a process to help a company from one country land softly – without crashing – into the market of another country through a designated incubator. The purpose is to help the soft landings companies identify business opportunities and succeed in the new market with least risks and costs (Chen, et al., 2010). The docility-based strategic entrepreneurship of soft landings is shown in Table 2 for implementing the “Landing Soft” platform in the new market.

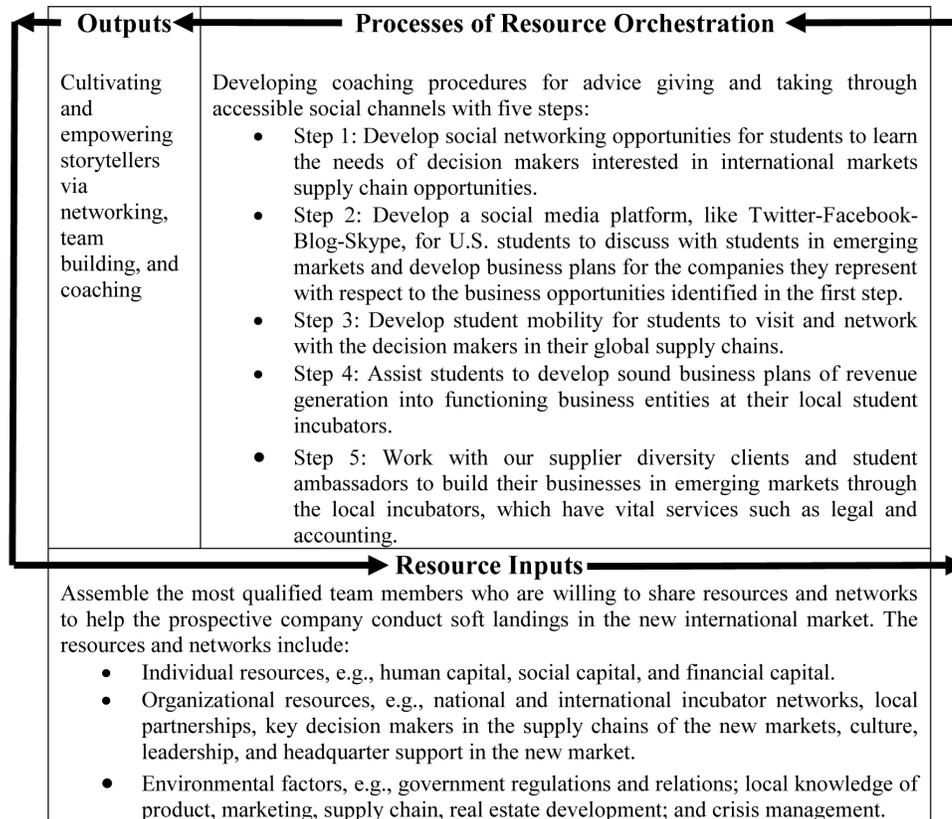
The resource inputs in Table 2 are based on the success models of international franchising such as KFC in China (Liu, 2008). International franchising as a global growth strategy is gaining its popularity (Chen, et. al., 2004). For example, the U.S. Commercial Service estimated that China, having over 2,600 brands with 200,000 franchised retail stores in over 80 sectors, is now the largest franchise market in the world (U.S. Commercial Service, 2007). The success of international franchising is highly dependent on the capability to create and transfer knowledge by leveraging and sharing resources within the networks (Chen, et al., 2006; Chen, et al., 2013).

The processes consist of five steps:

Step 1: Develop social networking opportunities for interested minority business owners to learn the new market opportunities in the global supply chains. An effective approach is to invite interested decision makers to speak at related classes, such as Sourcing in China and Entrepreneurship in China, to discuss what they need and what incentives they can offer for inspired students to pursue further to the next step. Another approach is to invite success storytellers as speakers to inspire the students about their journeys and connect the students to their networks.

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Table 2. The “Landing Soft” Platform for International Education in Supplier Diversity



Step 2: Develop a social media platform, like Twitter-Facebook-Blog-Skype, for American students to discuss with students in international markets and develop business plans for the companies they represent with respect to the business opportunities identified in the first step. We also leverage the international students at Louisiana State University from international markets to participate in the social media engagements.

Step 3: Develop student mobility for students to visit and network with the decision makers in their global supply chains. For example, we have developed global supply chain networks in textile and bio- pharmaceutical industries. The objective is to allow students to fine-tune their business plans with real-life data and facts.

Step 4: Assist students to develop sound business plans of revenue generation into functioning business entities at their local student incubators. For example, LSU has a student incubator (SI, 2014) providing individual coaching and networking services to allow students to advance their business plans. Our partners in international markets also have similar student incubators for us to network with.

Step 5: Work with our supplier diversity clients and student ambassadors to build their businesses in international markets through the local incubators, which have vital services such as legal and accounting. The four steps above have helped the new businesses reduce risks/costs and, most importantly, address the most challenging issue in international markets: talent recruiting and retention.

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The outputs in Table 2 focuses on cultivating storytellers and empowering them to tell their stories in each of the five steps of soft landing through networking, team building, and coaching. Those storytellers and the networked resources behind the success stories become the new resources to the resource inputs.

FUTURE RESEARCH DIRECTIONS

Combining information technology with globalization, the third industrial revolution produces an environment where we all are facing the problem of information overload. Simon (1971) spoke well when he said that “a wealth of information creates a poverty of attention” (p.41). That is, getting people’s attention in an information rich world is a major challenge. Ocasio (1997) proposed an attention-based theory of the firm, allowing the firm to shield off irrelevant information and gain access to information relevant to which the firm focuses. According to Ocasio (1997), attention is defined to “encompass the noticing, encoding, interpreting, and focusing of time and effort by organizational decision-makers on both (a) issues: the available repertoire of categories for making sense of the environment: problems, opportunities, and threats; and (b) answers: the available repertoire of action alternatives: proposals, routines, projects, programs, and procedures” (p.188).

Ocasio (1997) further classifies attention into three principles: (1) focus of attention, what decision makers do primarily depends on the selective issues and answers they focus attention on; (2) situated attention, what decision makers focus on and do depends primarily on the particular contextual environment they are located in; and (3) structural distribution of attention, how decision makers attend to the

Table 3. An Attention-based Knowledge Repository for “Flying High”

| Situating Attention: Relationship Touch-points | | Attention Structures: Connecting the dots for the focused attention | | | |
|---|--------|---|-------------------------------------|--------------------------|-----------------------------|
| | | Resource Inputs | Processes of Resource Orchestration | Cultivating Storytellers | Feedback to Resource Inputs |
| Steps for “Flying High” | Step 1 | Focus of Attention: Supplier Diversity Awareness <ul style="list-style-type: none"> ■ Understanding how supplier diversity works ■ Investigating supplier diversity opportunities ■ Obtaining supplier diversity prospectus ■ Making the choice ■ Preparing business plan for supplier diversity ■ Financing the supplier diversity business | | | |
| | Step 2 | Focus of Attention: Supplier Diversity Certifications <ul style="list-style-type: none"> ■ How to become certified in supplier diversity? ■ How to get training and services in supplier diversity? ■ How to prepare for getting the certifications? | | | |
| | Step 3 | Focus of Attention: Resource Pooling and Leveraging to Win Supplier Diversity Projects <ul style="list-style-type: none"> ■ How to acquire supplier diversity projects? ■ How win supplier diversity projects? | | | |
| | Step 4 | Focus of Attention: Resource Pooling and Leveraging for Advancing the Supplier Diversity Program <ul style="list-style-type: none"> ■ How to keep corporate clients of supplier diversity projects? ■ How to hire and train employees for more supplier diversity projects? | | | |
| | Step 5 | Focus of Attention: Global Supply Chains and Opportunities for You <ul style="list-style-type: none"> ■ What are the global supplier diversity opportunities? ■ How to participate in these opportunities? ■ How to prepare for these opportunities? | | | |

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particular contextual environment they are in depends on how the firm’s attention structure (including rules, resources, and relationships) channels and distributes various issues, answers, and decision makers into specific communications and procedures.

In the context of supplier diversity, what do focus of attention, situated attention, and attention structures look like? How do we design an attention-based “Flying High, Landing Soft” platform to benefit minority businesses interested in supplier diversity? We propose an attention-based knowledge repository in Table 3 for the “Flying High” platform. Such a framework has two dimensions. The first dimension is the five steps for “Flying High.” It is vital for relationship building to understand which stage the minority businesses is situated and allocate appropriate resources at different touch-points to help them perform their focuses of attention. The second dimension is the attention structures of the “Flying High” platform, consisting of resource inputs, processes of resource orchestration, cultivating storytellers, and feedback to resource inputs. The main body of the framework is the focus of attention of the “Flying High” steps. The objective of attention structures is to connect all the dots necessary to provide the services to the various focuses of attention.

Similarly, we propose an attention-based knowledge repository in Table 4 for the “Landing Soft” platform.

Table 4. An Attention-based Knowledge Repository for “Landing Soft”

| Situating Attention: Relationship Touch-points | | Attention Structures: Connecting the dots for the focused attention | | | |
|---|--------|--|-------------------------------------|--------------------------|-----------------------------|
| | | Resource Inputs | Processes of Resource Orchestration | Cultivating Storytellers | Feedback to Resource Inputs |
| Steps for “Landing Soft” | Step 1 | Focus of Attention: Connecting Businesses with Students <ul style="list-style-type: none"> ■ What are the needs of minority businesses when they go global? ■ How to effectively connect minority businesses with interested students to go global? ■ How to effectively connect students with success storytellers to prepare for good business plans of going global? | | | |
| | Step 2 | Focus of Attention: Connecting Local Students with Students in International Markets <ul style="list-style-type: none"> ■ How to develop a social media platform for local students to discuss with students in international markets and develop business plans for the companies they represent with respect to the business opportunities identified in the first step? ■ How to leverage the international students from international markets to participate in the social media engagements? | | | |
| | Step 3 | Focus of Attention: Connecting Student Mobility with International Markets <ul style="list-style-type: none"> ■ How to develop student mobility for students to visit and network with the decision makers in their global supply chains? ■ How to help students fine-tune the business plans with real-life data and facts during and after the student mobility? | | | |
| | Step 4 | Focus of Attention: Connecting Business Plans with Soft-Landing Incubators <ul style="list-style-type: none"> ■ How to assist students to develop sound business plans of revenue generation into functioning business entities at their local student incubators? ■ How to partner student incubators in international markets to execute the soft-landing projects efficiently and effectively? | | | |
| | Step 5 | Focus of Attention: Talent Recruiting and Retention to Grow in the New Markets <ul style="list-style-type: none"> ■ How to work with our supplier diversity clients and student ambassadors to build their businesses in international markets through the local incubators, which have vital services such as legal and accounting? ■ How to help the new businesses reduce risks/costs and, most importantly, address the most challenging issue in international markets: talent recruiting and retention? | | | |

A “Flying High, Landing Soft” Platform for Supplier Diversity

CONCLUSION

Two major challenges in supplier diversity were identified in this chapter. First, many minority suppliers lack the capability to deliver products which the corporate buyers need. Second, few minority suppliers have the ability to participate in the global markets opportunities. We address these two problems by proposing an innovative “Flying High, Landing Soft” platform for international education in supplier diversity to help multinationals manage their global supplier diversity. The platform, grounded in the theories of strategic entrepreneurship and docility-based distributed cognition, has four major components: docility-based learning communities with shareable networked resources as the inputs; processes of resource orchestration with accessible social channels and effective coaching; cultivating storytellers with effective storytelling; and fostering a virtuous cycle of continuous improvement by feeding back and enhancing the resource inputs.

We have started working with minority businesses, corporate supplier diversity leaders, and our international partners to test and enhance the procedures in the “Flying High, Landing Soft” platform. We are also expanding our platform to new emerging markets such as Turkey. As a first step, we plan to analyze IBM’s Corporate Service Corps (IBM, 2014) and Supplier Connection powered by IBM (Dischinger, et al., 2012) and see how the “Flying High, Landing Soft” platform can be adapted in the Turkish context to help multinationals manage their global supplier diversity in Turkey.

REFERENCES

- Adobor, H., & McMullen, R. (2007). Supplier Diversity and Supply Chain Management: A Strategic Approach. *Business Horizons*, 50(3), 219–229. doi:10.1016/j.bushor.2006.10.003
- Arnseth, L. (2012, October). Developing Global Diverse Supply Chains. *Inside Supply Management*, 26-30.
- Chen, Y., Chen, G., & Wu, S. (2006). *A Simonian Approach to E-business Research: A Study in Netchising*. *Advanced Topics in E-Business Research* (Vol. 1). E-Business Innovation and Process Management.
- Chen, Y., Justis, R. T., & Yang, H. L. (2004, March 5-7). Global E-Business, International Franchising, and Theory of Netchising: A Research Alliance of East and West. *Proceedings of the 18th Annual International Society of Franchising Conference*, Las Vegas, Nevada.
- Chen, Y., Watson, E., & Azevedo, R. F. L. (2011). Soft Landings Curriculum of U.S.-China Entrepreneurship. *China Currents*, 10(2).
- Chen, Y., Watson, E., & Azevedo, R. F. L. (2013). *E-Strategy and Soft Landings for Franchising in Emerging Markets*. *Trends in E-Business, E-Services, and E-Commerce: Impact of Technology on Goods, Services, and Business Transactions* (pp. 148–159). Hershey, PA: IGI-Global.
- Chen, Y., Watson, E., Liu, C., Cornachione, E., & Wu, S. (2010, June 25-29). Soft Landing Curriculum of Entrepreneurship in Emerging Markets. *Proceedings of the Academy of International Business 2010 Annual Meeting*, Rio de Janeiro, Brazil.

A “Flying High, Landing Soft” Platform for Supplier Diversity

- Dischinger, J. S., Karwatowski, C. D., & Raina, A. (2012). Supplier Connection: A supply-chain ecosystem for small business job growth. *IBM Journal of Research and Development*, 56(6), 11–1. doi:10.1147/JRD.2012.2218071
- Hitt, M. A., Ireland, R. D., Sirmon, D. G., & Trahms, C. A. (2011). Strategic Entrepreneurship: Creating Value for Individuals, Organizations, and Society. *The Academy of Management Perspectives*, 25(2), 57–75. doi:10.5465/AMP.2011.61020802
- Hong, J. F., & Snell, R. S. (2013). Developing New Capabilities across a Supplier Network through Boundary Crossing: A Case Study of a China-Based MNC Subsidiary and its Local Suppliers. *Organization Studies*, 34(3), 377–406. doi:10.1177/0170840612467154
- IBM. (2014). IBM’s Corporate Service Corps. Retrieved from http://www.ibm.com/ibm/responsibility/corporateservicecorps/wwa_turkey.html
- Krause, D., Ragatz, G., & Hughley, S. (1999). Supplier Development from the Minority Supplier’s Perspective. *Journal of Supply Chain Management*, 35(4), 33–41. doi:10.1111/j.1745-493X.1999.tb00242.x
- Liu, W. K. (2008). KFC in China: Secret Recipe for Success. Singapore: John Wiley & Sons (Asia) PTE LTD.
- MC. (2014). Mobile Classroom at Louisiana State University. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/mobile-classroom>
- Moore, R. G. (2010). Raising the Bar: An Update of Benchmarking Standards for Corporate Supplier Diversity Programs. *Minority Business Entrepreneur*. Retrieved from www.mbemag.com/index.php/magazine/back-issues/94-2010
- NBIA. (2014). National Business Incubation Association. Retrieved from www.nbia.org/member_services/soft_landings
- Ndinguri, E., Prieto, L., Phipps, S., & Katsioloudes, V. (2013). The Synergy between Minority Business Enterprises and Corporations: A Proposed Supplier Diversity Relationship Framework. *International Journal of Supply Chain Management*, 2(3).
- Ocasio, W. (1997). Towards an Attention-Based View of the Firm. *Strategic Management Journal*, 18(S1), 187–206. doi:10.1002/(SICI)1097-0266(199707)18:1+<187::AID-SMJ936>3.3.CO;2-B
- Ram, M., & Smallbone, D. (2003). Supplier Diversity Initiatives and the Diversification of Ethnic Minority Businesses in the UK. *Policy Studies*, 24(4), 187–204. doi:10.1080/0144287042000216117
- Ram, M., Smallbone, D., & Linneker, B. (2002). *Assessing the Potential of Supplier Diversity Initiatives as a Means of Promoting Diversification among Ethnic Minority Businesses in the UK*. Small Business Service.
- Secchi, D. (2010). *Extendable Rationality: Understanding Decision Making in Organizations*. New York: Springer.

A “Flying High, Landing Soft” Platform for Supplier Diversity

Shah, M., & Ram, M. (2006). Supplier Diversity and Minority Business Enterprise Development: Case Study Experience of Three US Multinationals. *Supply Chain Management: An International Journal*, 11(1), 75–81. doi:10.1108/13598540610642493

SI. (2014). Student Incubator at Louisiana State University. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/lsu-student-incubator/>

Simon, H. A. (1971). Designing Organizations for an Information Rich World. In M. Greeberger (Ed.), *Computers, Communications, and the Public Interest* (pp. 38–52). Baltimore, MD: The Johns Hopkins Press.

Simon, H. A. (1993). Altruism and Economics. *The American Economic Review*, 83(2), 156–161.

Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management*, 37(5), 1390–1412. doi:10.1177/0149206310385695

U.S. Commercial Service. (2007, September). China Franchising Industry: Access Dynamics and Emerging Markets, The JLJ Group. Retrieved from http://export.gov/china/build/groups/public/@eg_cn/documents/webcontent/eg_cn_027119.pdf

Whitfield, G., & Landeros, R. (2006). Supplier Diversity Effectiveness: Does Organizational Culture Really Matter? *Journal of Supply Chain Management*, 42(4), 16–28. doi:10.1111/j.1745-493X.2006.00019.x

Worthington, I., Ram, M., Boyal, H., & Shah, M. (2008). Researching the Drivers of Socially Responsible Purchasing: A Cross-National Study of Supplier Diversity Initiatives. *Journal of Business Ethics*, 79(3), 319–331. doi:10.1007/s10551-007-9400-x

ADDITIONAL READING

Christodoulidou, N., Leong, G. K., & Raab, C. (2012). Strategic Sourcing in the Hospitality Supply Chain. *Journal of Foodservice Business Research*, 15(2), 143–155. doi:10.1080/15378020.2012.677387

Clark, C. (2011). Diversity Initiatives in Higher Education: Just How Important “Is” Diversity in Higher Education? *Multicultural Education*, 19(3), 57–59.

Derven, M., & Gundling, E. (2014). *Leveraging Diversity & Inclusion for a Global Economy*. Association for Training and Development.

Gebremichael, B. A. (2014). Supply Chain Management for Sustainable Competitive Advantage. *Journal Of Business Management & Social Sciences Research*, 3(2), 83–87.

Graves, K. (2011). Global best practices in medical device procurement—A road map to system success. *Journal of Medical Marketing: Device, Diagnostic and Pharmaceutical Marketing*, 11(2), 101–108.

Gröschl, S. (2011). Diversity management strategies of global hotel groups: A corporate web site based exploration. *International Journal of Contemporary Hospitality Management*, 23(2), 224–240. doi:10.1108/09596111111119347

A “Flying High, Landing Soft” Platform for Supplier Diversity

- Hémond, Y., & Robert, B. (2012). Evaluation of state of resilience for a critical infrastructure in a context of interdependencies. *International journal of critical infrastructures*, 8(2), 95-106.
- Henderson, E. (2013). The Chief Diversity Officer’s View of the Diversity and Inclusion Journey at Weyerhaeuser. *Diversity at Work: The Practice of Inclusion*, 431-450.
- Henderson, G. R., & Williams, J. D. (Eds.). (2013). From Exclusion to Inclusion: An Introduction to the Special Issue on Marketplace Diversity and Inclusion. *Journal of Public Policy & Marketing*, 32(special issue), 1–5. doi:10.1509/jppm.32.S.1
- Hunt, K. G. (2011). Embracing Diversity: Committing to Diversity Is Not Just a Numbers Game, It’s a Mission. *Journal of Property Management*, 76(2).
- Madera, J. M. (2013). Best Practices in Diversity Management in Customer Service Organizations An Investigation of Top Companies Cited by Diversity Inc. *Cornell Hospitality Quarterly*, 54(2), 124–135. doi:10.1177/1938965513475526
- Manoharan, A., Gross, M. J., & Sardeshmukh, S. R. (2014). Identity-conscious vs identity-blind: Hotel managers’ use of formal and informal diversity management practices. *International Journal of Hospitality Management*, 41, 1–9. doi:10.1016/j.ijhm.2014.04.007
- Mark McKevitt, D., & Davis, P. (2014). Supplier development and public procurement: Allies, coaches and bedfellows. *International Journal of Public Sector Management*, 27(7), 550–563. doi:10.1108/IJPSM-03-2014-0041
- Min, H. (2013). Challenges and opportunities for minority owned trucking firms: A case study. *International Journal of Logistics Systems and Management*, 16(2), 136–146. doi:10.1504/IJLSM.2013.056161
- Morais, U. P., Pena, J., Shacket, K., Sintilus, L., Ruiz, R., Rivera, Y., & Mujtaba, B. G. (2014). Managing Diverse Employees at Starbucks: Focusing on Ethics and Inclusion. *International Journal of Learning and Development*, 4(3), 35. doi:10.5296/ijld.v4i3.5994
- O’Mara, J. (2013). Global benchmarks for diversity and inclusion. *Diversity at work: the practice of inclusion* (pp. 415-430).
- Richard, O. C., & Miller, C. D. (2013). Considering diversity as a source of competitive advantage in organizations. *The Oxford handbook of diversity and work* (pp. 239-250).
- Richard, O. C., Su, W., Peng, M. W., & Miller, C. D. (2014). Do external diversity practices boost focal firm performance? The case of supplier diversity. *International Journal of Human Resource Management*, 26(7), 1–21.
- Richardson, C. W. Jr. (2012). Diversity Performance as a Factor in Marketing Programs: A Comparative Analysis across Ethnic Group Target Audiences. *Journal of Marketing Development and Competitiveness*, 6(5), 62–70.
- Rogerson, C. M. (2012, September). Supplier diversity: A new phenomenon in private sector procurement in South Africa. *Urban Forum*, 23(3), 279-297. Amsterdam: Springer. doi:10.1007/s12132-012-9148-y

A “Flying High, Landing Soft” Platform for Supplier Diversity

Smallbone, D., Kitching, J., & Athayde, R. (2010). Ethnic diversity, entrepreneurship and competitiveness in a global city. *International Small Business Journal*, 28(2), 174–190. doi:10.1177/0266242609355856

Sollish, F., & Semanik, J. (2011). *Strategic global sourcing best practices*. London: John Wiley & Sons.

Spena, T. R., & Chiara, A. D. (2012). CSR, innovation strategy and supply chain management: Toward an integrated perspective. *International Journal of Technology Management*, 58(1/2), 83–108. doi:10.1504/IJTM.2012.045790

Stump, R. L., Joshi, A. W., & Kim, S. K. (2015). Supplier Diversity Programs and their Impact on Purchasing Agent Negotiation Strategies: A Role Theoretic Model. In H.E. Spotts (Ed.), *Creating and Delivering Value in Marketing* (p. 197). Germany: Springer International Publishing. doi:10.1007/978-3-319-11848-2_69

Talluri, S., DeCampos, H. A., & Hult, G. T. M. (2013). Supplier rationalization: A sourcing decision model. *Decision Sciences*, 44(1), 57–86. doi:10.1111/j.1540-5915.2012.00390.x

Theodorakopoulos, N., Ram, M., & Beckinsale, M. (2013). Human resource development for inclusive procurement by intermediation: A situated learning theory application. *International Journal of Human Resource Management*, 24(12), 2321–2338. doi:10.1080/09585192.2013.781433

Thomas, D. A. (2004). Diversity as strategy. *Harvard Business Review*, 82(9), 98–108. PMID:15449859

Turnock, J. (2013). Diversity at the Top. *Forbes*, 191(9), 65.

Whitfield, G., & Farrell, D. (2010). Diversity In Supply Chains: What Really Matters? *Journal of Diversity Management*, 5(4).

Wu, J. (2010). The Impact of Corporate Supplier Diversity Programs on Corporate Purchasers’ Intention to Purchase From Women-Owned Enterprises: An Empirical Test. *Business & Society*.

KEY TERMS AND DEFINITIONS

Franchising: A business opportunity based on granting the business rights and collecting royalties in return.

Global Entrepreneurship: International entrepreneurship programs helping entrepreneurs connect with resources to grow their businesses globally.

MBE: Minority business enterprises.

Mobile Classroom: A mobile vehicle effectively providing critically needed business counseling and related assistance for women- and minority-owned businesses in rural communities.

Soft Landings: A process to help a company from one country land softly – without crashing – into the market of another country through a designated incubator.

Strategic Entrepreneurship: Entrepreneurship culture developed in a large corporation as a part of its growth strategy.

Strategic Sourcing: Incorporating supply chain sourcing into the formation of company’s business strategy.

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Student Incubator: An incubator providing individual coaching and networking services to allow students to advance their business plans.

Supplier Connection: An initiative powered by IBM to help small businesses in US grow and create jobs by enabling them to connect with the supply chains of Fortune 500 companies, mid-market firms, and other enterprises.

Supplier Diversity: An inclusive growth program designed to help develop under-represented businesses into competitive suppliers of corporations.

Chapter 5

An Empirical Investigation of the Role of E-Communication in International Collaborations

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ABSTRACT

This chapter addresses the role of e-communication in international collaborations by examining its usage, cultural implications, and impact on trust building. Theoretically, this study is informed by social constructionism (Gergen, 1999; Goffman, 1959). Empirical insights were generated from the qualitative case study of WinCo which was an international collaboration between a UK-based wine and spirits multinational company and their distributors. The findings suggest that different e-communication channels are often used by collaborating partners to enhance the breadth and depth of their communication. New participants tend to enhance the skills of e-communication usage through self-learning, formal educational programs, and support from the company's employee development team. The widespread usage of e-communication impacts on partners' trust building in terms of their mutual perceptions of one another's competence and social bonding. National culture also affects partners' use of e-communication in international collaborative practice.

INTRODUCTION

International collaborations have become a favorable strategic vehicle for organizations to utilize in face of the competitive global economy (Cohen & Mankin, 2002; Harrigan, 1988). International collaborations are defined generally as inter-organizational collaborative relationships that cross national boundaries: examples include international supply chain networks, joint ventures, strategic partnerships, and alliances. There may be diverse motives of forming international collaborations, for example, market penetration, resource acquisition, product development, and knowledge transfer (Child & Faulkner, 1998). Regardless of the organizational motives, the fundamental assumption is that international collaborations can enable partnering organizations to gain advantageous situations which they cannot obtain by working alone.

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A major challenge for partnering organizations in international collaborations is how to coordinate and manage their collaborative relationships effectively with their counterparts who are often geographically dispersed (). Communication has been regarded as a key factor in the coordination and management process between partners. With the burgeoning development of information and communication technology (ICT), computer-mediated communication which is usually referred to as *e-communication* (EC) has been widely adopted (). The main channels of EC include emails, blogs, discussion forums and social media. The traditional face-to-face and telephone communication methods have been complemented by EC, which effectively facilitates partners' communication with significant savings in time and money and offers partners needed flexibility.

Despite the prevalence and potential of EC, there is still a lack of attention paid to its dynamics and unique characteristics in the context of international collaborations (Jean, Sinkovics, & Cavusgil, 2010; Pauleen & Yoong, 2001). The goal of this research is to extend knowledge on the role of EC in international collaborations. Drawing from the social constructionist perspective (Gergen, 1999; Goffman, 1959), this research seeks to explore how EC is used by partners who work across organizational and cultural boundaries and how EC impacts on partners' collaborative relationship in international collaborations.

This chapter will be structured as follows. It begins with the discussion of the theoretical underpinnings and cultural implications of EC in international collaborations. This is followed by the presentation of research strategies utilized. Then research findings and discussions will be explained. The chapter will be concluded with research contributions, limitations and implications for future research.

CONCEPTUAL BACKGROUND

Social Constructionist Theory

The theoretical influence of social constructionism on this research stems from its concern in relation to the constructive effects of discourse in creating and changing the social reality (Phillips & Hardy, 2002). Social reality can be represented in different ways by individuals whose experience is discursively constituted (Alvesson & Skoldberg, 2000). It indicates that language plays an active constructive role in the individuals' self-representations in various social contexts (Marshall, 1994). This social constructionist approach of multiple voices from the social reality stresses the multiple interpretations, which can be generated by researchers as well as the subjects researched. The above broad research field and the related issues imply the socially-constructed nature of collaboration because collaboration does not occur in a vacuum but in the processes of social interaction (Blumer, 1969; Mead, 1934) between actors who develop definitions of a situation and then act according to those definitions (Bogdan & Taylor, 1975, p.15). The action in collaboration is constituted within and gains its intelligibility through actors' social interaction (Gergen, 1999). This theoretical perspective will be applied in the understanding of the partners' interaction which is mediated by the usage of EC in international collaborations.

EC and Trust Building within International Collaborations

The growth of EC (also known as the internet- and web-based technologies) has significantly transformed the way companies manage cross-border collaborative practice (Grosse, 2002; Jarvenpaa & Leidner, 1999). Opportunities for international collaborations have been supported by EC as technology allows

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for easy, frequent and low-cost communication (Kettinger & Grover, 1997; Mackenzie, 2010). Traditional face to face communication has been complemented and/or replaced by EC which is often deemed as advantageous due to its interoperability and open-standard settings for the transfer of information between partnering organizations (Sanders, 2007). EC encompasses a wide range of technology-mediated applications such as email, forums, video conferencing blogs, internet, intranet and extranet (Boddy, 2005). These EC applications can be synchronous and/or asynchronous (Pauleen & Yoong, 2001). Synchronous EC applications (e.g., video conferencing or online-chat programs) are often adopted by participants who communicate at the same time. Asynchronous EC applications (e.g., email, blog, and forum) enable participants to overcome the temporal barriers and communicate at different times.

Although EC and face-to-face communication occur in different environments, similar challenges arise in respect of the relationship building among collaborating partners (Pauleen & Yoong, 2001). One of the challenges constantly addressed by academic scholars and practitioners is trust which has been regarded as an essential factor in the development of either virtual or face-to-face collaborative relationships (Child, 2001; Paul & McDaniel, 2004; Zhang & Huxham, 2009). The meaning of trust can be perceived differently based on the theoretical underpinnings evoked (Lane & Bachman, 1998; Nooteboom, 2002).

For instance, McAllister (1995, p.25) examines trust at the interpersonal level and defines trust as “the extent to which a person is confident in, and willing to act on the basis of, the words, actions, and decisions of another”. Gulati (1995) explores trust at the interorganizational level and defines trust as the expectations that partners have about their collaboration and about their partners’ future behaviors in relation to meeting those expectations. Despite the different perspectives of trust, there are some common features of predictability and risk taking embedded in these views (Zhang & Huxham, 2009). Trust can be built among collaborating partners if they have confidence about their counterparts’ future behavior and can take the risk of their counterparts’ future opportunistic actions (Ring & Van de Ven, 1994).

Compared to conventional face-to-face communication, EC has brought about new challenges to partners’ trust building. Jean et al. (2010) examine partners’ relationship learning in the context of international electronics supply chains and proposed that trust, among other factors, is a determinant of relationship learning. Given the importance of trust in international collaborations, few studies have been conducted to examine how EC affects trust building among collaborating partners. This study endeavors to fill the gap by exploring the effect of EC on partners’ trust building in international collaborations.

Cultural Influence on EC

In the examination of EC in international collaborations, it is inevitable to touch upon cultural factors (Hall, 1976; Hofstede, 1980) which are deeply embedded in social interaction across national boundaries. There are various ways of understanding and managing cross-cultural encounters. Three main perspectives which have been widely adopted in cultural studies are convergence, divergence and crossvergence (Ralston, Holt, Terpstra, & Kai-cheng, 1997; Webber, 1969). Firstly, the convergence perspective emphasizes that the common ideological values relating to economic activity and work-related behavior are held by managers in industrialized, capitalistic countries and these values have been gradually assimilated by managers in developing countries because of globalization (Webber, 1969). Examples can be seen in the standardization of products and services of multinational corporations (e.g., Coca-Cola and Disney) across the world.

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Secondly, the divergence perspective argues that “national culture drives values”, and even if a country adopts capitalism, the value systems with regard to management practice will “remain largely unchanged” (Ralston, et al., 1997, p.183). Examples of this perspective can be seen in the prominent works of Hall (1976) and Hofstede (1980, 1991). Hall (1976) develops an understanding of high versus low context cultural phenomena based on his investigation in various Eastern (e.g., China, Japan and Korea) and Western countries (e.g., the USA and Europe). Trompenaars and Hampden-Turner (1997) and Hofstede (1980, 1991) explore, to varying degrees, how business culture is closely related to national culture using a set of bipolar dimensions.

Trompenaars and Hampden-Turner (1997) propose a model of seven primary dimensions: universalism versus particularism; communitarianism versus individualism; neutral versus affective; diffuse versus specific; achievement versus ascription; attitudes towards time; attitudes towards the environment. Similar approaches to individualism versus collectivism have also been addressed by Triandis et al. (1988). Hofstede (1991) proposes a framework of five fundamental dimensions: individualism versus collectivism; power distance; uncertainty avoidance; masculinity versus femininity; time-orientation. It is conspicuous that there is a substantial overlap between these dimensions, especially in relation to individualism versus collectivism.

Thirdly, the crossvergence perspective provides an integrative alternative to the polar extremes of convergence and divergence by merging different cultural influences and creating a unique value system (Ralston, Gustafson, Cheung, & Terpstra, 1993; Ralston, et al., 1997). An example of this perspective can be seen in the case of Unilever (Maljers, 1992), a transnational company which actively promoted the philosophy of “think globally and act locally”. In this research, it is anticipated that the three perspectives of understanding and managing cross-cultural encounters are pertinent to the conceptualization of EC within international collaborations. Hence, all three perspectives will be considered in the interpretation of the empirical findings.

METHODOLOGY AND CONTEXT

Qualitative methodology was adopted to examine the research questions which address how EC is used by collaborating partners across national boundaries and how EC affects trust between partners. The main reason for choosing qualitative methodology is that it allows for the exploration of social and cognitive processes (Ring & Van de Ven, 1994), which helps to answer the “*how*” questions implied from the broad research field and manifested in the related issues (Denzin & Lincoln, 1998, p.8). Specifically, case study method (Eisenhardt, 1989; Yin, 2009) was adopted to examine the virtual communication between WinCo (a pseudonym) – a UK-based wine and spirits multinational company – and their distributors based in Asia, Europe, America/Canada, and Latin America. As one of the world’s leading companies in the wine and spirits industry, WinCo has formed collaboration with distributors of more than 60 countries. EC has been widely adopted by the organizational members of WinCo and their global distributors.

Primary data was collected through open-ended questionnaires (Easterby-Smith, Thorpe, & Lowe, 1991) which were sent to participants via email in December, 2011 and January, 2012. Open-ended questionnaires allow participants to present their responses in a detailed, narrative manner and the responses can be directly quoted which helps minimize the alternation of data (Rogani, 2007). The distribution of questionnaires via email allows participants to flexibly adjust their time to complete the questions. One disadvantage of the questionnaire usage is that participants may misunderstand the questions asked due

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to the standardization nature and possible ambiguity in the framing of questions. Hence, it is crucial to attend to the phrasing and language used in the process of designing a questionnaire (Blankenship, Crossley, Heidingsfeld, Herzog, & Kornhauser, 1950).

In this study, the framing of the open-ended questions was paid close attention to by the field researcher; the questions focused on the types of EC used in collaboration, cultural implications on partners' adoption and use of EC, and impact of EC on trust between partners. These questions were then critically reviewed by the field researcher's colleagues in the same academic institution to examine whether the questions were compatible with the research objectives. Based on the colleagues' constructive feedbacks, the questions were modified to enhance the clarity and relevance. An example of the open-ended questions asked can be found in the Appendix.

Purposive sampling (Easterby-Smith, et al., 1991) was adopted in the selection of questionnaire participants in order to attain a rich picture of the EC usage and its impact on the different levels and regions of management groups involved in an international supply chain. A total of 15 managers in WinCo and their distributors, who were at various managerial levels and based in different geographical regions globally, participated in the research by filling out the questionnaires and returning them to the researcher by email in February, 2012. Table 1 lists the managerial status and working region of the 15 participants. For confidentiality purposes, all participants' names were concealed and designated numbers (e.g., Respondent 1, 2, 3 to 15). In addition to the primary data, secondary data was collected through company publications (i.e., annual reports, news articles and magazines) on the research themes to triangulate the findings from the primary data (Denzin, 1978).

The data analysis was accomplished through ethnographic content analysis which involves "textual investigation" and categorization of emergent themes (Silverman, 1993, p.59). At the heart of it lies the "operation" of open coding (Seale, 2004, p.299) which involves the process of "breaking down, examin-

Table 1. List of participants' working backgrounds

| Respondent | Continent | Managerial Level | Company Represented |
|-------------------|------------------|-------------------------|----------------------------|
| 1 | Asia | Middle | Winco |
| 2 | Asia | Middle | Winco's distributor |
| 3 | Asia | Middle | Winco's distributor |
| 4 | Asia | Junior | Winco |
| 5 | Europe | Senior | Winco |
| 6 | Latin America | Middle | Winco's distributor |
| 7 | Europe | Middle | Winco's distributor |
| 8 | Asia | Logistics | Winco |
| 9 | Europe | Junior | Winco's distributor |
| 10 | Europe | Middle | Winco |
| 11 | America/Canada | Junior | Winco's distributor |
| 12 | Latin America | Senior | Winco |
| 13 | Latin America | Junior | Winco's distributor |
| 14 | Europe | Junior | Winco's distributor |
| 15 | Europe | Junior | Winco |

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ing, comparing, conceptualizing, and categorizing data” (Strauss & Corbin, 2004, p.303). Specifically, the primary and secondary data were systematically visited and revisited in order not to lose any expressions and insights in relation to the research themes on EC.

Each questionnaire response was reviewed sentence by sentence to highlight any expression relating to the forms and use of EC, its cultural implications, and impact on the trusting relationship between collaborating partners. Meanwhile, the company publications collected were also scanned for the identification of research themes. After numerous visits to the data collected, several emerging clusters of concepts (Glaser & Strauss, 1967) concerned with EC were generated and then these concepts were linked to the key research issues regarding the use and impact of EC in international collaborations.

FINDINGS AND DISCUSSION

Application of EC in International Collaborative Practice

Channels of EC

Examination of the WinCo case study suggests that different EC channels are often used by collaborating partners to enhance the breadth and depth of their communication. Email has been regarded as the most common EC channel for sharing information, task coordination, and social communication. There are many advantages of email such as immediacy and spontaneity, record keeping, cost efficiency, and overcoming time differences and language barriers. The following collation (Table 2) of questionnaire responses can serve as examples.

These advantages support Kettinger and Grover’s (1997) views on the fundamental role of email in an interorganizational context. The findings also suggest that partners regard email as the medium more for coordinating collaborative projects than for relationship building. This view seems to support those held by some researchers who have argued that email is less likely to be effective in communication

Table 2. Advantages of email usage in international collaborations

| Advantages of Email Usage in International Collaborations | Supporting Examples from the Questionnaire Responses |
|--|--|
| Immediacy and spontaneity | - “Email, fastest and now most widely used method of communication in my working environment...” (Respondent 10) - “E-mail is most common. It’s quick, easy and direct...” (Respondent 14) |
| Sharing information and record keeping | - “Email...keeps a record of the conversation taking place.” (Respondent 3) - “Purchase orders, forecasting data and schedule are often exchanged through email that it has an assurance that the other counterpart has for sure received your message. Email also serves a written confirmation.” (Respondent 8) |
| Cost efficiency | “Email is the most common as it is...cost-effective and also gives a historical copy of previous communications.” (Respondent 1) |
| Overcoming time differences | “Emails, as I mostly deal with the Americas, therefore we only have a few hours each day when we are in our respective offices for telephone calls.” (Respondent 7) |
| Overcoming cultural barriers | “...information can be tracked and in an environment with different cultures, it is a good method of communication to overcome any language issues.” (Respondent 14) |

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tasks that demand greater social presence or interaction (Pauleen & Yoong, 2001). Face-to-face and telephone calls tend to be seen as the conventional reliable methods for partners to know one another and build relationships.

The internet and intranets are also deemed as important EC channels. They facilitate partners' mass communication and collaborative activities, which can be seen from the following respondent's comments:

Internet and intranet are quite commonly used...we also send e-invites to consumers to invite them to events and e-letters to keep them informed of brand activities. (Respondent 1)

Particular Enterprise Resource Planning (ERP) and/or Electronic Data Interchange (EDI) systems such as Systems Applications and Products (SAP) and Oracle tend to be adopted by partners to facilitate the coordination of tasks. One respondent particularly addressed that "EDI/internet ordering" was an effective platform for global partners to "purchase orders and forecast demands". This view affirms Subramani's (2004) perspective that EC capabilities can facilitate firm business process and domain knowledge asset specificities.

Moreover, blogs, forums and instant messaging are regarded as an effective alternative to email communication. The respondents in this study saw great promise in Facebook, Twitter, and Blackberry RIM as effective alternative communication channels to email. They believed that these channels were effective for marketing, commercial activities and building relationships. This view supports Pauleen and Young's (2001, p.211) perspective on the use of synchronous messaging which "create a common context and perspective and perspective that support group work".

Training and EC Infrastructure

Although EC has been widely adopted in international collaborations, there seems to be limited training in relation to EC usage where knowledge is concerned. As Respondent 6 reported, "basically there is no or little training on its (EC) use as it is assumed that everyone is familiarized with the tools." This may impose challenges to those participants who newly join a company, which can be revealed from the following respondent's feedback:

Training is limited. New users will be given rudimentary training on the applications we use rather than on electronic communications themselves, i.e., Outlook and Exchange as opposed to email... (Respondent 5)

Despite the limited training, new participants tend to enhance the skills of applying EC through self-learning, formal educational programs, and support from the company's employee development team. The following respondents' comments serve as an example:

There are online tutorials but nowadays more or less expected you know the general use of emails. Intranet goes through word of mouth and is discussed during inductions. BBM is self-taught. (Respondent 6)

If your PC is upgraded with new software (e.g., Outlook), you will receive on the spot tuition (basics only + sometimes an operating manual), but if specific training is required our Employment Development Team will support the request. (Respondent 9)

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These findings support Townsend et al.'s (1998, p.23) view that collaborating partners have to become "proficient with a variety of computer-based technologies". The development of EC infrastructure to support collaborative activities tends to be perceived differently by partners. Two main perceptions emerged from the findings: *satisfactory* and *non-satisfactory*. The satisfactory perception is held by those collaborating partners who have established advanced information systems with dedicated technical support teams. The non-satisfactory perception is held by those partners who anticipate that some EC channels can be further improved in collaborative practice. Examples of both perceptions can be found in Table 3.

Instant messaging and conference calls were addressed by many respondents as under development, which was mainly due to the characteristics of the business environment. Respondent 11, who was a junior manager based in America/Canada, commented that the incompatible EC infrastructure development between the "technically advanced and less advanced" countries gave rise to communication challenges for partners in international collaborations.

In addition, Respondent 7 believed that the nature of the wine and spirits industry also influenced partnering organizations' approach to the development of EC. He commented, "... the Wine Industry is somewhat 'traditional' in its approach to IT advances when compared to 'new' industries like Media or Marketing." This finding is similar to that of Mandal et al. (2003) who examine the development of an information system infrastructure in a telecommunications company that manifests the distinctive industrial features such as the deregulation of the electricity market and product innovation.

Impact of EC on Trust between Collaborating Partners

Mutual trust plays a crucial role in successful international collaborations (Child, 2001). The findings suggest that the degree of interorganizational trust is closely linked to partners' trust building at the interpersonal level. The widespread usage of EC tends to impact on partners' trust building in relation to their mutual perceptions of one another's competence and social bonding. These two perspectives will be discussed below.

Competence

The role of EC seems to be perceived as a double-edged sword in partners' trusting building process. On the one hand, the adoption of EC allows partners to keep a detailed record of the communication activi-

Table 3. Satisfactory and non-satisfactory perceptions on EC infrastructure

| Satisfactory perception |
|--|
| - "I don't think there is a lack of (EC) infrastructure here... We are very fortunate that where we have any questions, we can directly contact our IT department." (Respondent 1) |
| - "I think that we have enough technology in which to perform our tasks even when you include devices such as Skype, teleconference calls and even video conferencing." (Respondent 3) |
| Non-satisfactory perception |
| - "...for conference call...if we could share our picture/excel file...it could help". (Respondent 2) |
| - "There is a lack of an 'instant messaging' type infrastructure, although this has been piloted recently..." (Respondent 7) |
| "Depending on the company and country there are limitations. Working in a highly technically advanced country like Canada where you have smart phone, messaging, emails and constantly connected to work it can make it challenging to communicate and deal with global companies that are less advanced." (Respondent 11) |

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ties, which positively facilitates partners' clarification and understanding of one another's responsibility and competence, as two respondents commented:

It gives a trail of emails that we can go back and check to confirm past discussions and agreements. One can no longer say, 'I can't remember saying that' etc., as everything should have been documented in emails and therefore it's easy to go back and check. (Respondent 1)

I would say that it builds trust levels as you can make the partners aware of every step that you are taking to resolve any issues to their satisfaction. (Respondent 9)

On the other hand, EC tends to negatively impact on partners' perceptions of one another's reliability and dependability because of the potential manipulation and distribution of confidential information. The majority of the respondents expressed concerns about this negative impact, which can be evident from the following comments:

Email can be saved, sent as blind copies, and manipulated etc... Depending on the nature of the correspondence and relationship, trust can be breached easily. (Respondent 11)

It makes people less trust on each other. People may pretend to be another user during the e-communication process. Some may put fake information on the internet. There are more and more junk mails. (Respondent 4)

Social Bonding

The social bonding between partners tends to be diminished because of EC usage. As mentioned in the proceeding section, partners prefer using face-to-face and telephone conversations to enhance the relationship building. The sole usage of EC may give rise to partners' increased misinterpretation and suspicion of one another's expectations and behaviors, which significantly impairs partners' good will toward collaboration and engagement in social bonding activities. As one respondent stated:

Personally I always prefer to have face to face communication whenever possible. I think trust is always established with time and experience...Ignoring communications and not following things through lead to dissatisfaction and mistrust. (Respondent 10)

The findings on trust in terms of competence and social bonding are in line with McAllister's (1995) two forms of trust which are based on cognition and affection. Cognition-based trust mainly comprises the elements of competence and responsibility which people will use to rationally assess whether others are trustworthy or not; affect-based trust mainly consists of the "emotional investments" which are manifested by "genuine care and concern for the welfare of partners" (McAllister, 1995, p.26).

Cultural Influence on the Application of EC

The findings of the WinCo case study suggest that national culture affects partners' use of EC in international collaborative practice. The effects of national culture can be "profound" and comprise, among

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other key issues, how individual members relate to each other (Pauleen & Yoong, 2001, p.214). The convergence, divergence and crossvergence perspectives (Ralston, et al., 1997) are pertinent in the conceptualization of partners' attitudes and behaviors towards the management of cross-cultural encounters in international collaborations. The following section will focus on the manifestation of the three perspectives in the case of WinCo.

Convergence

Collaborating partners tend to share convergent belief on the fundamental role of EC in the facilitation of communication and achievement of collaborative goals. Most respondents acknowledged that the "same platform" of EC has been adopted by partners. It led to "a standard way of working" which suited partners' needs to "manage the job". The following excerpts of questionnaire answers can serve as an example:

Email and internet have 'made the world smaller' as younger people come into the workplace. They have grown up with internet access as the norm. There is more homogeneity of cultures. (Respondent 7)

...We also tend to use the same tools and reporting for communicating and we have built up a standard way of working which suits both our needs to manage the job. (Respondent 14)

The similar perceptions that partners share toward the functionality of EC contribute to the frequent and effective use of EC in collaborative practice. EC channels such as emails, blogs, and instant messaging seem to serve as a medium for partners to increase the understanding of one another and build relationships. A number of respondents described the common characteristics of partners as "professionalism", "courtesy", "friendliness", "sense of humor" and "open-mindedness".

The benevolence and integrity that are perceived by partners toward one another contribute to the development of social relationships (Jarvenpaa, Knoll, & Leidner, 1998). Compared to conventional face-to-face and telephone communication channels, EC channels seem to be perceived as *important* alternatives. The findings suggest that it is essential for partners to utilize both conventional and EC channels in strengthening social relationships and trust building. As Respondent 10 commented,

...developing good working relationships is vital. Therefore email communication should never be the only method used. It is very important to keep telephone communications and, if it is possible, face to face meetings.

This is in line with Grosse's (2002, p.31) viewpoint on the necessity of balancing "distance work with face-to-face time" in the context of virtual team communication across cultures.

Divergence

In spite of partners' convergent beliefs on the functional role of EC, cultural differences tend to exist in the style of EC usage. The findings suggest that the main cultural differences lie in the areas of partners' language use, attitudes toward communication context, and group orientation. Firstly, language difference tends to cause partners' misinterpretations and distortions of meanings because each partner may interpret communications through their own cultural lenses. In the case of WinCo, English was used

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as the official business language. Because some partners were from non-English speaking countries, concerns were expressed toward the speakers' vocabularies and understanding of colloquialisms, which can be revealed from the following feedback:

The language barrier is the main thing, in that nuances of language are sometimes only understood by very fluent speakers of a language, and colloquialisms and acronyms can lead to confusion. (Respondent 7)

The language barrier is the difficulty. Although English is the business language not all foreign email recipients are at a proficient level. Therefore, trying not to cause offence when making a point or taking offence due to their limited vocabulary could be an issue. (Respondent 9)

Issues of translation are also important in partners' communication because misunderstanding may occur and delay decision making if meanings are translated inaccurately, as commented by Respondent 10:

The written word can sometimes be misinterpreted; the nuances of the English language and in particular regional terminology can unfortunately be lost in translation. This can then lead to misunderstanding and on very rare occasions can cause offence which was completely unintentional. (Respondent 10)

This is in line with Harzing et al.'s (2011) research findings which suggest that language is an important barrier significantly affecting decision-making in HQ-subsidary relationships. Based on the analysis of interview data from managers in eight German and Japanese corporate HQs and their subsidiaries in Japan or Germany, Harzing et al. (2011) provide 12 different solutions to language barriers, ranging from informal day-to-day solutions such as changing communication patterns and code-switching, to more structural solutions such as language training and a common corporate language.

Two of the solutions, which are building in redundancy in the communication exchange and code-switching, were mirrored in this study. Building in redundancy refers to partners' actions of repeating information with "illustrative examples" in order to clarify meanings; code-switching refers to second language users' actions of "reverting to talking between themselves in their native language" (Harzing, et al., 2011, pp. 282-283). The following comments can serve as examples of the two solutions:

Until the fluency level of the recipients of the communication is understood, any acronyms should be spelled out when first used and explained if necessary and colloquialisms kept to a minimum. (Building in redundancy addressed by Respondent 2)

Perhaps emails sent to and from different countries, in addition to the original email in original language, it can include a standard translated version of the email. (Code-switching addressed by Respondent 11)

Secondly, collaborating partners tend to show different attitudes toward the communication context. The findings suggest that the partners from Asia put more emphasis on the surrounding context and personal relations; whereas the partners from the USA pay more attention to the actual verbal messages. For example, when communicating ideas with counterparts via EC channels (e.g., emails and internet), partners based in China were perceived as more polite and indirect and partners based in the USA were perceived as abrupt, which can be seen in the following comments:

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The way of communication or expression of ideas is different. The Chinese culture may be more polite in their expression. Sometimes serious problems may not seem to be that bad. (Respondent 8)

The real differences are in the tone of your communication and it is important to remember this when communicating with them. As an example, they might send you what you would necessarily deem to be a very abrupt message but in fact this is the key way that they are getting their point across. (Respondent 3)

This finding is in line with Hall's (1976) theory of high- and low- context cultures, which argues that, for some cultures, communication more involves context than the actual verbal message. In high-context cultures, the understanding of a message should be linked to the surrounding context such as the backgrounds of people involved and history of the relationship; in low-context cultures, people prefer more "objective and fact-based information" (Pauleen & Yoong, 2001, pp. 214-215).

Thirdly, there seem to be different approaches to group orientation in the process of partners' application of EC. The cultural dimensions of individualism versus collectivism/communitarianism (Hofstede, 1980,1991; Triandis, et al., 1988; Trompenaars & Hampden-Turner, 1997) are reflected in the case of WinCo. In the individualistic society, according to Hofstede (1980), high value will tend to be placed in quick decisions, individual incentives and responsibility, and competition between people for recognition. Whereas in the collectivistic society, high value will tend to be placed on taking time to consult with group members, sharing common goals, and establishment of reward systems for groups rather than individuals (Child & Faulkner, 1998).

A good example of these two dimensions can be seen in partners' expectations of email response times. Most of the European respondents perceived the Asian partners as demanding in the request of immediate answers but slow in their response. As Respondent 9 explained,

The main difference I have found when dealing with the Hong Kong office is that they demand immediate answers and will email several times during the day or over the following day looking for an update. This is converse to seeking information from the Hong Kong office as they can be lax in their response.

The slow response to partners' emails may be due to the fact that the Asian managers usually took time to consult with their group members in order to reach consensus on decision making. As Respondent 14 stated,

Different expectations on response times can be an issue. Some partners do not respond quickly (or at all) even when requesting urgent information and this can be due to the hierarchy within their organization or cultural differences to ours.

Crossvergence

To resolve the communication barriers caused by cultural differences, collaborating partners tend to adopt the crossvergence approach (Ralston, et al., 1997) by developing cultural empathy. As Respondent 1 commented,

We build up very good relationships with our partners and we try to understand their culture and gauge how they work/react so that we can react accordingly to meet their needs as well as ensuring the supply

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chain does not suffer. When I am unsure of what information our customers are trying to give, I try to respond back in such a way that is courteous and does not implicate that their language may be an issue (i.e., I try to convey that the issue is my misunderstanding and not their use of English).

Cultural tolerance and empathy enable partners to engage in open communication and build shared understanding toward a collaborative agenda. It is essential that partners acquire the intercultural management and leadership skills (Wills & Barham, 1994) in multicultural team working. The skill of having a sense of humor tends to facilitate partners' relationship building. As Respondent 10 stated,

Understanding and acceptance of our different cultures is also very important, and you can never undervalue the importance of appropriate humor.

CONCLUSION

Drawing from social constructionist theory (Gergen, 1999; Goffman, 1959), this chapter examines the process of EC usage, its effect on trust building, and cultural influence on the application of EC in the context of international supply chain relationship. Empirical insights were generated from the qualitative case study of WinCo which was an international collaboration between a UK-based wine and spirits multinational company and their distributors. The findings suggest that different EC channels are often used by collaborating partners to enhance the breadth and depth of their communication. Email is regarded as the most common EC channel for sharing information, task coordination, and social communication. There is limited training in relation to EC usage as far as knowledge is concerned. New participants tend to enhance the skills of EC usage through self-learning, formal educational programs, and support from the company's employee development team.

In addition, the widespread usage of EC impacts on partners' trust in terms of their mutual perceptions of one another's competence and social bonding. Tensions exist in partners' perceptions of EC either as a positive or negative influencing factor of trust building. If used inappropriately, EC may undermine partners' trust which is difficult to rebuild. Furthermore, national culture affects partners' use of EC in international collaborative practice.

In particular, collaborating partners tend to share convergent beliefs on the fundamental role of EC in the facilitation of communication and achievement of collaborative goals. Cultural differences tend to exist in the style of EC usage which is manifest by partners' language use, attitudes toward communication context, and group orientation. To resolve the communication barriers caused by cultural differences, collaborating partners tend to adopt the crossvergence approach (Ralston, et al., 1997) by developing cultural empathy.

Contributions to Research

This study makes three contributions to international business research. Most obviously, it contributes to the understanding of the communication process via EC in international collaborative settings. Extant studies (Grosse, 2002; Jarvenpaa & Leidner, 1999; Jean et al., 2010) have shown the importance of information resources in relationship learning and knowledge sharing in international collaborative practice. This study extends this research field by investigating the process of EC usage and its impact

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on the collaborative relationship between partners. Moreover, the research findings clearly demonstrate the value of the affect- and cognition- based trust dimensions developed by McAllister (1995) who examines trust at the interpersonal level and mostly in a face-to-face communication context. This research extends McAllister's (1995) approach to trust by applying the trust dimensions at the interorganizational level and in a cross-cultural virtual communication context.

Finally, the study supports the views that some cultural and country level factors can affect virtual communication practices in a country and moderates the impact of EC usage on international collaborative practice based on the arguments in the literature (Jean et al., 2008; Jean et al., 2010; Sanders, 2007). Particularly, cultural factors such as convergence- divergence-crossvergence perspectives (Ralston, et al., 1997), language usage (Harzing, et al., 2011), high and low context of culture (Hall, 1976), and individualism versus collectivism dimension (Hofstede, 1980, 1991) are likely to play a critical role in recognizing the value of interpersonal and interorganizational interactions within a culture and, subsequently, in appreciating potential impacts of EC usage on improving international collaborative processes.

Implications for Practice

This study has implications for the practice of EC usage in international collaborations. Three of those implications for managers and organizations are now considered. First, as Mandal et al. (2003) suggest, a pre-alliance planning exercise of EC integration can make a significant contribution to the coordination between potential alliance partners. Through the participation of such an exercise, partners could identify the collaborative aims and visualize the roles and responsibilities of one another. Partners could also agree on which EC channels will be mutually adopted to facilitate communication and decision making. As Pauleen and Yoong (2001, p.216) argue, the greater variety of choice in EC channels that is available to partners could lead to "more flexibility, creativity and responsiveness in creating relationship-building strategies", but may also lead to "confusion and complications". It is up to partners to evaluate the situations which may affect the choice and usage of EC channels.

Second, as Paul and McDaniel (2004) advocate, it is critical for collaborating organizations to pay attention to trust building in order to achieve advantageous situations from a collaboration. The findings of this study show that interorganizational trust is often entangled with interpersonal trust. The conventional communication channels such as face-to-face and telephone meetings are still deemed as essential in the development of trust among partners. Thus, the collaborating organizations which are dominated by EC usage should consider complementing EC channels with other conventional communication methods in order to facilitate the trust building process.

Finally, collaborating organizations should also consider the need for training and on-going support in order to facilitate effective communication behaviors among partners. The findings from this study demonstrate that there is generally a lack of training support system which leads to partners' misinterpretation and misunderstanding of one another's expectations and behaviors. In line with the extant literature, the study suggests that collaborating organizations should pay attention to the training of employees in the areas of technology proficiency (i.e., EC selection and usage), cross-cultural communication and management skills (i.e., language proficiency, cultural empathy, and relationship building and networking skills). This can effectively enhance a partner's flexibility and ability to deal with ambiguous situations in an international collaboration.

An Empirical Investigation of the Role of E-Communication in International Collaborations**Future Research Directions**

This study addresses the role of EC in international collaborations by examining its usage, cultural implications, and impact on trust building. The findings should be evaluated taking into account several limitations. Firstly, in terms of the collaboration type, the selected case was an international supply chain. The supplier-distributor relationship feature may constrain the generalizability of the findings to other types of collaborative relationship, for instance, strategic alliances and joint ventures. Future studies may examine other forms of international collaborations or conduct comparative analysis on the application and effect of EC in the trust building process.

Secondly, several cultural dimensions (Hall, 1976; Hofstede, 1980, 1991) have been identified as pertinent in the understanding of EC usage. Future studies may explore the relevance of other cultural dimensions such as Trompenaars and Hampden-Turner's (1997) framework in EC-supported international collaborations. Finally, the partners from each collaborating organization were perceived as one general management group although the managerial background was noted for each participant. Future research may expand this type of analysis to include and compare multiple perspectives from the senior executives, middle managers, and front-end employees.

REFERENCES

- Alvesson, M., & Skoldberg, K. (2000). *Reflexive methodology: New vistas for qualitative research*. London: SAGE Publications.
- Andersen, T. J., & Foss, N. J. (2005). Strategic opportunity and economic performance in multinational enterprises: The role and effects of information and communication technology. *Journal of International Management*, 11(2), 293–310. doi:10.1016/j.intman.2005.03.008
- Blankenship, A. B., Crossley, A., Heidingsfield, M. S., Herzog, H., & Kornhauser, A. (1950). Questionnaire Preparation and Interviewer Technique. *Journal of Marketing*, 14(3), 399–433. doi:10.2307/1248194
- Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. New Jersey: Prentice-Hall, Inc.
- Boddy, D. (2005). *Management: An Introduction* (3rd ed.). Harlow: Prentice Hall.
- Bogdan, R., & Taylor, S. J. (1975). *Introduction to qualitative research methods: A phenomenological approach to the social sciences*. New York: John Wiley & Sons.
- Child, J. (2001). Trust: The fundamental bond in global collaboration. *Organizational Dynamics*, 29(4), 274–288. doi:10.1016/S0090-2616(01)00033-X
- Child, J., & Faulkner, D. (1998). *Strategies of co-operation: Managing alliances, networks and joint ventures*. Oxford: Oxford University Press.
- Cohen, S. G., & Mankin, D. (2002). Complex collaborations in the new global economy. *Organizational Dynamics*, 31(2), 117–133. doi:10.1016/S0090-2616(02)00096-7
- Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods* (2nd ed.). New York: McGraw-Hill.

An Empirical Investigation of the Role of E-Communication in International Collaborations

- Denzin, N. K., & Lincoln, Y. S. (Eds.). (1998). *Strategies of qualitative inquiry*. London: Sage Publications.
- Easterby-Smith, M., Thorpe, R., & Lowe, A. (1991). *Management research: An introduction*. London: Sage Publications.
- Eisenhardt, K. M. (1989). Building theory from case study research. *Academy of Management Review*, 14(4), 532–550.
- Gergen, K. (1999). *An Invitation to social construction*. London: SAGE Publications.
- Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine de Gruyter.
- Goffman, E. (1959). *The presentation of self in everyday life*. New York: Doubleday.
- Grosse, C. U. (2002). Managing communication within virtual intercultural teams. *Business Communication Quarterly*, 65(4), 22–38. doi:10.1177/108056990206500404
- Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38(1), 85–112. doi:10.2307/256729
- Hall, E. T. (1976). *Beyond culture*. Garden City, NY: Anchor Press/Doubleday.
- Harrigan, K. P. (1988). Joint ventures and competitive strategy. *Strategic Management Journal*, 9(2), 141–158. doi:10.1002/smj.4250090205
- Harzing, A. W., Koster, K., & Magner, U. (2011). Babel in business: The language barrier and its solutions in the HQ-subsiary relationship. *Journal of World Business*, 46(3), 279–287. doi:10.1016/j.jwb.2010.07.005
- Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage.
- Hofstede, G. (1991). *Cultures and organizations: Software of the mind*. Maidenhead: McGraw Hill.
- Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14(4), 29–64.
- Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science*, 10(6), 791–815. doi:10.1287/orsc.10.6.791
- Jean, R. J., Sinkovics, R. R., & Cavusgil, S. T. (2010). Enhancing international customer-supplier relationships through IT resources: A study of Taiwanese electronics suppliers. *Journal of International Business Studies*, 41(7), 1218–1239. doi:10.1057/jibs.2010.4
- Jean, R. J. B., Sinkovics, R. R., & Kim, D. (2010). Drivers and Performance Outcomes of Relationship Learning for Suppliers in Cross-Border Customer-Supplier Relationships: The Role of Communication Culture. *Journal of International Marketing*, 18(1), 63–85. doi:10.1509/jimk.18.1.63
- Kettinger, W. J., & Grover, V. (1997). The use of computer-mediated communication in an interorganizational context. *Decision Sciences*, 28(3), 513–555. doi:10.1111/j.1540-5915.1997.tb01321.x

An Empirical Investigation of the Role of E-Communication in International Collaborations

Lane, C., & Bachman, R. (Eds.). (1998). *Trust within and between organizations: Conceptual issues and empirical applications*. Oxford: Oxford University Press.

Mackenzie, M. L. (2010). Manager communication and workplace trust: Understanding manager and employee perceptions in the E-world. *International Journal of Information Management*, 30(6), 529–541. doi:10.1016/j.ijinfomgt.2010.04.001

Maljers, F. A. (1992). Inside Unilever - the Evolving Transnational Company. *Harvard Business Review*, 70(2), 46–52. PMID:10117368

Mandal, P., Love, P. E. D., & Irani, Z. (2003). Pre-alliance planning: Development of an information system infrastructure to support strategic alliance activities. *Management Decision*, 41(2), 132–140. doi:10.1108/00251740310457579

Marshall, H. (1994). Discourse analysis in an occupational context. In C. Cassell & G. Symon (Eds.), *Qualitative methods in organizational research: A practical guide* (pp. 91–106). London: Sage Publications.

McAllister, D. J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1), 24–59. doi:10.2307/256727

Mead, G. H. (1934). *Mind, self and society*. Chicago: University of Chicago Press.

Nooteboom, B. (2002). *Trust: Forms, foundations, functions, failures and figures*. Cheltenham, UK: Edward Elgar. doi:10.4337/9781781950883

Paul, D. L., & McDaniel, R. R. (2004). A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *Management Information Systems Quarterly*, 28(2), 183–227.

Pauleen, D. J., & Yoong, P. (2001). Relationship building and the use of ICT in boundary-crossing virtual teams: A facilitator's perspective. *Journal of Information Technology*, 16(4), 205–220. doi:10.1080/02683960110100391

Phillips, N., & Hardy, C. (2002). *Discourse analysis: Investigating processes of social construction*. London: Sage.

Ralston, D. A., Gustafson, D. J., Cheung, F. M., & Terpstra, R. H. (1993). Differences in Managerial Values - a Study of United-States, Hong-Kong and PRC Managers. *Journal of International Business Studies*, 24(2), 249–275. doi:10.1057/palgrave.jibs.8490232

Ralston, D. A., Holt, D. H., Terpstra, R. H., & Kai-cheng, Y. (1997). The impact of national culture and economic ideology on managerial work values: A study of the United States, Russia, Japan, and China. *Journal of International Business Studies*, 28(1), 177–207. doi:10.1057/palgrave.jibs.8490097

Ring, S. P., & Van de Ven, A. (1994). Developmental process of cooperative interorganizational relationships. *Academy of Management Review*, 19, 90–118.

Rogani, J. F. (2007). Library consortia and digital services. *New Library World*, 108(11/12), 504–525. doi:10.1108/03074800710838254

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Sanders, N. R. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management*, 25(6), 1332–1347. doi:10.1016/j.jom.2007.01.008

Seale, C. (Ed.). (2004). *Social research methods: A reader*. London: Routledge.

Silverman, D. (1993). *Interpreting qualitative data: Methods for analysing talk, text and interaction*. London: Sage.

Strauss, A. L., & Corbin, J. (2004). Open coding. In C. Seale (Ed.), *Social research methods: A reader* (pp. 303–306). London: Routledge.

Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *Management Information Systems Quarterly*, 28(1), 45–73.

Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *The Academy of Management Executive*, 12(3), 17–29.

Triandis, H. C., Bontempo, R., Villareal, M. J., Asai, M., & Lucca, N. (1988). Individualism and collectivism: Cross-cultural perspectives on self-ingroup relationships. *Journal of Personality and Social Psychology*, 54(2), 323–338. doi:10.1037/0022-3514.54.2.323

Trompenaars, F., & Hampden-Turner, C. (1997). *Riding the wave of culture: Understanding cultural diversity in global business*. New York: McGraw-Hill.

Webber, R. A. (1969). Convergence or Divergence. *The Columbia Journal of World Business*, 4(3), 75–83.

Wills, S., & Barham, K. (1994). Being an international manager. *European Management Journal*, 12(1), 49–58. doi:10.1016/0263-2373(94)90046-9

Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). London: Sage.

Zhang, Y., & Huxham, C. (2009). Identity construction and trust building in developing international collaborations. *The Journal of Applied Behavioral Science*, 45(2), 186–211. doi:10.1177/0021886309333327

KEY TERMS AND DEFINITIONS

Asynchronous E-Communication Applications: Communication by people at different times through the use of email, blog and forum.

Convergence: A belief that the value systems of different countries become similar.

Crossvergence: A belief that new and unique value systems can be developed across different countries.

Divergence: A belief that the values systems of different countries are distinct from one another.

E-Communication: Computer-mediated communication or electronic/virtual communication. The main channels include emails, blogs, discussion forums and social media.

International Collaborations: Cross-border collaborative arrangements between organizations, for example, international supply chain networks, joint ventures, strategic partnerships, and alliances.

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Social Constructionism: A philosophical approach or world view which addresses the multiple social realities interpreted and represented by people.

Synchronous E-Communication Applications: Simultaneous communication by people through the use of video conferencing and online-chat programs.

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APPENDIX: AN EXAMPLE OF THE SURVEY QUESTIONS

Electronic Communication (E-Communication) Mechanisms and Usage at Work

1. What are the main forms of e-communication used?
2. Which e-communication method(s) is (are) most commonly used? Why?
3. What training sessions are available for e-communication usage?
4. Is there a lack of Information Communication Technology infrastructure? Why?
5. What are the benefits of e-communication?
6. What are the limitations of e-communication?

Impact of E-Communication

1. What signifies user satisfaction in e-communication?
2. To what degree does e-communication affect partners' trust levels? Why?
3. What can be done to strengthen partners' trust levels within the international supply chain?

Cultural Influence on the E-Communication Usage

1. What similarities have you found when communicating with other cultures through e-communication?
2. What differences have you found when communicating with other cultures through e-communication?
3. What are the major difficulties of using e-communication when you deal with another culture?
4. What can be done to overcome these difficulties?

Chapter 6

Information Quality in Supply Chain Software

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ABSTRACT

In the new dynamic economic environment where supply chains increasingly face constant change and instability, the better supply chain planning and management enabled by advanced data management systems provides enhanced value proposition for customers resulting in improved profitability for firms along the supply chain. However, achieving such high quality level of supply chain visibility is not an easy task requiring technological capability, organizational willingness and data quality management intensively demanding attention from both managers and scholars. Therefore, the chapter begins with an overview of the role of information systems in supply chain management followed by a discussion regarding the role of information quality in successful supply chain interactions. Data quality management in terms of strategy and data governance is then reviewed. Finally, data quality tools complementing strategy dimension of data quality management are studied.

1. INTRODUCTION

Information management as the new supply chain's frontier (Lee, Pipino, Funk, & Wang, 2009) stresses the important role of information quality both in organizational and inter-organizational information systems (Pereira, 2009) leading to supply chain integration and management (Hartono, Li, Na, & Simpson, 2010), supply chain agility (Gunasekaran & Ngai, 2004) and operational efficiency (DeGroote & Marx, 2013). In the new dynamic economic environment where supply chains increasingly face constant change and instability, this better supply chain planning and management due to advanced data management systems such as reference data management systems (Chae, Yang, Olson, & Sheu, 2013), master data management systems (Chen et al., 2013), and RFID technologies (Loshin, 2010b) provides enhanced value proposition for customers resulting in improved profitability for firms along the supply chain in such roles as supplier, manufacturer, distributor, and retailer.

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However, achieving such high quality level of supply chain visibility is not an easy task requiring technological capability such as Information Technology (IT) infrastructure capability, organizational willingness such as top management dedication and data quality management (Sarac, Absi, & Dautère-Pérès, 2010) intensively demanding attention from both managers and scholars. Despite the fact that there exists no consensus to differentiate “data quality” and “information quality”, some authors prefer to reserve the term “data quality” for technical issues and “information quality” for general and non-technical issues (see, for example, Lee et al., 2009; McGilvray, 2010).

However, in this chapter, we do not make such a distinction and choose to use the terms “data quality” and “information quality” interchangeably to avoid repetitive and boring use of a single term throughout the chapter and we believe this does not harm the rigor of discussion since they both refer to the same idea in our presentation. Furthermore, we do not intend to provide a substantial and systematic review of data quality literature as it is not the mission of this chapter.

Therefore, this chapter does not cover the whole published literature of data quality. However, we provide a proper presentation of data quality management issues and their impact on supply chain performance based on useful and pertinent research works so as to provide a suitable big picture for the reader about common data quality impacts on supply chain management, data quality problems and their solutions and guide the interested reader to consult technical references as advised throughout the chapter for more technical details.

In this chapter, we discuss information quality in supply chain management in terms of strategies and tools required for data quality management. The review begins with an overview of the role of information systems in supply chain management followed by a discussion regarding the role of information quality in successful supply chain interactions. Data quality management in terms of strategy and data governance is then reviewed. Finally, data quality tools complementing strategy dimension of data quality management are reviewed.

2. INFORMATION MANAGEMENT AS THE NEW SUPPLY CHAIN'S FRONTIER

Information sharing systems play an important role in the success of supply chain management through enabling the access of supply chain partners to quality shared information. Sharing useful, accurate and accessible information enables firms to quickly learn the dynamics in their supply chain environment (Pereira, 2009). This important process provides valuable knowledge about the supply chain context for eager and attentive supply chain managers to make effective and efficient decisions. Such precise decisions lead to planning and controlling supply chain processes in a productive manner that is never possible without proper access to quality shared information. Consequently, information quality problem is now a top priority concern for many aspiring supply chain managers.

There is growing concern among companies, aware of positive and negative impacts of data quality throughout the world, to establish organizational departments to deal with business data quality issues seriously as failing to delegate the responsibility of data quality is a preventing barrier for the achievement of data quality in an organization to be discussed in later sections of this chapter. In fact, many appropriate strategic, tactical and operational decisions must be made to ensure information life cycle has the acceptable level of quality guarantee from the viewpoint of the stakeholders and users of data.

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2.1. Information Management in Supply Chain Integration and Management

The role of information management in supply chain management is hardly deniable. Many supply chain partners have decentralized their value-adding activities by outsourcing their non-core process. The outsourcing approach is totally based on the exploitation of IT so as to gain the integration of partnering firms in a supply chain via the crucial provision of information exchange (Hartono et al., 2010). The success of such integration between companies active in a supply chain is completely dependent on necessary information management solutions implemented across the supply chain as required. Due to the distributed nature of a supply chain, information management approaches must support the appropriate exchange of data between supply chain players leading to successful achievement of outsourcing. In particular, applying the idea of lean thinking to information management helps define and eliminate waste in an information management setting resulting in improved information exchange, sharing, and collaboration (Hicks, 2007).

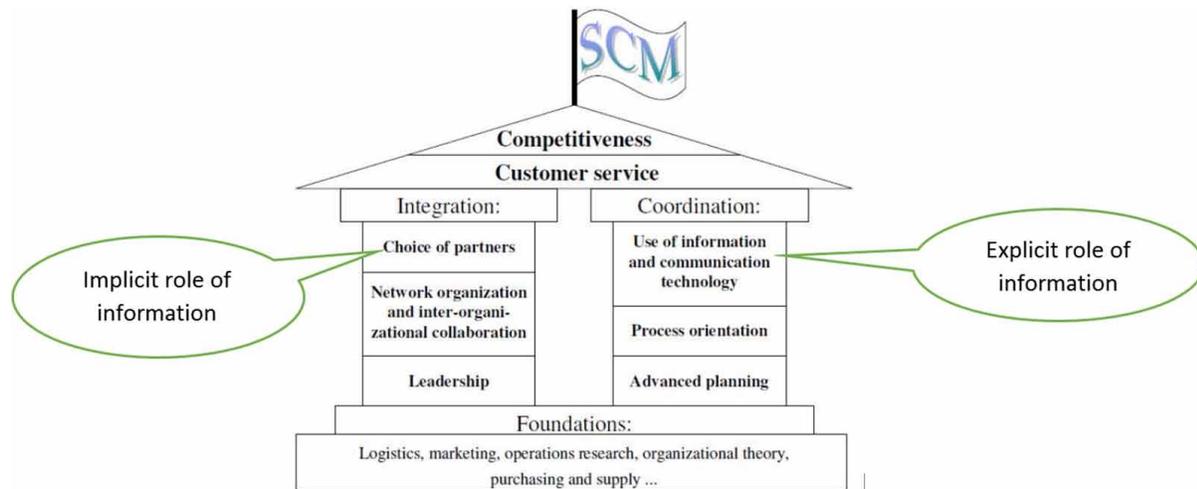
In supply chain management, access to proper information is an important prerequisite to manage supply chain flows fruitfully. There is a famous management saying which indicates that “the speed of physical movement of any product in the chain is never more than the speed of exchange of its related information.” This means that, for example, despite the physical availability of a specific product in the right quantity in a typical warehouse, the product will be practically regarded as unavailable if its pertinent data such as product name, product code and inventory on hand which is stored in the warehouse database does not properly match with the real world facts. Such a not uncommon and at the same time false stock-out of products even in large and mature enterprises worldwide highlights the importance of managing the information of important entities such as customers, products, locations and accounts in the supply chain.

The well-known House of SCM of Stadler and Kilger (2002) considers two important pillars for supply chain management. The first pillar deals with supply chain integration and the second pillar is associated with supply chain coordination. While the focus of the former pillar helps determine the players of the supply chain game, the second pillar deals with how the game will be played by partners. For example, in the supplier selection process of integration pillar and with regard to the significant impact of globalization of trade and the internet on a purchaser’s choice set (De Boer, Labro, & Morlacchi, 2001), many organizations are suffering from the chaos of information which stresses the requirement for information management system to support the selection of partners (Dias, 2001) which we call the implicit role of information in House of SCM as it is not explicitly mentioned in the integration pillar.

Furthermore, companies do not join each other for the mere purpose of joining. They are willing to cooperate in the value adding processes of the supply chain. However, there is no collaboration without information sharing. For example, if a company plays the role of a customer and places orders to be supplied by the other company called supplier what actually happens in the ordering process is the exchange of information of orders between the two companies which is regarded as an important complement for the physical product delivery process. Therefore, the second pillar is also highly dependent on information management as it is explicitly mentioned in the coordination pillar of House of SCM which we call the explicit role of information (Figure 1). In the ordering example, if the interaction of the two firms lacks proper infrastructure for information management, many undesired conditions arise that incur considerable costs to the supply chain and harm the competitiveness of the chain which is similar in nature to the previously mentioned example of false stock-out.

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Figure 1. This figure shows House of SCM (Stadler & Kilger, 2002) in which the explicit role of information management in coordination pillar and implicit role of information management in integration is indicated



The Internet, which was once regarded as a critical elements and is now a water-like vitality for the digital world and even for life itself, enhances communications between firms and customers through improved interactivity (Watson, Akselsen, & Pitt, 1998). Such inundation of companies with information along with the extension of domain of competition from “between individual firms” to “between supply chains” (Craighead, Hult, & Ketchen, Jr, 2009; Ketchen & Hult, 2007; Slone, 2004; Whipple & Frankel, 2000), has motivated supply chain managers to invest in information management solutions such as data science, predictive analytics, and big data to achieve competitive advantage (Hazen, Boone, Ezell, & Jones-Farmer, 2014).

Many important solutions to common issues in supply chains are also based on information sharing. For example, the notorious bullwhip phenomenon which is observed in forecast-driven distribution channels is commonly dealt with through information sharing among suppliers, manufacturers, wholesalers, and retailers so as to gain effective supply chain visibility which dampens bullwhip effect significantly (Simchi-Levi, 2005). As another example, consider the concept of Vendor Managed Inventory (VMI) in which the supplier makes the replenishment decision for products supplied to a customer. This is done based on various inventory and supply chain policies in which information sharing between supply chain members is a vital requirement without which the VMI replenishment policy is doomed to fail (Angulo, Nachtmann, & Waller, 2004)

To conclude this section, we re-emphasize the undeniable role of information management in the success of supply chain management based on the above discussion. This is due to the fact that access to proper information is an important prerequisite for the fruitful management of supply chain flows as it was illustrated via analyzing the role of information in House of SCM for better integration and coordination of partners. In the next section we analyze the role of information management in supply chain agility.

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2.2. Information Management in Supply Chain Agility

Consider a professional truck driver who travels every day from city A to city B in the morning and travels the reverse order in the evening in a mountainous area. This frequent travel between the two cities allows him to be aware of every road turn and have the ability to drive the truck even blindly. Now compare the truck driver with a professional pilot who flies over the same area every day. The same story is not true with the man in the sky. Each time a pilot flies, he must be briefed with complete details for the new weather conditions outside the plane high above the clouds in the same geographical region he has flown over just some hours ago.

Supply chain managers in today's global competition era are more like a pilot than a truck driver. Not only do they need to be able to sense the rapid market changes, but also they must provide appropriate responses (Ganguly, Nilchiani, & Farr, 2009; Overby, Bharadwaj, & Sambamurthy, 2006; Sambamurthy, Bharadwaj, & Grover, 2003). This objective is achieved only through proper information management. Thus, information does not play a simple role. It enables managers to monitor the complex customer's behavior in a real time manner. In addition, based on the collected data they are able to design, share and implemented plans with their partners so as to respond to abrupt changes of market effectively. Such intelligent behavior is never feasible without access to properly managed data as quality data is key to clever decision making by busy managers of today.

In an empirical study, DeGroot and Marx (2013) investigated the impact of IT on supply chain agility through collection and analysis of data from 193 U.S. manufacturers. They find that IT improves the supply chain's ability to sense changes of market via improving information quality, and to respond to the changes by designing and implementing a coordinated response plan across the supply chain to develop an agility-based competitive advantage. From the above discussion we learn that information management through emergent technologies and systems enable supply chain managers to manage the chain in a more integrated and flexible manner (see also White, Daniel, & Mohdzain, 2005). The role of information management in operational efficiency is analyzed in the next section.

2.3. Information Management in Operational Efficiency

Although with the ever increasing popularity of the idea of supply chain management and the rise of global supply chains, the benefits of information management systems are now typically discussed and analyzed in contexts beyond the boundaries of a single firm, it is still noteworthy to consider the impacts of information management on the internal efficiency of firms across various functions and operations as it is discussed below.

In their seminal paper, Bakos and Treacy (1986) identify internal strategy, competitive strategy and business portfolio strategy as three important strategic perspectives for the analysis of impacts of information technology on a firm and indicate that information technology has potential simultaneous impact on the three components. They also provide an illuminating example for the phenomenon. Consider a distributor who establishes an online system to receive customer orders with terminals installed in purchasing locations resulting in efficiency of the firm's operations as an element of internal strategy. The success of customers to achieve inventory reduction via supply of useful information and speeding orders for the customer contributes to the firm's competitive strategy which is made possible based on

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increasing switching costs for the customers. Furthermore, the same technological capability may still be regarded as an important asset in other industries which paves the way for the firm to enter a new industry such as mail-order retailing which has significant impact on the portfolio strategy.

The impact of information systems on operational efficiency measured in terms of financial performance are positively stronger in presence of greater environmental changes, more proactive company strategy, and closer Chief Executive Officer / Chief Information Officer (CEO/CIO) ties which may be achieved by assessment of environmental contexts, strategic directions, and top management team arrangement to allow CIOs a more strategic role (Li & Ye, 1999). Achieving efficiency in a firm is highly dependent on quality of decisions made by managers. Since decision making is inherently a cognitive activity, it is necessary to represent real world things in a suitable way or simply model the reality by information systems.

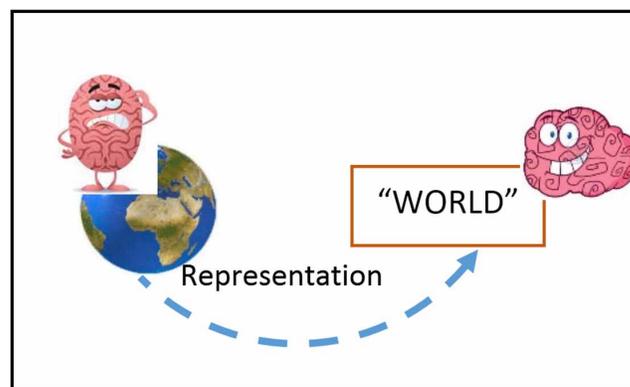
More formally, the real world under study is *better understood* if there exists a representation function R such that,

$$value(\text{understand}(WORLD)) < value(\text{understand}(R(WORLD)))$$

where *understand* is the function suitably defined for the cognitive understanding activity and *value* is the function suitably defined for the cognitive activity of measuring the value of understanding (Figure 2).

To conclude this section, it must be noted that despite the considerable advantages of information systems for the success of a corporate strategy, information quality is key for successful world representation. An information system that represents the world improperly enables managers to make wrong decisions and implement these wrong and incorrect decisions quite quickly the consequences of which is at least operational inefficiency if not complete game loss. Therefore, in the next section we discuss the role of information quality for the success of firms in quality decision making.

Figure 2. Representing real world via a representation function helps understand it better and gain improved insight



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3. THE ROLE OF INFORMATION QUALITY

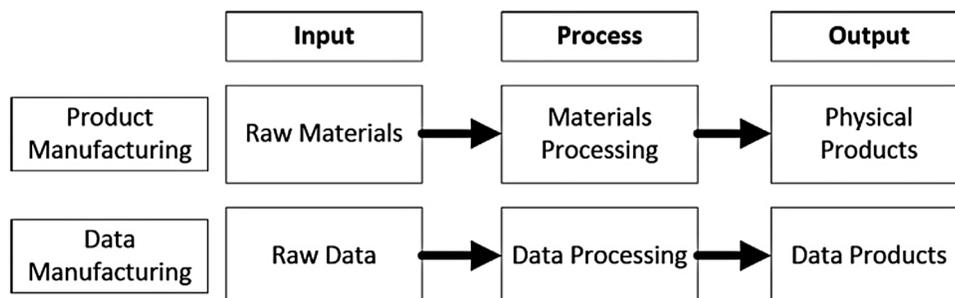
In many organizations today, one seemingly simple choice is to overlook data quality as an organizational issue. However, as mentioned in the previous section, if the information management system of an organization fails to offer quality information to its managers, then the quality of managerial decisions must be significantly under question leading to the rise of the famous “Garbage In, Garbage Out” (GIGO) phenomenon. To avoid the undesired result of GIGO, paying heed to the illuminating definition of information quality may shed some light on the issue. Information quality is the degree to which information and data can be a trusted source for all/any required uses (McGilvray, 2010). According to the definition, since information quality involves having the right set of correct information at the right time, in the right place for the right people, it is regarded as a prerequisite to make effective decisions so as to run the business, serve customers and achieve business goals successfully and thereby involves all the people in organization.

The concept of quality is a well-studied and deep concept in production and manufacturing context and such a history has attracted many data quality researchers to draw analogy between product and information so as to analyze and discuss data quality problems. Although the analogy is sometimes controversial (Sebastian-Coleman, 2012), the illuminating comparison is still suitable for our purpose of introducing the idea of information quality as it is illustrated in Figure 3.

Accepting the above comparison as a logical basis, one may be reminded of such concepts as information factory, data suppliers, data acquirers, data creators, data processors, data packagers, data delivery agents, data consumers and different levels of data management (Loshin, 2001). This meaningful observation gives rise to an important accountability question as quality is a concept interwoven with responsibility. Who must be held responsible for each of these roles? In the traditional organizational chart of a company, all data related issues are assigned to information technology related departments such as IT department. Is data quality also a technical IT problem? The answer is both affirmative and negative. The answer is affirmative because the data life cycle throughout its chain in the organization is made possible via technical software, hardware and network made available by IT expertise. The answer is also negative because according to definition of information quality, the question of information quality involves everyone in the company.

In other words, IT is involved with the form of information while the rest of organization is involved with the content of information. However, both of them are necessary for the realization of data quality in the company. It is not sufficient to purchase and install different organizational and inter-organizational

Figure 3. An analogy between product and data manufacturing processes (Wang, Storey, & Firth, 1995)



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systems to manage organizational data in an acceptable manner. Such a cold and technical approach to the IT aspect does not suffice as the other complementing part is still missing. Without the necessary and proper engagement of people with data quality concerns active in different functions and processes of organization, complete achievement of information quality is more a wish than a reality. But, how is it possible to help an organization achieve acceptable levels of data quality in the organization? This is the question we cover in the remainder of the chapter.

In so doing, we illuminate the role of data quality more in the remainder of this section. Specifically, we discuss the role of data quality in two areas. First we highlight the role of information quality in the organizational context. This involves, in particular, the role of master data management in Enterprise Resource Planning (ERP) systems. Subsequently, we focus on the inter-organizational aspect of data quality which includes the benefits of data quality for various partners in a supply chain. In both of these areas, there are important points which must be made to pave the way for the justification of our final section in this chapter which deals with the solutions recommended by professional experts to be taken to achieve successful data quality management in an organization. In fact, consideration about strategies, approaches, processes, people, methods and technologies required to be observed to maintain data quality in an organization are explained.

3.1. The Role of Information Quality in Organizational Systems

The variety of approaches and challenges faced by organizations to manage the sharing of both intra and inter-organizational information (Durugbo, 2013) demonstrate the important role of information for the existence of organizations as it is sometimes likened to oxygen for human life (Al-Hakim, 2008). Organizations apply information for three important purposes of making sense of change in environment, creating new knowledge for innovation and making decisions about courses of action (Choo, 1996). In other words, as Loshin (2010b) indicates, “data is used to both run and improve the ways that organizations achieve their business objectives”. For example, corporate portals are now a common practice in many organizations to facilitate the access of organizations to structured data (Dias, 2001) leading to efficient and effective organizational decisions (McGilvray, 2010) which is done based on various models such as web portals.

3.1.1. ERP Systems

Stand-alone systems with major problems of redundancy, inconsistency, and lack of integrity are considered the main source problem which has motivated organizations to move from a function-oriented to a process-oriented approach so as to manage business operations based on integrated information systems as an effort to develop organizational integrity (Kurbel, 2013). The problem of integration with multiple levels of data integration, function integration, activity integration, process integration, method integration, and program integration if not solved properly will cause such problems as redundancy, inconsistency, stand-alone systems and lack of integrity. A typical ERP system consisting of purchasing and procurement, material planning, inventory management, warehousing, production planning, manufacturing, quality assurance, maintenance, marketing, sales and distribution, shipment, customer service, financial and managerial accounting, controlling, and human resources modules is the well-known

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solution sought by managers to solve the integration issue in which the diversity of modules is indicative of wide organizational domain involved in the integration process as required by the business. (For a review of ERP systems, their origins, evolution, and implementation issues, refer to Kurbel (2013)).

All these activities depend on quality data for both operational and analytical purposes as the success of ERP is largely dependent on the quality of data inputted to each of the organizational processes covered by the ERP system. This is due to the fact that the organizational view of critical objects typically known as master data plays a crucial role in operations and analysis of various business functions. Although customers, suppliers, employees, products, policies and accounts are among the most important entities an organization deals with to achieve its operational and strategic objectives, ignoring to consider the proper processes to ensure different aspects of data quality leads to negative undesired consequences and results in organizational management failure.

According to Kurbel (2013), an information system may be defined as “a computer system that processes inputted information or data, stores information, retrieves information, and produces new information to solve its task automatically or to support human beings in the operation, control and decision making of an organization.” Therefore, ensuring the success of an ERP system as an information system requires maintaining the ability to manage master data across an enterprise as an effort to provide the definitions and meanings of important business concepts if possible and the ability to distinguish business terms with different referents which in turn leads to “envisioning how to organize an enterprise view of the organization’s key business information objects and to govern their quality, use, and synchronization to optimize the use of information to achieve the organization’s operational and strategic business objectives” (Loshin, 2010a).

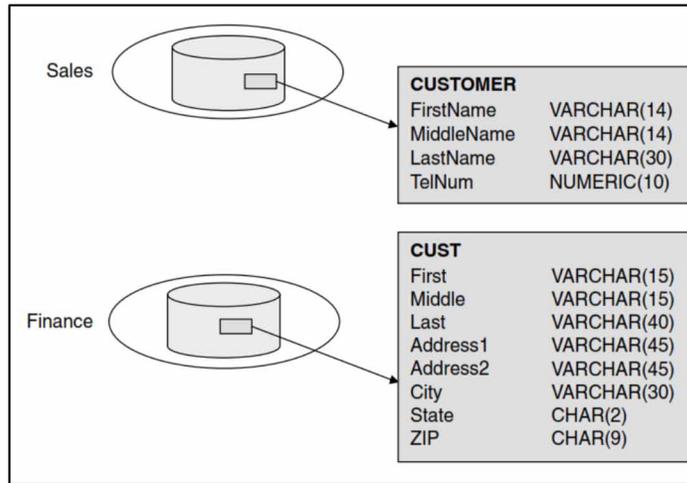
Instituting an MDM program to achieve consistency and accuracy of master data in an ERP system may imply improvement of data quality across the organization (Loshin, 2010a). However, data quality means different things for different users as there are different dimensions of data quality such as uniqueness, accuracy, consistency, completeness, timeliness and currency which means that each user may have his or her specific requirements. Loshin (2010a) illustrates the variety of requirements for data quality via a customer-centered example which is based on the different customer data quality requirements of various business functions in an enterprise. He considers the business functions of marketing, sales and shipping for his illustration.

For the telemarketer, the customer’s telephone number must be accurate to prevent the annoying twice calling of a specific customer with self-defeating impacts. The sales department is concerned about the duplication of customer records while for the shipping department customer’s location information is important. This leads to the challenging fact that the customer’s data is stored in each department’s database differently with different ways of representation as it is shown in figure 4. As another example, consider the disparity of meaning for the same attribute across the organization. The same “address” attribute, for instance, will have three different meanings of “warehouse address”, “central office” and “procurement office” if the “address” attribute is not managed consistently across the enterprise.

This highlights the need to develop data quality management systems with the purpose of ensuring acceptable levels of data quality according to enterprise data requirements for the ERP system which will be discussed in detail in the final section of this chapter. In the next subsection, we will review the inter-organizational impact of data information quality which shows the importance of data quality management when data is exchanged between business partners beyond the four walls of the enterprise.

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Figure 4. In an enterprise which lacks a proper master data management system, each department may have different concerns for the customer’s data quality with different ways of representing the customer’s information (Loshin, 2010a)

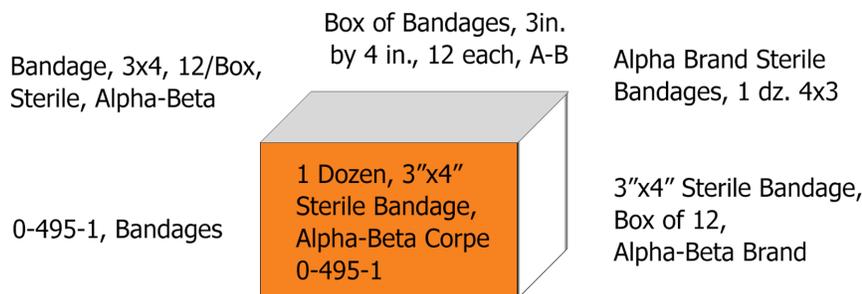


3.2. The Role of Information Quality in Inter-Organizational Systems

In the first section we discussed the significance of information management in the success of supply chain management via providing supply chain partners with access to proper information as an important prerequisite to manage supply chain flows both efficiently and effectively. The role of information quality in the success of supply chain management, however, is still in need of more discussion which is the task of this subsection.

Figure 5. Illustrates how many combinations and variations of identity attributes such as name, size, quantity, manufacturer, and product code can lead to multiple references to the same item. The same situation can occur with place entities that have attributes such as postal address, global positioning system (GPS) coordinates, or landmark references, and event entities that have attributes such as name, date, time, attendees, and location.” (Talbert, 2011).

Figure 5. Possible alternative names for a specific product which leads to disparity if not properly managed (Talbert, 2011)



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3.2.1. Supply Chain Management Systems

The need of supply chains to data may be analyzed in more detail based on data quality concepts. Data is commonly classified in three categories of reference data, master data and transactional data (McGilvray, 2010; Loshin, 2010b; Sebastian-Coleman, 2012) Reference data provides the alphabet of data exchange between two interested entities for data exchange including both human beings and computer systems leading to basic data standards and format setting; master data models the words of the data exchange with infrequent changes and transactional data describes commonly specific aspects of the issue under discussion via data exchange which depend commonly on time and process. For example, consider this sentence which describes an ordering event from a retailer to a supplier: “The order is sent from company A as a retailer to company B as a supplier for the purchase of 200 units of product P of type 2-inch at the unit purchasing price of \$100 to be delivered on 2014/11/30.”

In this example, how should we write the date “2014/11/30”? What is the right format to represent data of date type? Should we write “2014/11/30” or “2014/30/11” or “2014-11-30” or “2014-30-11” or “20141130” or “20143014”- to name just few of infinite possibilities? What about the value “inch”? There are a great many number of alternatives to represent the idea of inch: “inch”, “in”, “#”, “_{inch}”, “_{in}”, “_#”- again to name few. As a result, reference data management is the effort to determine the standard formats and definitions for basic data elements such basic names, classification structures, measurement and counting units, description attributes and description values to provide a sound basis for the quality development of the next data category: master data. The name of supplier “company A” and the name of retailer “company B” along with the name of the product “Product P” are instances of master data.

We apply reference data standards to define master data. For instance, the standard “gate valve” name from the set of reference data standards may be used to play the role of basic name as part of the full name for product P. The full name will certainly contain important descriptive elements such as type, model, brand and other important technical specifications. Such questions like “How much is product P?” or “How many of product P do you need” refer to transactional data. In each specific transaction in which the retailer is willing to buy product P, he uses the same master data to describe the companies and the product. However, specific characteristics of each order such as price and quantity may differ from one order to the other which are instances of reference data.

Now when we talk about the role of data quality in supply chain management, it means supply chain partners should come up with a suitable solution to manage the life cycle of reference data, master data and transactional data across the supply chain. Failing to do so leads to explosion of disorder of data with considerable inefficiencies harming the competitive advantage of the chain. To have a better idea, remember the example in Figure 5 in which a product could be described in many ways. This means that the product master data is not managed in the chain. Figure 6 depicts the situation.

To solve the issue, a centralized master data management program is instituted for the chain where the supplier, wholesaler and retailer use the same master data for a specific product. In particular, this may be achieved through centralized creation and dissemination of electronic product catalogs to serve all the partners which is illustrated by Figure 7.

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Figure 6. The disparate situation of product master data in a typical three stage supply chain where master data management efforts is missing

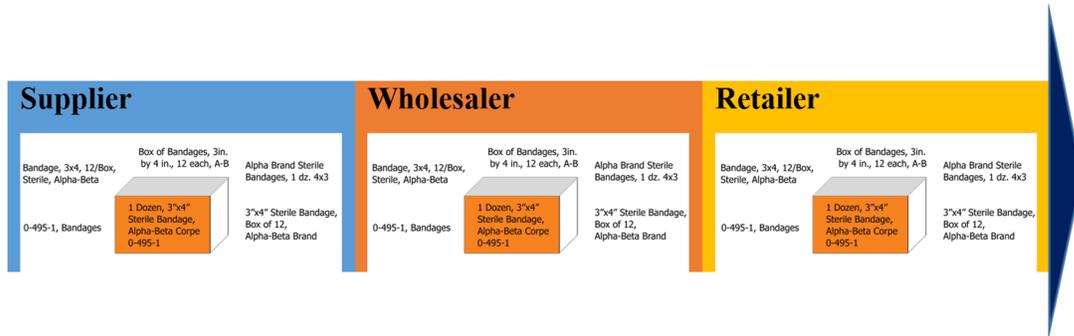
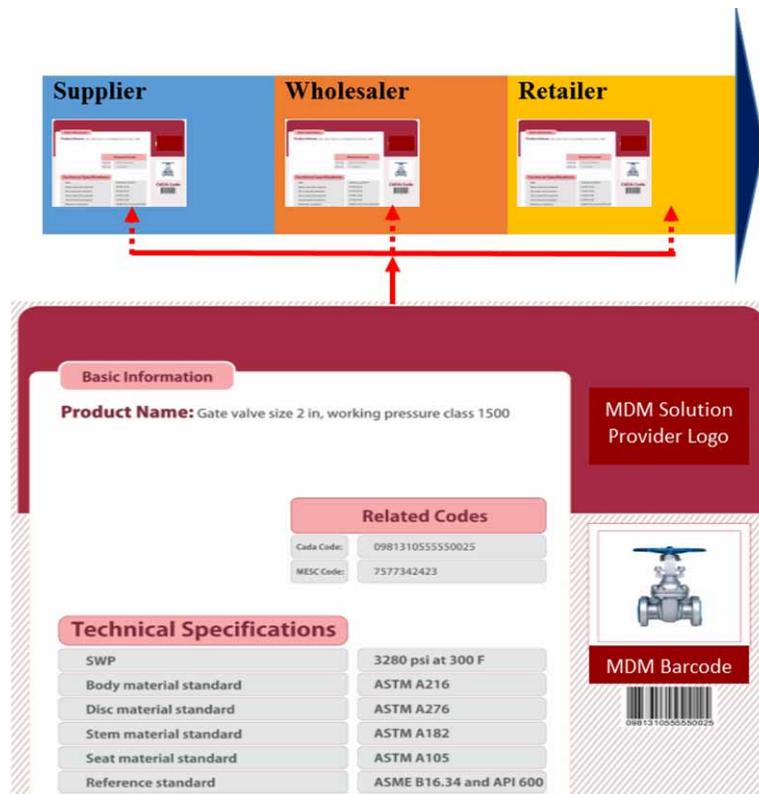


Figure 7. This figure shows a sample for creation and dissemination of electronic product catalogs to manage product master data for supply chain partners



There are many ways to evaluate the impacts of data quality management on supply chain management. Both quantitative and qualitative methods may be applied to develop a thorough analysis of the effects data quality management has on supply chain performance. This may help to the design a useful business case for data quality to motivate managers and investors to support the effort of supply chain data quality management. For the details of the techniques McGilvray (2010) is a suitable reference to consult.

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3.2.1.1. Benefits for Customers

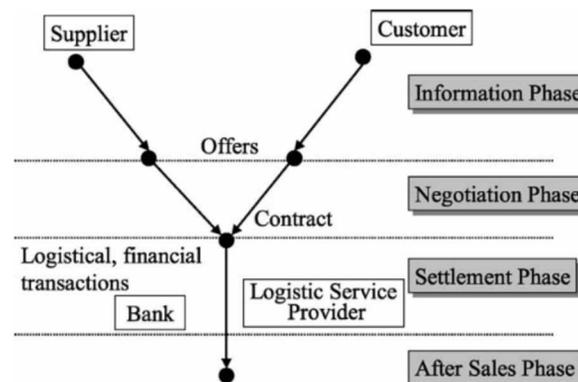
Customers need quality data to fulfill their requirements for products provided by the suppliers to the market. For each transaction, each customer needs to identify and evaluate its requirements, locate potential sources of supply and select supplier, negotiate with the supplier to determine contract parameters such as price, quantity and terms of delivery, settle logistical and financial issues also known as settlement phase and finally enter the after-sales phase to receive guarantee and warranty support for the product bought from the supplier as shown in Figure 8 (Schmid & Lindemann, 1998; Scharl, 2000; Skjøtt-Larsen, Kotzab, & Grieger, 2003).

Throughout this process, access to quality data helps customers gain efficiency and effectiveness in the transaction. In fact, customers are enabled by proper information management systems which support supply chain management to collect data, access data, analyze data and collaborate with suppliers and implement product purchasing best practices and approaches successfully via finding better suppliers, improving contract management, enhancing product delivery and optimizing post transaction services (Simchi-Levi, 2005).

One of the most important purchasing best practices followed by supply chain customers in Business-to-Business (B2B) interactions is the recent trend of electronic approaches to sourcing and procurement known as e-procurement and e-sourcing as stressed by many researchers and practitioners (Wu, Zsidisin, & Ross, 2007). Such electronic procurement solutions have the potential to enable many benefits including efficiency improvement and labor reduction via eliminating paper-based and manual processes across the organization, spend analysis based on gathering accurate and meaningful information of the previous purchases made and support strategic sourcing based on supplier performance (Neef, 2001). However, the success of e-procurement systems is in need of an organizational procurement strategy implemented via integrated system architectures (Puschmann & Alt, 2005) which is not totally possible without “access to the right data” (Loshin, 2010b) via such important tools as electronic catalogs.

Electronic catalogs provide “the right amount of good quality content” as an important success factor of EP systems particularly in large organizations. The quality of data in e-catalogs is managed via centralized master data management as a key element for data quality in the catalog (Puschmann & Alt,

Figure 8. The phases of a typical transaction between a buyer and a supplier (Skjøtt-Larsen et al., 2003)



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2005). Furthermore, XML-based e-catalogs combined with standardized feature descriptions enable attribute-based search engines, including parametric search and preference search preventing undesired and costly events where frustrated users have to accept bad search results or contact the supplier's purchasing department for complementary advice (Doring, Fischer, Kiessling, & Preisinger, 2005).

With regard to the above discussion, one may conclude that many of the best practices sought by customers in their procurement processes is geared to data quality. In fact, the top challenges for sourcing and procurement departments are "poor data quality," "too many data sources," and "lack of standardized processes" which necessitates the role of data quality management for the success of organizational procurement strategies (Loshin, 2010b).

3.2.1.2. Benefits for Suppliers

Suppliers need quality data to gain strategic and operational achievement in their supply processes. They rely on accurate information to develop, price, manufacture, market, sell and deliver new products and services. Suppliers to fully exploit the benefits of Enterprise Resource Planning (ERP), Supply Chain Management (SCM), Customer Relationship Management (CRM), among others, need a "consolidated view of high quality representations of every critical instance of a business concept" (Loshin, 2010b) which is made possible by data quality management and in particular master data management.

Master data management helps supplier define their key entities to produce high quality data. In all the aforementioned best practices such as ERP, quality of master data is an important prerequisite for the ERP to generate the expected results for the supplier. If the supplier, for example, is not able to provide accessibility, completeness, accuracy and timeliness of his product data, the resulting chaos and unreliability of data leads to significant inefficiencies across the enterprise and harms the competitive advantage of the organization.

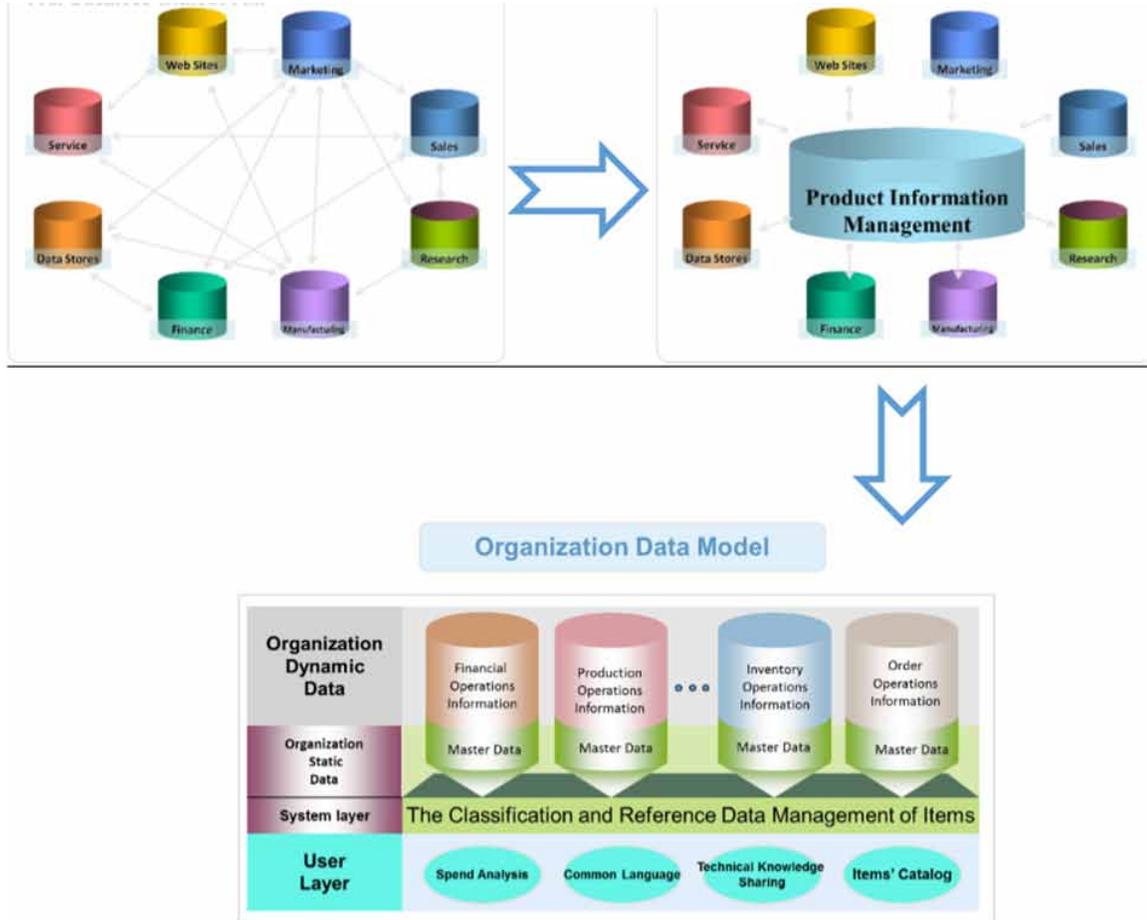
The same disparate situation of data which was discussed for a supply chain in Figure 6, will exist for a supplier across the different functional departments if master data management is not properly instituted. However, with the proper institution of master data management in a supplying company, all the departments will have the same view of critical business entities which leads to integrated business processes and prevents unnecessary costs and inefficiencies sometimes known as "single source of truth" (Dyché & Levy, 2011) as depicted in Figure 9.

3.3. Benefits for Other Supply Chain Players

The role of data quality in driving strategic and operational gains for other roles in a typical supply chain management setting such as manufacturer, distributor and retailer may be analyzed using the discussion provided for the customer and supplier in the previous sections and for the sake of brevity is not repeated. This is due to the fact that according to the SCOR model (Stephens, 2001), each role in a typical supply chain has the potential to possess planning, sourcing, making, delivering and returning functions which makes for example a manufacturer both a customer with respect to upstream partners and a supplier with respect to downstream partners.

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Figure 9. Master data management provides a single source of truth for all the functional departments in a supplying company



4. DATA QUALITY STRATEGIES AND TOOLS

In the previous section, we discussed the importance of data quality for supply chain partners. In this section, we review strategies and tools required to manage data quality necessary for successful supply chain management.

4.1. Data Quality Strategy and Data Governance

There is an important concern among data quality researchers and practitioners expressed under different labels such as “data governance” which stresses the dangers of over-emphasizing the technical aspect of data management while overlooking the other equally important organizational aspects such as management support, human resource management and alignment with other important enterprise strategic and operational plans (Fisher, 2009). This view requires that we regard IT assets and information

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assets as two different entities. IT assets include computers, communication, and databases as instances of technology which contribute to task automation while information assets are defined as documented facts with values or potential values for the business (Khatri & Brown, 2010).

Data quality management involves such activities as measuring, evaluating, improving, and ensuring so as to maximize the fitness of data as an effort to improve value of data for the business (DA, 2009)). Data governance is key to achieve this goal. In data governance, it is critical to determine what decisions are necessary to be made regarding the management of data quality. Equally important, the decision makers who must be held accountable for the decisions have to be determined (Khatri & Brown, 2010) In fact, according to Redman (2013) in data quality handbook, if an organization is willing to begin, improve, and maintain a data quality program it must develop a data quality management system which clarifies accountabilities for data, receives a top organizational priority from leadership and keeps developing a culture to view data as an important organizational asset.

Data governance sets the rules of data management. Compared to a railway system, data governance determines which rails must be installed where and by whom to design the necessary infrastructural architecture for the journey between two specific geographical points, taking into account various economic, social, cultural and even political measures to ensure the alignment of the railway system with strategic and operational goals of developers. The same story holds true for data. Data governance calls to clarify the “what”, “why”, “who”, “how”, “where” and “when” of the creation, storage, access, maintenance and even disposal of data throughout its life cycle to guarantee data is fit for business objectives and goals (see, for example, the POSMAD framework by McGilvray (2010)) Once the governance of data is established and maintained over time (Data governance is not necessarily static and done once forever (Otto, 2013)), what remains is the day-to-day operational and technical management of data based on technology as the multitude of daily train travels in the above train example.

To give the reader a better idea of data governance, we summarize the illuminating case of Johnson & Johnson in governing organizational data from Sadiq (2013). Johnson & Johnson as a Fortune 50 company with more than 250 subsidiaries located in 57 countries, a staff of 114,000 around the world and revenue of US\$65 billion in 2011 is organized in three business segments of “Pharmaceuticals,” “Medical Devices and Diagnostics,” “and Consumer Products.” Johnson & Johnson’s business strategy include keeping a balanced product portfolio and growing via acquisitions based on relying its core competencies and outsourcing two thirds of its overall production.

One of the main problems of Johnson & Johnson was lack of a shared view of key business objects across the enterprise. For instance, one business unit treated “product samples” as free while the other unit interpreted the same term as “promotional products” rising from a missing company-wide data management department. This situation had led to many drawbacks and inefficiencies such as poor process performance, sending incorrect invoices to customers, delayed shipping and manufacturing activities, poor new product introduction due to new product status transparency issues, missing managerial accountability for the whole process, poor data quality particularly in logistics data such as weight and dimensions of products.

Additionally, SAP ERP was implemented across the company to institute a standard application system for planning, production, sales, and distribution activities including software tools for managing master data creation. Despite this, data management processes, such as the creation and maintenance of material master data was missing at the start time of the system. This meant that master data had still a local and much varied organization resulting in dissatisfaction of the investment in the project.

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To deal with the issue, the executive management of Johnson & Johnson established and fully supported a company-wide Enterprise Master Data (EMD) department to guarantee and manage data quality leading to an organizational culture in which data was understood as a company asset. In so doing, subject matter experts from all functional units such as finance, engineering, or procurement were involved to form a mutual understanding of key business objects via harmonized definitions of entities. This resulted in defining roles and responsibilities for master data management and use and creating a set of 420 master data attributes in which material type determined ownership of data.

The owners were requested by the EMD team to develop business rules for master data management to be used in operational systems like SAP. One example of such rules is to require “gross weight” description for every finished good. Such data governance effort in Johnson and Johnson has created 3000 master data records of finished products and 11,000 master data records raw material with a 99.991% data quality level which is based on the ratio of the number of records without error to the total number of records in the SAP ERP system.

The above story from Johnson & Johnson highlights an important point with regard to data governance. Despite the fact that their ERP system possessed “software tools for managing master data creation” a single source of truth about critical business objects was not created until Enterprise Master Data (EMD) department was founded. This once again justifies the concern of ignoring organizational aspects of data quality management while over-emphasizing the technological aspects of the issue. Therefore, data governance plays a key role in achieving a consistent view of data across the enterprise which is of course complemented by the technology support. In particular to achieve master data management, an enterprise requires to handle issues like lack of delegation of responsibilities for maintenance of master data, lack of rewards for ensuring valid master data, lack of master data control routines, lack of employee competencies, lack of user-friendliness of the software that are used to manage master data (Haug & Arlbjørn, 2011).

4.2. Data Quality Tools

Data quality tools enable companies to measure and assess the quality of their existing data based on various techniques and algorithms. These tools emphasize the data driven aspect of data quality management which directly deal with the data such as updating obsolete data values while data governance processes focus on the process-driven aspect of data quality management as discussed in the previous section (Batini & Scannapieco, 2006). In data quality software market standalone tools are offered that support the core functionality required for data quality management such as profiling, parsing and standardization, generalized “cleansing”, matching, monitoring, and enrichment which are briefly defined in Table 1 (Friedman & Bitterer, 2006).

Data profiling techniques are mainly applied in organizational data quality assessment for the purpose of data review, potential anomalies identification, specification of data quality dimensions and recommendation of operations for inspection of data quality (Loshin, 2010b). The application of these techniques gives empirical insight into existence of potential data problems. The detailed review of technicalities of data profiling algorithms is beyond the scope of this chapter and the interested reader may refer to Loshin, 2010b; Batini & Scannapieco, 2006; McGilvray, 2010; and Talburt, 2011 for further details.

Information Quality in Supply Chain Software*Table 1. Core functionalities required in data quality management provided by data quality tools offered by software market (Friedman & Bitterer, 2006)*

| Functionality | Definition |
|---------------------------------------|---|
| Profiling | The analysis of data to capture statistics (metadata) that provide insight into the quality of the data and help to identify data quality issues. |
| Parsing and standardization | The decomposition of text fields into component parts and the formatting of values into consistent layouts based on industry standards, local standards (for example, postal authority standards for address data), user-defined business rules and knowledge bases of values and patterns. |
| Generalized “cleansing” | The modification of data values to meet domain restrictions, integrity constraints or other business rules that define when the quality of data is sufficient for the organization. |
| Matching | Identifying, linking or merging related entries within or across sets of data. |
| Monitoring | Deploying controls to ensure that data continues to conform to business rules that define data quality for the organization. |
| Enrichment | Enhancing the value of internally held data by appending related attributes from external sources (for example, consumer demographic attributes or geographic descriptors). In addition, these products provide a range of related functional capabilities that are not unique to this market but which are required to execute many of the data quality core functions, or for specific data quality applications. |
| Connectivity | The ability to interact with a range of different data structure types. |
| Subject-area-specific support | Standardization capabilities for specific data subject areas. |
| International support. | The relevance for data quality operations on a global basis. |
| Metadata management | The ability to capture, reconcile and interoperate metadata related to the data quality process. |
| Configuration environment | Capabilities for creating, managing and deploying data quality rules. |
| Operations and administration | Facilities for supporting, managing and controlling data quality processes. |
| Workflow/data quality process support | Processes and user interfaces for various data quality roles, such as data stewards. |
| Service enablement | Service-oriented characteristics and support for service-oriented architecture (SOA) deployments. |

5. CONCLUSION

In this chapter, the role of information quality for the enhancement of supply chain management was discussed based on available and pertinent literature to provide a broad view of the positive impacts of data quality if properly managed and the negative impacts if proper management of data is neglected. Specifically, we discussed the role of information in supply chain integration and management, supply chain agility and operational efficiency within a single enterprise.

To shed more light on the issue, we analyzed the impacts of data quality in two arenas of organizational and inter-organizational systems. In particular, we analyzed master data management for ERP systems as a suitable representing example of organizational systems and master data management for supply chain systems as a suitable representing example for inter-organizational systems. In both arenas, our analysis revealed that data quality management helps managers to make effective decisions for better management of both enterprises and supply chains. Furthermore, to provide a sound basis to develop data quality management we discussed strategic and technical aspects of data quality management. In particular, we provided the important case of Johnson and Johnson enterprise as a leading example to illustrate the importance of data governance as the important complement of technological side of data quality management.

Information Quality in Supply Chain Software**REFERENCES**

- Al-Hakim, L. (Ed.). (2007). *Information quality management: theory and applications*. Hershey, PA: IGI Global. doi:10.4018/978-1-59904-024-0
- Angulo, A., Nachtmann, H., & Waller, M. A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of business logistics*, 25(1), 101-120.
- Bakos, J. Y., & Treacy, M. E. (1986). Information technology and corporate strategy: A research perspective. *Management Information Systems Quarterly*, 10(2), 107–119. doi:10.2307/249029
- Barateiro, J., & Galhardas, H. (2005). A Survey of Data Quality Tools. *Datenbank-Spektrum*, 14(15-21), 48.
- Batini, C., & Scannapieco, M. (2006). *Data quality: concepts, methodologies and techniques*. Berlin: Springer.
- Chae, B. K., Yang, C., Olson, D., & Sheu, C. (2014). The impact of advanced analytics and data accuracy on operational performance: A contingent resource based theory (RBT) perspective. *Decision Support Systems*, 59, 119–126. doi:10.1016/j.dss.2013.10.012
- Chen, W. J., Baldwin, J., Dunn, T., Grasselt, M., Hussain, S., Mandelstein, D., & Xu, F. (2013). *A Practical Guide to Managing Reference Data with IBM InfoSphere Master Data Management Reference Data Management Hub*. Armonk, NY: IBM Redbooks.
- Choo, C. W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International Journal of Information Management*, 16(5), 329–340. doi:10.1016/0268-4012(96)00020-5
- Craighead, C. W., Hult, G. T. M., & Ketchen, D. J. Jr. (2009). The effects of innovation–cost strategy, knowledge, and action in the supply chain on firm performance. *Journal of Operations Management*, 27(5), 405–421. doi:10.1016/j.jom.2009.01.002
- DA, M. (2009). The DAMA guide to the data management body of knowledge.
- De Boer, L., Labro, E., & Morlacchi, P. (2001). A review of methods supporting supplier selection. *European Journal of Purchasing & Supply Management*, 7(2), 75–89. doi:10.1016/S0969-7012(00)00028-9
- DeGroot, S. E., & Marx, T. G. (2013). The impact of IT on supply chain agility and firm performance: An empirical investigation. *International Journal of Information Management*, 33(6), 909–916. doi:10.1016/j.ijinfomgt.2013.09.001
- Dias, C. (2001). Corporate portals: A literature review of a new concept in Information Management. *International Journal of Information Management*, 21(4), 269–287. doi:10.1016/S0268-4012(01)00021-4
- Doring, S., Fischer, S., Kiessling, W., & Preisinger, T. (2005, April). Optimizing the catalog search process for e-procurement platforms. *Proceedings of Data Engineering Issues in E-Commerce 2005 International Workshop* (pp. 39-48). IEEE. doi:10.1109/DEEC.2005.15

Information Quality in Supply Chain Software

- Durugbo, C., Tiwari, A., & Alcock, J. R. (2013). Modelling information flow for organizations: A review of approaches and future challenges. *International Journal of Information Management*, 33(3), 597–610. doi:10.1016/j.ijinfomgt.2013.01.009
- Dyché, J., & Levy, E. (2011). *Customer data integration: Reaching a single version of the truth* (Vol. 7). New York: John Wiley & Sons.
- Fisher, T. (2009). *The data asset: how smart companies govern their data for business success* (Vol. 24). New York: John Wiley & Sons.
- Ganguly, A., Nilchiani, R., & Farr, J. V. (2009). Evaluating agility in corporate enterprises. *International Journal of Production Economics*, 118(2), 410–423. doi:10.1016/j.ijpe.2008.12.009
- Gunasekaran, A., & Ngai, E. W. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), 269–295. doi:10.1016/j.ejor.2003.08.016
- Hartono, E., Li, X., Na, K. S., & Simpson, J. T. (2010). The role of the quality of shared information in inter-organizational systems use. *International Journal of Information Management*, 30(5), 399–407. doi:10.1016/j.ijinfomgt.2010.02.007
- Haug, A., & Stentoft Arlbjørn, J. (2011). Barriers to master data quality. *Journal of Enterprise Information Management*, 24(3), 288–303. doi:10.1108/17410391111122862
- Hazen, B. T., Boone, C. A., Ezell, J. D., & Jones-Farmer, L. A. (2014). Data quality for data science, predictive analytics, and big data in supply chain management: An introduction to the problem and suggestions for research and applications. *International Journal of Production Economics*, 154, 72–80. doi:10.1016/j.ijpe.2014.04.018
- Hicks, B. J. (2007). Lean information management: Understanding and eliminating waste. *International Journal of Information Management*, 27(4), 233–249. doi:10.1016/j.ijinfomgt.2006.12.001
- Ketchen, D. J. Jr, & Hult, G. T. M. (2007). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management*, 25(2), 573–580. doi:10.1016/j.jom.2006.05.010
- Khatri, V., & Brown, C. V. (2010). Designing data governance. *Communications of the ACM*, 53(1), 148–152. doi:10.1145/1629175.1629210
- Kurbel, K. E. (2013). *Enterprise Resource Planning and Supply Chain Management: Functions, Business Processes and Software for Manufacturing Companies*. New York: Springer. doi:10.1007/978-3-642-31573-2
- Lee, Y. W., Pipino, L. L., Funk, J. D., & Wang, R. Y. (2009). *Journey to data quality*. The MIT Press.
- Li, M., & Richard Ye, L. (1999). Information technology and firm performance: Linking with environmental, strategic and managerial contexts. *Information & Management*, 35(1), 43–51. doi:10.1016/S0378-7206(98)00075-5
- Loshin, D. (2001). *Enterprise knowledge management: The data quality approach*. London: Morgan Kaufmann.

Information Quality in Supply Chain Software

Loshin, D. (2010a). *Master data management*. London: Morgan Kaufmann.

Loshin, D. (2010b). *The practitioner's guide to data quality improvement*. Amsterdam: Elsevier.

McGilvray, D. (2010). *Executing data quality projects: ten steps to quality data and trusted information™*. London: Morgan Kaufmann.

McIntire, M. J. (2014). *Supply Chain Visibility: From Theory to Practice*. New York: Gower Publishing, Ltd.

Neef, D. (2001). *E-procurement: From strategy to implementation*. London: FT press.

Otto, B. (2013). On the Evolution of Data Governance in Firms: The Case of Johnson & Johnson Consumer Products North America. In *Handbook of Data Quality* (pp. 93–118). Berlin, Heidelberg: Springer. doi:10.1007/978-3-642-36257-6_5

Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise agility and the enabling role of information technology. *European Journal of Information Systems*, 15(2), 120–131. doi:10.1057/palgrave.ejis.3000600

Pereira, J. V. (2009). The new supply chain's frontier: Information management. *International Journal of Information Management*, 29(5), 372–379. doi:10.1016/j.ijinfomgt.2009.02.001

Puschmann, T., & Alt, R. (2005). Successful use of e-procurement in supply chains. *Supply Chain Management: An International Journal*, 10(2), 122–133. doi:10.1108/13598540510589197

Redman, T. C. (2013). Data Quality Management Past, Present, and Future: Towards a Management System for Data. In *Handbook of Data Quality* (pp. 15–40). Berlin, Heidelberg: Springer.

Sadiq, S. (Ed.), (2013). *Handbook of Data Quality*. New York: Springer. doi:10.1007/978-3-642-36257-6

Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options. *Management Information Systems Quarterly*, 27(2), 237–263.

Sarac, A., Absi, N., & Dauzère-Pérès, S. (2010). A literature review on the impact of RFID technologies on supply chain management. *International Journal of Production Economics*, 128(1), 77–95. doi:10.1016/j.ijpe.2010.07.039

Scharl, A., Kuljis, J., Thomas, P. J., & Paul, R. J. (2000). *Evolutionary web development*. New York: Springer-Verlag, Inc. doi:10.1007/978-1-4471-0517-6

Schmid, B. F., & Lindemann, M. A. (1998, January). Elements of a reference model for electronic markets. In *System Sciences, Proceedings of the Thirty-First Hawaii International Conference* (Vol. 4, pp. 193–201). IEEE. doi:10.1109/HICSS.1998.655275

Sebastian-Coleman, L. (2012). *Measuring Data Quality for Ongoing Improvement: A Data Quality Assessment Framework*. New York: Newnes.

Simchi-Levi, D. (2005). *Designing and managing the supply chain*. New York: McGraw-Hill College.

Skjøtt-Larsen, T., Kotzab, H., & Grieger, M. (2003). Electronic marketplaces and supply chain relationships. *Industrial Marketing Management*, 32(3), 199–210. doi:10.1016/S0019-8501(02)00263-8

Information Quality in Supply Chain Software

- Slone, R. E. (2004). Leading a supply chain turnaround. *Harvard Business Review*, 82(10), 114–121. PMID:15559580
- Stadler, H., & Kilger, C. (2002). Supply Chain Management and Advanced Planning: Concepts. *Models, Software and Case Studies*. Berlin.
- Stephens, S. (2001). Supply chain council & supply chain operations reference (SCOR) model overview. *Supply chain council*, 303.
- Talbur, J. R. (2011). *Entity resolution and information quality*. Amsterdam: Elsevier.
- Wang, R. Y., Storey, V. C., & Firth, C. P. (1995). A framework for analysis of data quality research. *Knowledge and Data Engineering. IEEE Transactions*, 7(4), 623–640.
- Watson, R. T., Akselsen, S., & Pitt, L. F. (1998). Attractors: Building mountains in the flat landscape of the World Wide Web. *California Management Review*, 40(2), 36–56. doi:10.2307/41165932
- Whipple, J. M., & Frankel, R. (2000). Strategic alliance success factors. *Journal of Supply Chain Management*, 36(3), 21–28. doi:10.1111/j.1745-493X.2000.tb00248.x
- White, A. E. D. M., Daniel, E. M., & Mohdzain, M. (2005). The role of emergent information technologies and systems in enabling supply chain agility. *International Journal of Information Management*, 25(5), 396–410. doi:10.1016/j.ijinfomgt.2005.06.009
- Wu, F., Zsidisin, G., & Ross, A. (2007). Antecedents and outcomes of e-procurement adoption: An integrative model. *Engineering Management. IEEE Transactions*, 54(3), 576–587.

Chapter 7

Value Creation and Appropriation in Buyer– Supplier Relationships: Governance, Competition and Cultures

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ABSTRACT

The productive relationship between buyer and supplier is often subject to opportunistic behaviors of the supplier. When selecting a supplier, firms have to balance between benefits of production efficiency and costs of transactional integrity. To minimize the supplier's opportunism, firms devise formal and informal governance mechanisms that match with characteristics of the relationship at the firm level, sourcing strategy of the buyer, at the industry level, competition among suppliers, and at the country level, national culture where the supplier's operations are located. While concurrently employing both formal and informal governance mechanisms may be more effective in suppressing the supplier's opportunism, it may be too costly in the design and implementation. The best strategy for the buyers is to adopt the governance mechanism that matches with characteristics of the relationship at different levels.

INTRODUCTION

The productive relationship between buyer and supplier in terms of contract manufacturing or outsourcing has become a prevalent business model that potentially offers substantial benefits to organizations. However, such relationship is often subject to self-serving behaviors of the supplier to the detriment of the buyer. When selecting a supplier, firms must determine how much value will be created from that supplier, and how that value will be divided between the firm and the supplier (Obloj & Zemsky, 2015). Firms may not achieve competitive advantage based solely on production efficiency of their supplier. They have to evaluate, among other attributes, the integrity of their supplier. Firms may use supplier integrity, a costly contractual hazard as a criterion in selecting their suppliers or relocating their sourcing

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activities accordingly. The tradeoff between benefits of production efficiency and costs of contracting is therefore critical in determining performance of the productive relationship (Poppo & Zenger, 2002).

Supplier opportunism including self-serving behaviors is typically a critical element in determining overall costs of contracting (Heide, Kumar, & Wathne, 2014). To influence ongoing decisions of the supplier in such a way that minimizes its potential opportunism, firms often rely on specific formal and informal governance mechanisms. The formal mechanisms include monitoring, while the informal ones include relational norms (Gulati & Singh, 1998). The buyer's ability to monitor and suppress opportunism is however contingent on characteristics of the exchange including sourcing strategies (Heide et al., 2014). In the context of contract manufacturing, firms often have to make a choice between in-house production (e.g., 'make' decision) and outsourcing to independent suppliers (e.g., 'buy' decision). In some circumstances, firms rely on concurrent external sourcing and internal manufacturing for the same product (Parmigiani, 2007). These different sourcing strategies will determine the degree to which the buyer is able to suppress the supplier's opportunism via specific governance mechanisms such as monitoring and relational norms.

In addition to such firm-level sourcing strategies, industry-level characteristics of the exchange in terms of supplier competition also determine the extent to which the buyer can suppress the supplier's opportunism. Competition among suppliers reduces their surplus from producing general-purpose products for the buyer. The buyer may, therefore, be in a stronger bargaining position to demand the supplier to invest in relationship-specific assets that produce higher-value customized products without sufficient reciprocal commitment (Jia, 2013; Kang, Mahoney, & Tan, 2009; Kittilaksanawong, 2015). Such relationship-specific investments would lose at least part of their value if the buyer terminates the relationship early. This threat may allow the buyer to discourage the supplier from engaging in any opportunistic activities that reduce performance of the productive relationship.

When the productive relationship is extended across national boundaries, changes in country-level characteristics of the exchange in terms of institutional environment may alter the effectiveness of governance mechanisms in the productive relationship (Williamson, 1991). The governance costs associated with the use of formal and informal governance mechanisms to suppress the supplier's opportunism in purely domestic contexts may be very much different when the productive relationship extends across national boundaries with the complicating influence of national culture (Handley & Angst, 2015; Poppo & Zenger, 2002).

This chapter discusses the challenges in the buyer and supplier relationship and highlights recommendations for scholars to deepen knowledge in this area and for managers to optimize the value in productive relationships with their suppliers. The chapter begins with the balance between production efficiency and costs of contracting. Due to this tradeoff, the chapter then explains the importance of aligning governance mechanisms (e.g., formal and informal mechanisms) with characteristics of the productive relationship (e.g., sourcing strategies, supplier competition, and national cultures) to suppress the supplier's opportunism and to optimize benefits from the exchange. The subsequent sections discuss in a greater depth on the influence of firm-level sourcing strategy, industry-level supplier competition, and country-level national culture on such alignment. The last section provides implications for scholars and managers involving in this important buyer and supplier relationship.

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BALANCE BETWEEN VALUE CREATION AND APPROPRIATION UNDER THREATS OF SUPPLIER OPPORTUNISM

When firms select a contracting partner from among competing suppliers, they generally weigh between production efficiency and integrity of these suppliers. The value in such productive relationship is contingent not only on value creation in terms of production efficiency but also on value appropriation in terms of agency dimensions that shape the design of outsourcing contract and the opportunistic incentives of supplier (Obloj & Zemsky, 2015). Moral hazard associated with the supplier's integrity is critically one of hidden contractual costs to the detriment of the buyer. These hidden costs become more significant when performance of the relationship is difficult to measure. Such costs tend to be more pronounced for firms sourcing from suppliers in emerging markets where agency costs are relatively high (Hoskisson, Eden, Lau, & Wright, 2000). Although access to low-cost and high-quality human capital in these markets promises high value creation, their weak market institutions and particularly ineffective legal enforcement may lead to a substantial moral hazard that largely reduces value appropriation from exchange relationships.

The agency costs between buyer and supplier are likely to increase with the parties enter into incentive gaming (Obloj & Zemsky, 2015). Without threats of such incentive gaming, incentives of the buyer and the supplier are more likely to be aligned, thereby enhancing overall efficiency in the productive relationship. In most contracting situations, however, the buyer and the supplier are likely to move away from the optimal alignment of their incentives in the opposite direction to maximize their respective value appropriation. Under the threats of moral hazard on the supplier side, firms may therefore not contract with the supplier that has a higher propensity and ability to game the incentives despite of their high production efficiency. The propensity and ability of supplier to game the incentives may significantly alter the ex-ante agreements during the ex-post renegotiation.

When threats of the supplier's opportunism associated with incentive gaming are sufficiently high, firms will instead select a supplier with higher transactional integrity but lower production efficiency (Obloj & Zemsky, 2015). A buyer thus has incentives to search for suppliers that invest in reputation for trustworthiness. In many circumstances, firms offer stronger incentives to suppliers with higher transactional integrity regardless of their production efficiency. The rents generated from the productive relationship are thus shared between the buyer and the supplier by added value of the supplier and the supplier's bargaining power toward the buyer (Brandenburger & Stuart, 2007). Such trade-off is typically a result of incomplete contracts that are often subject to supplier opportunism underlying the productive relationship.

ALIGNMENT BETWEEN GOVERNANCE MECHANISMS AND CHARACTERISTICS OF PRODUCTIVE RELATIONSHIP

The balance between value creation and appropriation is essential in the buyer and supplier relationship that is subject to the supplier's opportunism. To achieve this balance, firms must align their governance mechanisms with characteristics of the exchange. This alignment is critical in the establishment and management of inter-firm relationships (Dyer & Singh, 1998). Formal and informal mechanisms (e.g., formal contract and interpersonal relationship) are regarded as two major modes of inter-organizational

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governance. Both mechanisms are argued to be effective in aligning behaviors of the supplier with the interest of the buyer; however, their use has to match with characteristics of the productive relationship (Poppo & Zenger, 2002).

On one hand, properly designed contracts reduce goal misalignment and thus mitigate the risk of self-interest seeking (Landis, Mishra, & Porrello, 2005). The contractual clauses for such purposes include rewards and penalties associated with short-term compensation and long-term business opportunities that are explicitly tied to performance of the supplier. On the other hand, informal mechanisms in terms of cooperative relationships such as open communication, information sharing, and joint problem solving create shared norms and mutual commitment that determine inter-organizational competitive advantage (Dyer & Singh, 1998; Li, Xie, Teo, & Peng, 2010; Poppo & Zenger, 2002; Uzzi, 1997). These practices are governed by a desire for solidarity that aligns the parties' goals through informal social pressures and drives their behaviors according to the shared value system (Heide & John, 1992; Liu, Luo, & Liu, 2009).

However, that cooperative partnerships with shared norms and values are widely believed to be more flexible and cost effective than formal contracts in reducing the risk of opportunism (Dyer & Singh, 1998; Uzzi, 1997). Coupling economic incentives to performance outcomes may signal a weakening relationship among the exchange parties, thereby undermining their intrinsic motivation to cooperate (Kessler & Leider, 2012). Besides, due to bounded rationality of the parties, the risk of residual opportunism associated with the incomplete formal contract can be further addressed through informal relational means (Li et al., 2010). Essentially, cooperative and committed orientation in the relational governance facilitates adaptation of the parties to the formal agreements and subsequent modifications more effectively (Poppo & Zenger, 2002). Formal and informal mechanisms are thus complementary in such a way that the formal mechanisms improve clarity about the roles and responsibilities among the parties that subsequently reduces uncertainty and enhances their coordination and commitment.

SOURCING STRATEGIES

Although buyer and supplier in the productive relationship belong to the same value chain, their objectives and incentives may not necessarily be aligned. Firms must weigh production efficiency and integrity among potential suppliers as discussed earlier. Productive exchanges that are subject to a high risk of opportunism require more costly mechanisms to regulate the parties' behaviors. Firms thus have to devise an appropriate governance mechanism to minimize risks from the supplier's opportunism. Specifically, the governance mechanism (e.g., formal and informal mechanism) needs to be aligned with characteristics of the inter-firm relationship (e.g., sourcing strategies) as discussed earlier.

Shirking and poaching are two major forms of opportunistic behaviors in the productive relationships (Wathne & Heide, 2000). The former is the extent to which the supplier deliberately underperforms or withholds resources when the buyer is unable to detect its actions (Handley & Benton, 2012). The latter refers to the degree to which the supplier is likely to utilize information obtained through the relationship for its own unauthorized benefits (Handley & Benton, 2012). To minimize these behaviors, the buyer employs formal governance mechanisms such as monitoring (Eisenhardt, 1985) and informal governance mechanisms including solidarity norms (Ouchi, 1979). Whereas the former allows the buyer to acquire ongoing information for enforcement, the latter reduces the goal divergence and transactional frictions.

Supplier monitoring is defined as effort by the buyer to verify performance and compliance of the supplier. Such monitoring plays a disciplinary role to reduce information asymmetry between the parties

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and thus mitigate the supplier's opportunism (Eisenhardt, 1985; Ouchi, 1979). The effectiveness of this disciplinary role will be enhanced when the buyer employs a concurrent sourcing strategy (Heide et al., 2014). In a concurrent sourcing arrangement, the buyer possesses internal production options and thus proprietary information that may be used as additional enforcement opportunities. A solidarity norm between the buyer and the supplier is defined as a bilateral collective expectation that the productive relationship itself is valued (Heide & John, 1992). The norm of solidarity between buyer and supplier is thus relational and expected to have distinct effects on the collaborative performance.

In a broader governance mechanism, firms may choose to interact with their supplier under different sourcing strategies including a singular or a concurrent sourcing arrangement (Parmigiani, 2007). A singular sourcing arrangement represents conventional roles of buyer and seller. For a concurrent sourcing arrangement, however, the buyer has an option to source the same product from the external supplier or from the buyer's internal supply source. Therefore, the effects of governance mechanisms in terms of monitoring and solidarity norms on transacting outcomes in terms of supplier opportunism and performance will be shaped by characteristics of the inter-firm relationship in terms of a singular and a concurrent sourcing arrangement (Heide et al., 2014).

Compared with a singular sourcing arrangement, a concurrent sourcing arrangement will better strengthen the effectiveness of monitoring in suppressing the supplier's opportunism, thereby better enhancing supplier performance (Heide et al., 2014). In-house production options offer the buyer direct insights into particular production processes. These insights allow the buyer to more effectively monitor the supplier. While some information about the production may also be available from other external suppliers, experiential knowledge related to the actual production may only be obtained from the in-house experience (Kogut & Zander, 1992). In a singular sourcing arrangement, however, the information available only from other external suppliers may not be complete and sufficiently in-depth (Grant, 1996).

Information available from in-house production also allows the buyer to make more appropriate attributions regarding the supplier's actions (Michael, 2000). Such information enhances the supplier's acceptance of the buyer's legitimate authority, thereby increasing the effectiveness of the monitoring (Anderson, 1988). Information acquired through the monitoring may also facilitate value chain coordination (Dyer & Nobeoka, 2000). Such information in combination with the buyer's insights from its in-house production may go beyond enforcement to assist the supplier in making corrections and improvement in its production processes, thereby improving its performance (Ouchi, 1979). A buyer with internal production of the same product can also penalize the opportunistic supplier by shifting externally sourced order to the buyer's own in-house production.

Solidarity norms between the buyer and the supplier will suppress the supplier's opportunism and thus enhance supplier performance (Heide et al., 2014). Such norms create built-in restraints on self-seeking behaviors, thus mitigate the supplier's opportunism. However, this effect will be stronger in a singular rather than in a concurrent sourcing arrangement. Solidarity norms align goals and foster mutual understanding among the buyer and the supplier (Ouchi, 1979). Such roles are more pronounced in a singular sourcing arrangement because the buyer has limited insights into the supplier's production processes. Meanwhile, solidarity norms are also more effective in a singular sourcing arrangement because these norms supplement the lack of in-house knowledge about the production which exposes the buyer to the supplier's opportunism. However, when the solidarity norms are emphasized, a buyer who establishes internal production options may be perceived by its supplier as a competitor, thereby worsening the motivational effect in the productive relationship (Malhotra & Gino, 2011).

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SUPPLIER COMPETITION AND RELATIONSHIP-SPECIFIC INVESTMENTS

In addition to the alignment of firm-level characteristics of the exchange in terms of sourcing strategies discussed above, the extent to which the buyer can suppress the supplier's opportunism is also determined by the alignment of industry-level characteristics of the exchange in terms of supplier competition. On one hand, competition among suppliers reduces their surplus from producing general-purpose substitutes. To increase the attractiveness of their products, some suppliers invest in relationship-specific assets that are customized to their particular buyer. On the other hand, such investments exacerbate hold-up risks and thus weaken the supplier's bargaining position. Accordingly, whether or not a supplier will invest in such relationship-specific assets will be determined by additional value of the relationship-specific product relative to its general-purpose substitute, fixed investments required to build the specific asset, market value of the general-purpose substitute, bargaining power between suppliers and buyers, and intensity and structure of the competition among suppliers (Jia, 2013).

Relationship-specific investments are an advanced commitment that is irreversible and unsalvageable, and the value of their alternative uses is much lower than that of non-specific investments (Riordan & Williamson, 1985; Williamson, 1983). Without sufficient reciprocal commitment from the buyer, the asset specificity in such investment made by the supplier creates a level of safeguard for the buyer against the supplier's opportunism. This safeguard is the result of the buyer's increased bargaining power in threatening the supplier to discontinue the relationship early and appropriate a large part of the value created from such investments (Williamson, 1983). Because of the industry-level competition among the suppliers, their decision to make such investments without sufficient reciprocal commitment from their buyer however goes beyond the transaction costs rationale (Jia, 2013; Kang et al., 2009; Kittilaksanawong, 2015).

To safeguard returns from relationship-specific investments, suppliers may negotiate with their buyer to devise governance mechanisms that mitigate such threats. However, as buyers want to contain their supplier's opportunism and meanwhile, their supplier faces tradeoffs between relationship-specific and general-purpose investments, the negotiation of governance contracts may not warrant sufficient safeguard for the supplier (Jia, 2013). The nature of interactions between the buyer and the supplier will eventually determine the supplier's investment in relationship-specific assets and the supply of highly customized products for the buyer. For example, if a product commands a large market share, its supplying firms will be encouraged to make such idiosyncratic investments associated with that product, even in the absence of sufficient governance mechanisms or reciprocal commitment to mitigate the hold-up risks (Shervani, Frazier, & Challagalla, 2007). Therefore, industry competition and market power affect the supplier's bargaining power and thus its incentives to invest in relationship-specific assets.

NATIONAL CULTURES

When the productive relationship is extended across national boundaries, the effectiveness of governance mechanisms in suppressing the supplier's opportunism as discussed earlier may not only be determined by the firm-level sourcing strategy and the industry-level competition among suppliers. Changes in the country-level characteristics of the exchange in terms of institutional environment may significantly alter

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the effectiveness of such governance mechanisms (Handley & Angst, 2015; Hofstede, 1985; Poppo & Zenger, 2002; Williamson, 1991). Countries have become more integrated into the global economy and increasingly shared similar work practices and organizational cultures. However, due to deep rooted differences in norms and value systems, organizations in different countries still adopt different practices and form heterogeneous organizational cultures (Ralston, Holt, Terpstra, & Yu, 1997).

National culture, at the lower level of inter-firm relationship, constrains or enhances the effectiveness of formal and informal governance in suppressing the partners' opportunism (Hofstede, 1985; Williamson, 1991). Firms perceive the hazards in their contracting environment but with some degree of error (Sampson, 2004). Some firms may erroneously perceive these two types of governance to be similarly effective across different cultural contexts (Tversky & Kahneman, 1974). These mistakes, therefore, place some firms at a disadvantage under ineffective governance that misaligns with their cultural norms. Individualism and uncertainty avoidance are two critical cultural norms in managerial decision making that largely shape the effectiveness of governance mechanisms in suppressing the supplier's opportunism (Handley & Angst, 2015). The mismatch between governance mechanisms and cultural norms of the supplier is likely to minimize the effectiveness of governance mechanisms in attenuating the supplier's opportunism.

Formal and informal governance are more aligned with cultural norms of the supplier's operations in individualistic and collectivist societies respectively. Suppliers in individualistic societies are more rational, and more responsive to extrinsic economic incentives (Davis, Schoorman, & Donaldson, 1997; Doney, Cannon, & Mullen, 1998). They are more receptive to compensation systems and future opportunities that are contingent on their performance. However, suppliers in collectivist societies are more driven by social factors (Davis et al., 1997), so they are more receptive to long-term relationships, harmony, and cooperation (Doney et al., 1998; Dyer & Singh, 1998). Suppliers in these societies are likely to accept a governance mechanism that emphasizes social or clan control (Eisenhardt, 1985; Li et al., 2010).

Informal governance is better aligned with cultural norms of the supplier's operations in high uncertainty avoidance societies than formal governance (Hofstede, 1985). Suppliers in high uncertainty avoidance cultures feel uncomfortable with uncertainty. They are less receptive to incentive or outcome-based contracts that shift compensation risk to themselves. Although some contractual clauses may reduce uncertainty through the clarification of roles and responsibilities, they are likely to avoid such contingent nature of the formal governance (Handley & Angst, 2015). Suppliers in these societies tend to value stable relationships that nurture bonds for longer-term benefits.

DISCUSSION AND IMPLICATIONS

Firms establish the productive relationship with suppliers that have different levels of production efficiency and transactional integrity. Their competitive advantage derived from such relationships is determined not only by value creation in terms of production efficiency but also by value appropriation in terms of transactional integrity of the supplier in a complementary manner (Obloj & Zemsky, 2015). Therefore, value creation toward the buyer from the supplier's investment in technologies to enhance production efficiency will be more pronounced when the supplier concurrently increases their transactional integrity by making ethical investments to increase value appropriation by the buyer.

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Due to the need for such balance, firms devise different governance mechanisms that align with characteristics of the productive relationship (Handley & Angst, 2015; Heide et al., 2014; Jia, 2013). At the firm level, a concurrent sourcing strategy more effectively suppresses supplier opportunism and enhances supplier performance than a singular sourcing strategy because in-house production provides the buyer in-depth knowledge and options for backward integration (Heide et al., 2014). Such legitimate in-house information strengthens the effectiveness of monitoring mechanisms. However, in a single sourcing strategy, without such information, high level of monitoring may instead increase supplier opportunism and diminish supplier performance.

While the formal governance such as monitoring is often viewed as a means of suppressing opportunism, in a concurrent sourcing arrangement, the buyer's in-house knowledge may further help the supplier improve its production processes (Zajac & Olsen, 1993). Solidarity norms enhance alignment of the parties' goals in a singular sourcing arrangement (Heide et al., 2014). However, this informal governance may not work well together with a concurrent sourcing arrangement because its in-house production options may worsen motivational effect in the productive relationship.

At the industry level, competition among suppliers encourages the supplier to make unilateral relationship-specific investments. These investments determine the extent to which the buyer can suppress the supplier's opportunism via different governance mechanisms (Jia, 2013; Kang et al., 2009; Kittilaksanawong, 2015). Certain governance mechanisms such as long-term contract may increase the supplier's relationship-specific investments. In general, the decision on such investment is determined by additional value created by the relationship-specific product, sunk cost required to create such customized product, outside market value of the substitute products, bargaining skills among market players, as well as intensity and structure of the competition (Jia, 2013). Therefore, in high intensity of market competition, the supplier may still have the incentives to invest in relationship-specific assets even without sufficient reciprocal commitment from the buyer.

When the productive relationship is extended across national boundaries, at the country level, the effectiveness of formal and informal governance in reducing the supplier's opportunism is contingent upon the cultural context of the productive relationship (Handley & Angst, 2015). The formal governance is more effective when the supplier's operations are located in more individualistic and low uncertainty avoidance cultures. Managers should thus adopt formal contracts that emphasize economic and financial incentives. In collectivist and high uncertainty avoidance societies, however, the informal governance is more effective in mitigating the supplier's opportunism. Extensive reliance on contractual governance may instead increase the opportunism. Suppliers in these cultural settings may perceive strong incentive-based contracts as an injustice (Zhou & Xu, 2012). Managers wishing to employ contractual governance thus should also incorporate relational mechanisms.

Suppliers with operations in individualistic cultures are likely to have a greater proclivity toward opportunism. Firms should not extensively rely on relational governance because the trusting nature in this governance is not effective in deterring opportunism in these cultures. Suppliers in collectivist and high uncertainty avoidance cultures are however more receptive to the social and cooperative nature, as well as the certainty derived from the focus on solidarity norm and longer-term commitments. Managers should therefore focus on information sharing, cooperative problem resolution, and open communication in their governance system. The combination of formal and informal governance may be more effective; however, it may be costly for the design and implementation (Das & Teng, 1998). Managers should therefore balance marginal benefits and costs of concurrently using both governance mechanisms. The best strategy for the buyers may be to match the governance mechanism with the cultural context.

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Scholars may further explore the combined effect of sourcing strategy and competition among suppliers on the formal and informal governance mechanism. If these two characteristics of the productive relationship are complementary, their combined effect may strengthen the effectiveness of governance mechanisms in suppressing the supplier's opportunism. If they are substituted, the buyers may be better off choosing one of them to match the type of governance. Similarly, scholars may also investigate the potential complementary and substituted effect of sourcing strategy and national culture. The effectiveness of different sourcing strategy in suppressing the supplier's opportunism may also be subject to cultural norms and differences between the countries that the productive relationship occurs.

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REFERENCES

- Anderson, E. (1988). Transaction costs as determinants of opportunism in integrated and independent sales forces. *Journal of Economic Behavior & Organization*, 9(3), 247–267. doi:10.1016/0167-2681(88)90036-4
- Brandenburger, A., & Stuart, H. (2007). Biform games. *Management Science*, 53(4), 537–549. doi:10.1287/mnsc.1060.0591
- Das, T. K., & Teng, B. S. (1998). Between trust and control: Developing confidence in partner cooperation alliances. *Academy of Management Review*, 23(3), 491–512.
- Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20–47.
- Doney, P. M., Cannon, J. P., & Mullen, M. R. (1998). Understanding the influence of national culture on the development of trust. *Academy of Management Review*, 23(4), 601–620.
- Dyer, J., & Singh, H. (1998). The Relational View: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal*, 21(3), 345–367. doi:10.1002/(SICI)1097-0266(200003)21:3<345::AID-SMJ96>3.0.CO;2-N
- Eisenhardt, K. M. (1985). Control: Organizational and economic approaches. *Management Science*, 31(2), 134–149. doi:10.1287/mnsc.31.2.134
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122. doi:10.1002/smj.4250171110
- Gulati, R., & Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, 43(4), 781–814. doi:10.2307/2393616

Value Creation and Appropriation in Buyer-Supplier Relationships

- Handley, S. M., & Angst, C. M. (2015). The impact of culture on the relationship between governance and opportunism in outsourcing relationships. *Strategic Management Journal*, 36(9), 1412-1434. doi:10.1002/smj.2300
- Handley, S. M., & Benton, W. C. Jr. (2012). The influence of exchange hazards and power on opportunism in outsourcing relationships. *Journal of Operations Management*, 30(1-2), 55-68. doi:10.1016/j.jom.2011.06.001
- Heide, J. B., & John, G. (1992). Do norms matter in marketing relationships? *Journal of Marketing*, 56(2), 32-44. doi:10.2307/1252040
- Heide, J. B., Kumar, A., & Wathne, K. H. (2014). Concurrent sourcing, governance mechanisms, and performance outcomes in industrial value chains. *Strategic Management Journal*, 35(8), 1164-1185. doi:10.1002/smj.2145
- Hofstede, G. (1985). The Interaction between national and organizational value systems. *Journal of Management Studies*, 22(4), 347-357. doi:10.1111/j.1467-6486.1985.tb00001.x
- Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in emerging economies. *Academy of Management Journal*, 43(3), 249-267. doi:10.2307/1556394
- Jia, N. (2013). Competition, governance, and relationship-specific investments: Theory and implications for strategy. *Strategic Management Journal*, 34(13), 1551-1567. doi:10.1002/smj.2077
- Kang, M. P., Mahoney, J. T., & Tan, D. (2009). Why firms make unilateral investments specific to other firms: The case of OEM suppliers. *Strategic Management Journal*, 30(2), 117-135. doi:10.1002/smj.730
- Kessler, J. B., & Leider, S. (2012). Norms and contracting. *Management Science*, 58(1), 62-77. doi:10.1287/mnsc.1110.1341
- Kittilaksanawong, W. (2015). How do emerging economy firms learn to evolve from contract manufacturing to own brand management? In A. A. Camillo (Ed.), *Global Enterprise Management: A New Perspective on Challenges and Future Development* (pp. 1-18). New York: Palgrave MacMillan. doi:10.1057/9781137510709.0003
- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383-397. doi:10.1287/orsc.3.3.383
- Landis, K. M., Mishra, S., & Porrello, K. (2005). *Calling a Change in the Outsourcing Market: The Realities for the World's Largest Organizations*. New York: Deloitte Consulting.
- Li, Y., Xie, E., Teo, H. H., & Peng, M. W. (2010). Formal control and social control in domestic and international buyer-supplier relationships. *Journal of Operations Management*, 28(4), 333-344. doi:10.1016/j.jom.2009.11.008
- Liu, Y., Luo, Y., & Liu, T. (2009). Governing buyer-supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management*, 27(4), 294-309. doi:10.1016/j.jom.2008.09.004

Value Creation and Appropriation in Buyer-Supplier Relationships

- Malhotra, D., & Gino, F. (2011). The pursuit of power corrupts: How investing in outside options motivates opportunism in relationships. *Administrative Science Quarterly*, 56(4), 559–592. doi:10.1177/0001839212441350
- Michael, S. C. (2000). Investments to create bargaining power: The case of franchising. *Strategic Management Journal*, 21(4), 497–514. doi:10.1002/(SICI)1097-0266(200004)21:4<497::AID-SMJ87>3.0.CO;2-#
- Obloj, T., & Zemsky, P. (2015). Value creation and value capture under moral hazard: Exploring the micro-foundations of buyer-supplier relationships. *Strategic Management Journal*, 36(8), 1146–1163. doi: 10.1002/smj.2271
- Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833–848. doi:10.1287/mnsc.25.9.833
- Parmigiani, A. (2007). Why do firms both make and buy? An investigation of concurrent sourcing. *Strategic Management Journal*, 28(3), 285–311. doi:10.1002/smj.580
- Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8), 707–725. doi:10.1002/smj.249
- Ralston, D. A., Holt, D. H., Terpstra, R. H., & Kai-cheng, Y. (1997). The impact of national culture and economic ideology on managerial work values: A study of the United States, Russia, Japan, and China. *Journal of International Business Studies*, 28(1), 177–207. doi:10.1057/palgrave.jibs.8490097
- Riordan, M. H., & Williamson, O. E. (1985). Asset specificity and economic organization. *International Journal of Industrial Organization*, 3(4), 365–378. doi:10.1016/0167-7187(85)90030-X
- Sampson, R. C. (2004). The cost of misaligned governance in R&D alliances. *Journal of Law Economics and Organization*, 20(2), 484–526. doi:10.1093/jleo/ewh043
- Shervani, T. A., Frazier, G., & Challagalla, G. (2007). The moderating influence of firm market power on the transaction cost economics model: An empirical test in a forward channel integration context. *Strategic Management Journal*, 28(6), 635–652. doi:10.1002/smj.585
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124–1131. doi:10.1126/science.185.4157.1124 PMID:17835457
- Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 42(1), 35–67. doi:10.2307/2393808
- Wathne, K. H., & Heide, J. B. (2000). Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions. *Journal of Marketing*, 64(4), 36–51. doi:10.1509/jmkg.64.4.36.18070
- Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review*, 73(4), 519–540.
- Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly*, 36(2), 269–296. doi:10.2307/2393356

Value Creation and Appropriation in Buyer-Supplier Relationships

Zajac, E. J., & Olsen, C. P. (1993). From transaction costs to transactional value analysis: Implications for the study of interorganizational strategies. *Journal of Management Studies*, 30(1), 131–145. doi:10.1111/j.1467-6486.1993.tb00298.x

Zhou, K. Z., & Xu, D. (2012). How foreign firms curtail local supplier opportunism in China? Detailed contracts, centralized control, and relational governance. *Journal of International Business Studies*, 43(7), 677–692. doi:10.1057/jibs.2012.7

Chapter 8

Review of RFID Applications in Perishable Inventory Management

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ABSTRACT

Radio frequency identification (RFID) technology, which enables real time data collection, has been proposed as a promising solution in perishable inventory management. Research shows that RFID technology has many benefits for perishable products; therefore, this chapter presents an overview of RFID technology and its applications to perishable inventory management. The findings provide a comprehensive review and support the managers in evaluating an investment decision to implement RFID and employ RFID in inventory management for perishable products.

INTRODUCTION

Perishable product inventory management has been an attractive research area and has received attention for many decades (Bakker, Riezebos, & Teunter, 2012). Managing inventory for perishable and non-perishable products is different because the perishable products depreciate the value over time. That depreciation reduces the benefits to the society (e.g., less revenue, more wastage, and less product quality). For example, the temperature in a warehouse can reduce the quality of coffee thus decreasing the value of that coffee. Consequently, the consumers do not have the best coffee quality, and manufacturers do not earn the expected revenue.

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Moreover, companies usually provide product categories (e.g., product size and flavour) to meet variant demands. The high numbers of categories increase the difficulty of inventory management such as the difficulty in controlling quality for each unit of product or checking the number of products in the warehouse. Expired product is an additional problem in managing inventory. A report conducted for the international congress “Save Food!” states that in industrialised countries, more than 40% of food is lost at retailers and consumers (Gustavsson, Cederberg, Sonesson, Van Otterdijk, & Meybeck, 2011). Considering these difficulties, Pahl and Voß (2014) suggested that the development of technology helps to collect information and improve inventory management for perishable products (e.g., reduce wastage, improve customer satisfaction, and increase profit margin).

Technology collects information of products in warehouses (e.g., information about quality and age) and helps to solve the challenges in managing inventory for perishable products (Kärkkäinen, 2003). Data relating to products in warehouses provides information about quality status, and then the managers decide to issue which product first to avoid expiration. Another benefit is the replenishment timing and accuracy that is improved because the quantity of availability product in warehouse is known exactly and quickly.

Radio frequency identification (RFID), which enables automatic real-time data collection, is a promising revolution in supply chain management and inventory management. It is widespread in applications (e.g., retailing, manufacturing) and has received much global attention. Major retailers and manufacturers are testing and implementing RFID in their businesses. Wal-Mart reported that RFID reduces stock-out situation by 21% and reduces manual orders; Metro Group saves labour cost and time by using RFID (Leung, Cheung, & Chu, 2014). Research states that RFID keeps perishable products fresh through better management (Roberti, 2005). RFID can combine and transfer more product data (e.g., data of temperature, humidity). RFID readers can also distinguish between several tags without human intervention (Kumar, Reinitz, Simunovic, Sandeep, & Franzon, 2009). In summary, RFID technology brings benefits to the whole supply chain and retail sector in particular (Hingley, Taylor, & Ellis, 2007).

This chapter presents an overview of RFID technology and its applications to perishable inventory management. The findings provide a comprehensive review of the application of RFID technology to perishable inventory management and support managers in evaluating RFID implementation. The results support the managers in making RFID investment decisions and using RFID technology in inventory management systems. With those objectives, the chapter is organised as follows. The first section introduces RFID technology such as RFID readers, tags, and antennas. The second section reviews the application of RFID to perishable inventory management based on three main classifications: time-temperature information, products' quality, and inventory accuracy. The third section reviews the challenges and the evaluation of RFID investment. The final section concludes and presents the results of this chapter.

BACKGROUND

Traditionally, many companies use barcode in automated and standardised system in warehouses. A barcode is optical machine-readable data about an object or a product (Sriram, Rao, Biswas, & Ahmed, 1996), and originally barcodes represented data by the width and spacing of parallel lines. Barcode scanning reduces manual errors in handling data and supports managing inventory; particularly, it helps to

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reduce the quantity of expired perishable products. However, there are some problems in using barcode. Scanning in barcode requires manual handling of the reader or the object. This makes the scanning is challenging, especially in warehouses where the facility design is not efficient for a large number of products.

Moreover, barcodes require line-of-sight between the reader and the object, which is a problem in dirty environments, reducing the accuracy and speed of scanning as objects must be moved or sorted to allow the barcode to be moved into a visible position (Kärkkäinen, 2003). Therefore, other technology can also support inventory management. RFID has emerged as an alternative technology to support inventory management. The principles of RFID are transferring and receiving data amongst objects at a distance without requiring line-of-sight.

The major components for RFID are tags and readers. A tag, which is attached to an object to identify and track the object, has substrate material with a microchip (stores data) and an antenna (transfers and receives data). Researchers classify a tag as an active tag (requires a battery to power microchip), or a passive tag (does not require power source), or a semi-active tag (uses battery for a cycle run of the microchip). Tags can be classified as read-only, write-once read-many, electronically erasable programmable read-only memory, and read-write tag.

A reader has an antenna to radiate and receive signals from tags. Performance is evaluated based on the range and the rate that a reader can identify, read, or write to a tag. An overview of the components and working principles of RFID is provided by Kumar et al. (2009). This chapter considers the problem of applying RFID to manage inventory for perishable products, where the products have limited lifetime (e.g., dairy, or healthcare products) and the products' quality decreases undetectably. These products are important for daily lives and need to supply to the consumer at the right time (e.g., the patient has to transfuse blood when needed). Additionally, the perishable products are easily spoilage because of the short lifetime characteristic. Therefore, a good perishable inventory management should not only supply right product at the right time, but also reduces the wastage.

RFID technology has emerged as a promising solution which help to manage the inventory and reduce the wastage (Lee & Özer, 2007). Advantages include the ability to capture and use real-time data (e.g., sales or products' quality information) which support the application of RFID to manage perishable inventory. Companies are now testing and implementing RFID in their warehouses or distribution management (e.g., Unilever uses RFID in warehousing and Tesco uses RFID in retailing). The next section reviews the applications of RFID to inventory management perishable products.

APPLICATION TO PERISHABLE INVENTORY MANAGEMENT

Perishable products with short life time have few factors (e.g., large volume, wide range, limited safety stock, strict traceability requirement, high wastage cost, cost efficiency, stock out situation, and targeted and accurate information) that create complexities for inventory management (Vecchi & Brennan, 2009). Vecchi and Brennan (2009) summarised the opportunities that RFID technology can address these complexities of each factor. The applications of RFID to perishable inventory management include key applications for time-temperature monitoring, products' quality management, and inventory accuracy. RFID tags help to manage and use the time-temperature information, a characteristic that has great impact on the freshness of perishable products, during inventory management.

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Numerous technologies, including RFID tags, can track, record, and transfer the time and temperature of products are on the market for years (Jedermann, Emond, & Lang, 2008). While the RFID tags help to predict the products' lifetime (Kumar et al., 2009), the more important question is how this information should be used in perishable inventory management. Ketzenberg, Bloemhof, and Gaukler (2015) find that the time-temperature information can determine the products' lifetime through the supply chain. With this information, the retailer knows when the inventory perishes and avoids the product expiration. The results show that a retailer can reduce 43.2% in average cost per period with the information, which is a significant benefit of using time-temperature information. RFID also supports use of new technology (i.e., Time Temperature Integrator) which monitors the storage conditions (Sahin, Babai, Dallery, & Vaillant, 2007).

The time-temperature information also increases the efficiency of using price differentiation or dynamic pricing strategy, which assigns different prices to the items based on the item's status (e.g., quality, remaining lifetime). Liu, Tang, and Huang (2008) considered using real-time product quality data to set price and ordering quantity to maximise supermarket profits. When both price and demand depend on the remaining lifetime of products, using time-temperature information increases the retailer's profit (Herbon, Levner, & Cheng, 2014). Those results confirm that using time-temperature information can aid reduction of wastage and increase profits.

RFID tags help to ensure the consumers are buying the safe products. The need to have safe perishable products (e.g., food or healthcare) is important as these types of products are necessary for daily lives. The researchers take the advantages of RFID technology to supply safe products to consumers. In case of food issues, RFID tags help to identify origin and destination of products, specify products' location, and provide immediate information (Jones, Clarke-Hill, Hillier, & Comfort, 2005). By integrating RFID tags, the system can detect quality issues, then a retailer can proactively alter the distribution plan to minimise the cost and provide safe products to consumers (Shi, Zhang, & Qu, 2010).

Finally, RFID tags help to improve the inventory accuracy of perishable products. The inventory inaccuracy (e.g., products are lost, forbidden, or misplaced on wrong shelf) creates stock-out situation, reduces the customer satisfaction level, and increase inventory cost. The retailers can use the RFID tags to track the products' movement, locate the products, and therefore improves the inventory accuracy. Rekik, Sahin, and Dallery (2008) proved that taking the information of inventory accuracy into account when optimise the replenishment policy leads to important savings. While there are benefits for perishable inventory management, the implementation of RFID is still slow. There are many challenges when implementing and running the RFID system; therefore, the core question is whether RFID systems create value for companies. The next section reviews the challenges and evaluation methods for a company when implementing RFID systems.

CHALLENGES AND EVALUATION METHOD IN THE IMPLEMENTATION OF RFID SYSTEMS

Challenges for RFID implementation include technical issues, lack of standards, and the cost of implementing and running systems (Michael & McCathie, 2005). Technical issues exist as one of the main challenges in implementing and running RFID. Kumar et al. (2009) summarised three major technical

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issues of RFID systems: the difficulty to read tags near a human body because of the interference from water content, the read range is short (i.e., the operating range for high frequency system is from 3 to 4 meters), and the read accuracy (i.e., the tag need to be perpendicular to the antenna of the reader). Kumar et al. (2009) also mentioned the lack of common standards because every company defines the frequency individually and the high costs of tags as the other two challenges for implementing and running RFID systems. Vecchi and Brennan (2009) listed major cost challenges in RFID deployment: investment for needed infrastructure, integration, and training.

Despite these many challenges, RFID is still a promising revolution in supply chain management. It improves the efficiency of logistics and supply chain management by providing opportunities to reduce stock out situation, improves inventory accuracy, and increases customer service level (Lee & Park, 2008). Therefore, companies need to evaluate the implementation carefully to ensure the benefits of RFID systems. The evaluation occurs before and even after investment to ensure that RFID technology is fully utilised. Baars, Gille, and Strüker (2009) suggested a three-step process of evaluation: benefit identification (i.e., identification schema includes automation, information, transformation, and specification), benefit forecast (i.e., select and approximate the relevant indicators to the benefit types), and benefit assessment (i.e., translate forecast value to monetary terms to select).

Lee and Lee (2010) presented a supply chain RFID investment evaluation model as a basis to maximise the value of RFID technology and define the optimal investment level for a company. Those evaluation models help managers to develop RFID implementation plans, determine the scope of implementation, allocate resource, and scrutinise the success of implementation.

CONCLUSION

RFID technology has emerged as a promising technology to improve inventory management for perishable products that saves the wastage and improves the inventory accuracy and operating benefits. This chapter first provided the concise overview of RFID technology and then it reviewed the applications and challenges of implementing RFID technology on perishable inventory management. This chapter also extended and filled the gap in the extant literature mentioned in the summary paper of Vecchi and Brennan (2009) by incorporating the evaluation methods for implementing RFID technology. Despite the challenges on technical, standards, and cost, RFID technology has been applied to perishable inventory management to control the time-temperature information, ensure the food quality, and improve the inventory accuracy. The results show that RFID technology helps to reduce wastage, stock outs, and operating profits.

Managers can apply the evaluation model developed by Lee and Lee (2010) to make RFID investment decisions. Lee and Lee (2010)'s model considers three supply chain investment factors – ordering efficiency, just-in-time efficiency, and operating efficiency – and derives optimal RFID investment levels for each factor. The model provides insights into RFID investment decisions; it states that the demand level and inventory cost structure differentiates the RFID investment opportunities for each company. This chapter lays out the inventory management for perishable products and can be extended in several directions such as studying detailed evaluation methods of implementing RFID to provide guidelines for manager when implementing RFID systems.

Review of RFID Applications in Perishable Inventory Management**REFERENCES**

- Baars, H., Gille, D., & Strüker, J. (2009). Evaluation of RFID applications for logistics: A framework for identifying, forecasting and assessing benefits. *European Journal of Information Systems*, 18(6), 578–591. doi:10.1057/ejis.2009.32
- Bakker, M., Riezebos, J., & Teunter, R. H. (2012). Review of inventory systems with deterioration since 2001. *European Journal of Operational Research*, 221(2), 275–284. doi:10.1016/j.ejor.2012.03.004
- Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: Extent, causes and prevention*. Retrieved from www.fao.org/docrep/014/mb060e/mb060e.pdf
- Herbon, A., Levner, E., & Cheng, T. C. E. (2014). Perishable inventory management with dynamic pricing using time-temperature indicators linked to automatic detecting devices. *International Journal of Production Economics*, 147(1), 605–613. doi:10.1016/j.ijpe.2013.07.021
- Hingley, M., Taylor, S., & Ellis, C. (2007). Radio frequency identification tagging. *International Journal of Retail & Distribution Management*, 35(10), 803–820. doi:10.1108/09590550710820685
- Jedermann, R., Emond, J.-P., & Lang, W. (2008). Shelf life prediction by intelligent RFID – Technical limits of model accuracy. In H.-J. Kreowski, B. Scholz-Reiter, & H.-D. Haasis (Eds.), *Dynamics in Logistics* (pp. 231–238). Berlin: Springer. doi:10.1007/978-3-540-76862-3_22
- Jones, P., Hillier, D., & Comfort, D. (2005). The benefits, challenges and impacts of radio frequency identification technology (RFID) for retailers in the UK. *Marketing Intelligence & Planning*, 23(4), 395–402. doi:10.1108/02634500510603492
- Kärkkäinen, M. (2003). Increasing efficiency in the supply chain for short shelf life goods using RFID tagging. *International Journal of Retail & Distribution Management*, 31(10), 529–536. doi:10.1108/09590550310497058
- Ketzenberg, M., Bloemhof, J., & Gaukler, G. (2015). Managing perishables with time and temperature history. *Production and Operations Management*, 24(1), 54–70. doi:10.1111/poms.12209
- Kumar, P., Reinitz, H. W., Simunovic, J., Sandeep, K. P., & Franzon, P. D. (2009). Overview of RFID technology and its applications in the food industry. *Journal of Food Science*, 74(8), 101–106. doi:10.1111/j.1750-3841.2009.01323.x PMID:19799677
- Lee, D., & Park, J. (2008). RFID-based traceability in the supply chain. *Industrial Management & Data Systems*, 108(6), 713–725. doi:10.1108/02635570810883978
- Lee, H., & Özer, Ö. (2007). Unlocking the value of RFID. *Production and Operations Management*, 16(1), 40–64. doi:10.1111/j.1937-5956.2007.tb00165.x
- Lee, I., & Lee, B.-C. (2010). An investment evaluation of supply chain RFID technologies: A normative modeling approach. *International Journal of Production Economics*, 125(2), 313–323. doi:10.1016/j.ijpe.2010.02.006

Review of RFID Applications in Perishable Inventory Management

- Leung, J., Cheung, W., & Chu, S.-C. (2014). Aligning RFID applications with supply chain strategies. *Information & Management*, 51(2), 260–269. doi:10.1016/j.im.2013.11.010
- Liu, X., Tang, O., & Huang, P. (2008). Dynamic pricing and ordering decision for the perishable food of the supermarket using RFID technology. *Asia Pacific Journal of Marketing and Logistics*, 20(1), 7–22. doi:10.1108/13555850810844841
- Michael, K., & McCathie, L. (2005). *The pros and cons of RFID in supply chain management*. Paper presented at the International Conference on Mobile Business. doi:10.1109/ICMB.2005.103
- Pahl, J., & Voß, S. (2014). Integrating deterioration and lifetime constraints in production and supply chain planning: A survey. *European Journal of Operational Research*, 238(3), 654–674. doi:10.1016/j.ejor.2014.01.060
- Rekik, Y., Sahin, E., & Dallery, Y. (2008). Analysis of the impact of the RFID technology on reducing product misplacement errors at retail stores. *International Journal of Production Economics*, 112(1), 264–278. doi:10.1016/j.ijpe.2006.08.024
- Roberti, M. (2005). RFID will help keep perishables fresh. Retrieved from RFID Journal website: <http://www.rfidjournal.com/articles/view?1775>
- Sahin, E., Zied Babai, M., Dallery, Y., & Vaillant, R. (2007). Ensuring supply chain safety through time temperature integrators. *The International Journal of Logistics Management*, 18(1), 102–124. doi:10.1108/09574090710748199
- Shi, J., Zhang, J., & Qu, X. (2010). Optimizing distribution strategy for perishable foods using RFID and sensor technologies. *Journal of Business and Industrial Marketing*, 25(8), 596–606. doi:10.1108/08858621011088338
- Sriram, T., Rao, K. V., Biswas, S., & Ahmed, B. (1996). *Applications of barcode technology in automated storage and retrieval systems*. Paper presented at the Proceedings of the 1996 IEEE IECON 22nd International Conference on Industrial Electronics, Control, and Instrumentation. doi:10.1109/IECON.1996.571035
- Vecchi, A., & Brennan, L. (2009). Supply chain innovation for short-life products: A preventive assessment of RFID deployment and implementation. *International Journal of Business Innovation and Research*, 3(5), 535–554. doi:10.1504/IJBIR.2009.027176

ADDITIONAL READING

- Fan, T., Tao, F., Deng, S., & Li, S. (2015). Impact of RFID technology on supply chain decisions with inventory inaccuracies. *International Journal of Production Economics*, 159(1), 117–125. doi:10.1016/j.ijpe.2014.10.004
- Fan, T.-J., Chang, X.-Y., Gu, C.-H., Yi, J.-J., & Deng, S. (2014). Benefits of RFID technology for reducing inventory shrinkage. *International Journal of Production Economics*, 147(January), 659–665. doi:10.1016/j.ijpe.2013.05.007

Review of RFID Applications in Perishable Inventory Management

Feng, B., Yao, T., Jiang, B., & Talluri, S. (2014). How to motivate vendor's RFID adoption beyond mandate? A retailer's perspective. *International Journal of Production Research*, 52(7), 2173–2193. doi:10.1080/00207543.2013.860493

Narayana, S. A., Pati, R. K., & Vrat, P. (2014). Managerial research on the pharmaceutical supply chain - A critical review and some insights for future directions. *Journal of Purchasing and Supply Management*, 20(1), 18–40. doi:10.1016/j.pursup.2013.09.001

Thiesse, F., & Buckel, T. (2015). A comparison of RFID-based shelf replenishment policies in retail stores under suboptimal read rates. *International Journal of Production Economics*, 159(1), 126–136. doi:10.1016/j.ijpe.2014.09.002

Yazici, H. J. (2014). An exploratory analysis of hospital perspectives on real time information requirements and perceived benefits of RFID technology for future adoption. *International Journal of Information Management*, 34(5), 603–621. doi:10.1016/j.ijinfomgt.2014.04.010

Yee-Loong Chong, A., Liu, M. J., Luo, J., & Keng-Boon, O. (2015). Predicting RFID adoption in healthcare supply chain from the perspectives of users. *International Journal of Production Economics*, 159(1), 66–75. doi:10.1016/j.ijpe.2014.09.034

KEY TERMS AND DEFINITIONS

Inventory Management: Activities employed to control the stock of products, work-in-process, or materials. Inventory management happens in all nodes of supply chain to transfer materials to finished products and deliver finished products to consumers.

Perishable Product: A product has short life time or one that easily deteriorates. These items include fresh foods, dairy products, and pharmaceuticals. This short lifetime complicates the inventory management as they must be processed and move through the supply chain for sale to customers before they perish and lose either part of their value or their entire value.

Radio Frequency Identification (RFID): A system using radio frequencies to transfer data from tags on items to readers that are connected to other computer systems. This allows automatic identification and tracking products.

Chapter 9

Supply Chain Resilience

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ABSTRACT

The chapter will consist of a literature review that will be framed to address the following three questions. The first question is “What is a resilient supply chain?” The aim is to provide an in-depth understanding of resilience and to distinguish a supply chain which is resilient from one which is not. The second question is “Why companies should build a resilient supply chain?” Some factors have increased firms’ vulnerability and the losses associated with unpredictable events. Companies should understand that the advantages linked to building resilience do not become evident only in case of disastrous events, but also during the ordinary operations execution. The third question is: “How to build resilience?” The most relevant ways to build resilience will be illustrated by drawing on some short case studies that were purposefully chosen in order to present a practical implementation of some of the different techniques used to create resilience. At the end of the chapter, conclusion, managerial implications, limitations and directions for future research will be provided.

INTRODUCTION

Today, companies are much more vulnerable than in the past. Indeed, some factors have significantly heightened the risk to which firms are exposed. Some reasons for the increasing risk are the creation of global and complex supply chains, the widespread use of outsourcing, and the extensive diffusion of the lean manufacturing principles across many companies. Simultaneously, firms must consider the growing expectations of customers who are increasingly unwilling to tolerate delays or increases in prices. Although modern supply networks must contend with significant risks, many companies do not implement sufficient measures to reduce them. It is therefore possible to identify a mismatch between the high risk exposure and the poor measures implemented by many firms. In fact, companies that attempt to prevent the disastrous consequences of high impact-low probability events are very few as the majority of firms only focus on low impact-high probability occurrences (Chopra & Sodhi, 2004).

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The reasons for this lack of attention towards risk reduction practices can be identified in a psychological factor as some companies could be hardly withstand the diffusion of a culture of bad events prevention, which could be judged as a pessimistic and no-motivating attitude. However, the main reason for the inadequate risk reduction measures often lies in the complexity of weighting the economic benefits obtained when supply chain breakdown are prevented (Sheffi, 2005c). Indeed, resilient companies are able to continue their operations even after unpredictable negative events and this continuity allows them to avoid the costs associated with supply chain disruptions. It is difficult to measure the benefits obtained due to cost avoidance and this increases the difficulty in justifying resilience creation (Sheffi, 2005c).

Over the last few decades, the interest in supply chain resilience has increased due to the growing awareness of the huge direct and indirect losses associated with a lack of resilience (Ponis & Koronis, 2012). Events such as natural disasters and terrorist attacks have stressed the importance of building resilience in order to react quickly to unforeseen occurrences (Snyder & Shen, 2007). However, the attention paid to this topic is insufficient and can be considered as an emerging research area that is still relatively recent and yet unexplored (Ponis & Koronis, 2012). Conversely, resilience should be treated as a topic of primary importance and companies should prioritize this goal. The recent experience of the most resilient companies has provided some valuable lessons.

First, a quick reaction during and immediately after a disruptive occurrence is not an adequate response as the majority of consequences depends on what preventive measures the company has implemented prior to the event (Sheffi, 2005c). Therefore, suitable preventive measures aimed at fostering resilience should be planned well in advance when everything is going well and very often nobody wants to think of what could go wrong. Second, another valuable lesson for some firms is that resilience must be developed from the inside, which means delegating risk management to some external experts is not sufficient to protect the business (Sheffi & Rice, 2005). A culture of resilience should be shared among the members of the organization (Sheffi, 2005c). For these reasons, companies that strive to be competitive should focus their efforts on the creation of resilience which should be considered as a prerequisite to survive and prosper in the current troubled markets. Due to the growing importance of resilience, some academics have started to assess this issue in-depth and have started to propose different solutions to build resilience throughout the supply chain. The main pitfall of this stream of literature is that the research area is still highly fragmented and we still lack a comprehensive understanding of the topic. Therefore, there is a valuable opportunity to conduct further research on the existing literature so as to produce a more exhaustive theoretical framework.

To this end, this chapter consists of a literature review that will be framed to address the following three questions: 1) What is a resilient supply chain? The objective of this section is to help the reader to recognize resilience and to distinguish a supply chain that is resilient from one which is not; 2) Why should companies build a resilient supply chain? As previously mentioned, some factors have increased firms' vulnerability and the losses associated with unpredictable events. Companies should understand that the advantages linked to building resilience do not become evident only in case of disastrous events, but also during the ordinary operations execution (Sheffi, 2005c); and 3) How can resilience be built? Contributions from the extant literature aim at addressing this question. The most relevant ways to build resilience will be illustrated by drawing on some short case studies that were purposefully chosen to present a practical implementation of some of the different techniques used to foster resilience. At the end of the chapter, the conclusion, managerial implications, limitations and directions for future research

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will be provided. In particular, the goal of this chapter is to provide a comprehensive overview of the literature on this topic by focusing the attention on high impact-low probability events, such as natural disasters, suppliers' bankruptcy, and terrorist attacks.

WHAT IS A RESILIENT SUPPLY CHAIN?

In materials science, resilience is the physical property of a material which can return to its original shape after a deformation that does not exceed its elastic limit (Rice & Caniato, 2003). Used in supply chain management jargon, the term *resilience* indicates the ability of a company to maintain the continuity of operations (Ponomarov & Holcomb, 2009) or, at least, to restore them quickly when a major disruption occurs. In supply chain jargon, the definition of resilience is implicit in the concept of control since a resilient firm has to be able to manage performance variability (Bukowski & Feliks, 2012) and to maintain the command over its structure during disruptions (Ponomarov & Holcomb, 2009).

Two other key factors characterize the definition of supply chain resilience: agility and adaptability. A resilient network is agile since it is able to respond to sudden short-term changes in demand or supply (Lee, 2004) which can be caused by temporary trends widespread throughout consumers or supply shortages. A resilient supply chain is also adaptable because, after disruptions, it does not always return to its original condition so it can conversely move to a new and more desirable state (Christopher & Peck, 2004). In particular, adaptable networks are able to find a new configuration when significant and durable market changes occur (Lee, 2004), such as a technical standard variation. Broadening the concept of resilience, this property can be considered as a source of competitive advantage. Indeed, resilience building is aimed at acquiring a better positioning relative to competitors in order to transform disruptions into opportunities (Sheffi, 2005a), serving rivals' customers when they are not able to do so.

In common language, *resilient* and *robust* are often used as synonyms, but in the context of supply chain they have different meanings (Christopher & Peck, 2004). *Robust* signifies "strong in constitution, sturdily built", while *resilient* means "capable of regaining its original shape or position after bending, stretching, compression, or other deformation; elastic" (Collins, 2014). By thus employing the two definitions in the context of supply chains and comparing them, it is possible to state that a resilient supply chain is like a robust one with two additional qualities, which are agility and adaptability. These properties make resilient supply networks responsive to significant variations in inputs, feature which does not belong to robust supply chains that can just handle minor changes in resources (Christopher & Rutherford, 2004).

WHY SHOULD COMPANIES BUILD A RESILIENT SUPPLY CHAIN?

Building Resilience to Reduce Modern Supply Chain Vulnerability

The vulnerability of many supply chains has increased in the last few decades. This phenomenon is not only due to some external factors like natural disasters and terrorist attacks, but also due to some changes in the business model of the majority of firms (Christopher & Lee, 2004). Indeed, many companies are

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currently characterized by complex supply chains, an extensive use of outsourcing, and manufacturing operations organized on the basis of lean principles. First, many firms have contributed to the creation of global and integrated supply chains which involve a huge number of actors located throughout the globe (Sheffi, 2005c). This fact increases the risk of disruption because if the probability that a specific event occurs in a particular plant is low, the likelihood that whatever part of a supply chain has to face unexpected circumstances is very high (Sheffi, 2005c).

In particular, the creation of integrated relationships between supply chain members has positive effects because it means that the flow of information and materials is continuous and not fragmentary, but at the same time, integration means that every company of a supply chain is more and more dependent on the other firms and that its performance directly derives from its collaborators work (Yu et al, 2009). Additionally, the majority of firms are less vertically integrated than they were in the past and they rely upon numerous suppliers who are specialized in providing a particular product or service. In this way, large companies have partly lost control of their operations and they have increased their vulnerability to disruptions caused by political, economic and social disorders, which often affect the countries where low cost suppliers are located (Snyder & Shen, 2007).

Finally, a growing number of firms are arranging their operations following lean manufacturing principles which impose stock reduction in order to cut the costs associated with redundancy and waste. When a supply chain is organized following only the basics of high speed and low cost, it often becomes very unable to react to unforeseen events (Lee, 2004), and the final result is an increase in vulnerability as it was evident in the case of Toyota. In fact, the Japanese cars producer had troubles in its Sequoia SUV plant in Indiana because one of its suppliers was waiting for some steering sensors which were blocked in Germany at a time when the air traffic was interrupted (Sheffi, 2005c). This instance shows how precarious the operations continuity of lean firms is due to the lack of sufficient stock. Furthermore, the performance of these companies is heavily influenced by their suppliers' dependability. In conclusion, firms should employ resources to build resilient supply chains in order to counterbalance the intrinsic characteristics of modern networks which make them more vulnerable than in the past.

Building Resilience to Avoid Monetary Losses

Creating resilience is fundamental to avoid the highly significant costs caused by disruptions when precautionary measures have not been taken. Hendricks and Singhal (2003), examining a sample of 519 announcements of disruptions made publicly by companies, found that after adjusting for ordinary market movement, stock value drops of about 10% during the day of the declaration and the day after. Analyzing a sample of 827 disruptions announcements, the two authors assessed in 2005 that the equity risk grows at 13.50% during the year of the declaration with respect to the previous year. Moreover, the average abnormal stock returns decreases of 40%, considering a period that starts the year before the announcement and ends the year after (Hendricks & Singhal, 2005).

The losses caused by disruptions can be appreciated also comparing resilient firms with unprepared ones. In 2000, a plant of Philips NV, a communal chip supplier of Ericsson and Nokia, caught fire in New Mexico. The two Scandinavian companies had very different reactions. Nokia started monitoring day-by-day the supplier. When the Finnish firm understood that there would have been several weeks of delay in deliveries, it asked other suppliers to provide some chips and made an arrangement with Philips NV for the chips which were produced just by it. Philips promised that Nokia's chips would have been manufactured in other plants. Conversely, Ericsson, after having received the news of the fire, simply

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decided to wait for Philips NV components. When the Swedish company realized the seriousness of the problem it was too late: the majority of chip suppliers were too busy in serving Nokia to satisfy Ericsson. Because of the shortage in components, Ericsson was unable to launch a new generation of mobile phone. At the end of the first quarter when the disruption occurred, Ericsson suffered a loss of between \$430 and \$570 million USD, and at the end of 2000 Ericsson communicated that the mobile phone division caused a loss of \$2.34 billion USD (Sheffi, 2005c). Six months after the fire Ericsson's market share fell by 3%, while Nokia's increased by the same percentage points (Sheffi, 2005c).

Disruptions can have severe consequences especially in the ecommerce context, where products and services have to be available 24 hours a day. For Amazon, it was appraised that one minute of downtime cost \$31,000 USD in 2008 and \$66,240 USD in 2013 (Clay, 2013). It is evident that disruptive occurrences cause remarkably significant direct and indirect costs to companies that are unprepared to react to unexpected circumstances. Firms which begin a decision making process regarding resilience creation should carefully consider the costs caused by disruptions and the benefits associated with the prevention of these events. However, the wide variety of possible disruptive occurrences and the complexity of calculating the advantages of their prevention, in terms of cost avoidance (Sheffi, 2005c), make costs and benefits very hard to be assessed in advance. Managers should try to do their best in order to evaluate, in the most complete way, the series of costs and benefits linked to resilience.

HOW TO BUILD A RESILIENT SUPPLY CHAIN?

After a thorough illustration of the properties that distinguish a resilient supply chain from the others and having stressed the importance of building resilience, describing why modern supply chains really need it and the severe consequences associated with a lack of resilience, it is natural to ask in what manner a company could and should contribute to the creation of a resilient supply chain. Hereafter, the most used methods to create resilience will be presented and compared.

Building Resilience through Redundancy

In the extant literature, the two most well-known methods for resilience building are redundancy and flexibility. The former is certainly a strategy that many firms have implemented, especially in the past, to prevent production breakdown. Indeed, in many companies redundancy has arisen spontaneously, not as part of an organized resilience building plan, but just as the simplest way to smoothly manage manufacturing operations and to satisfy customer's fulfillment. The main strategies to create redundancy are safety stock, excess capacity, and multi-sourcing (Sheffi & Rice, 2005).

Almost every company has safety stock and a low level of redundancy can be considered to be normal while a high level is considered to be too expensive by many firms (Sheffi, 2005c). Moreover, excessive stock can lead to a wrong attitude in problem solving. Indeed, in companies where there is a significant level of inventory, every time a product presents a defect managers can simply take another one from the warehouse (Sheffi, 2005c). In lean companies where safety stock is reduced to the minimum, a faulty product forces managers to investigate the causes of the problem and find an ultimate solution (Sheffi, 2005c). A low rate of capacity utilization is not tolerated by the majority of firms which constantly try to adapt their capacity to changes in demand in order to stop bearing excessively high fixed costs. However, for some companies, excess capacity is an essential source of success.

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The Spanish garments producer Zara maintains a low rate of capacity utilization in order to be quicker than its competitors in reacting to demand peaks (Ferdows et al., 2004). Indeed, Zara managers have understood that in a market characterized by a high level of demand variability, the time customers are requested to wait increases exponentially when capacity is tight (Ferdows et al., 2004). Additional capacity can be particularly useful also for companies that operate in sectors where unforeseen events happen almost daily. This is the case of the US-based global courier services, FedEx. Every night, two empty FedEx planes leave one from the East Coast and the other from the West Coast, both directly to Memphis. The two planes return at dawn. In case of problems in deliveries everywhere in the United States, these two planes can go on site, collect the package and bring it to its final destination (Sheffi, 2005c). FedEx maintains this extra capacity to continue serving customers providing them dependable and fast deliveries even when things do not go as planned.

Finally, a multi-sourcing strategy helps companies maintain operations continuity when a supplier experiences an unexpected event or in case of demand fluctuations (Tang, 2006). This happens due to the fact that the focal firm shares its risk with more than one supplier and in this way risk exposure lowers (Rice & Caniato, 2003). However, a multi-sourcing strategy can lead to an increase in costs; in fact, it is difficult that all the suppliers are as efficient as the first-choice one and, additionally, it is not possible to obtain the same discounts which are offered by suppliers when they provide the whole quantity of a component (Rice & Caniato, 2003).

In conclusion, building resilience through redundancy has its advantages and disadvantages. In fact, safety stock allows companies to quickly solve problems associated with faulty products, supply shortages, and demand peaks – and at the same time managing extra stock means bearing additional costs. Moreover, the majority of managers attempt to adapt capacity to the phase of the industry life cycle their companies find themselves to cut costs. However, some companies steal customers from their rivals exactly through additional capacity, a fact which can lead to a market share increase during demand peaks.

Finally, managing relationships with many suppliers requires substantial time and significant financial resources. At the same time, it is unlikely that a major disruption would hit all the suppliers of a component and in this way supply dependability increases. Despite the fact that some companies have been able to find a level of redundancy allowing them to obtain an advantage, it is undeniable that redundancy leads to a cost increase (Rice & Caniato, 2003). The problem is that the majority of redundant resources will be used only in case of an unexpected event; therefore, if no disruptions occur in the company, the costs associated with redundancy creation will not be counterbalanced by the benefits (Sheffi & Rice, 2005).

Building Resilience through Flexibility

Another method for resilience creation is flexibility. It is easier for firms to implement redundancy than flexibility. In fact, the former only requires building an overabundance along the supply chain, while the latter needs radical changes in the company operations and culture (Sheffi, 2005c). In many aspects, flexibility can be considered as the opposite of redundancy. Indeed, in the majority of companies which try to achieve flexibility, the safety stock maintained is very low. However, it could be advisable to build some inventory buffers of inexpensive but fundamental components, since they are often the causes of bottlenecks (Lee, 2004). Another key difference between flexibility and redundancy is that the companies that adopt the former generally do not tolerate excess capacity, which is considered as a burden. In

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these firms, unexpected events which inhibit a part of the capacity entail tradeoffs in terms of products and customers and, therefore, managers must choose which customers they want to serve as first and to manage the cost increase caused by capacity reconfiguration (Rice & Caniato, 2003).

Some features can be designed in a supply chain in order to make it flexible. Two preventive measures that a company can implement to facilitate the production process and the recovery after disruptions include components, equipment, and plants interchangeability through their standardization, and postponement (Sheffi, 2005c). Regarding the former, an example of equipments standardization is provided by the Irish low-cost airlines, Ryanair, which uses only one airplane model, Boeing 737s. This choice helps to reduce costs associated with spare parts and personnel training (Slack et al, 2010), and it permits the ability to replace an airplane with another when unforeseen circumstances do not allow operations as they were planned. The Irish airlines can use only one airplane type thanks to its business model, which is based on the offer of flights that are similar to each others in terms of distances served and passenger volumes.

The second practice consists of arranging product and process design in such a manner that it becomes possible to postpone some operations in order to differentiate the product at the moment when information about customers preferences are available (Sheffi, 2005a). A postponement strategy is implemented due to concepts such as modular components, commonality, and standardization that allow the delay of product customization until demand requests are clear (Tang, 2006). It is evident that postponement leads to some important advantages even during the ordinary operations execution and not only in case of major disruptions. In fact, the frequent market fluctuations can be efficiently managed thanks to postponement, which allows product matching with customers needs (Sheffi, 2005c). Once the company has borne the cost for postponement implementation, this technique allows the reduction of production expenses while simultaneously maintaining a high level of customer satisfaction (Sheffi, 2005c).

The contribution of postponement in resilience building is in the rapid product reconfiguration that this practice allows when a disruption hits the company (Tang, 2006). Postponement has been used for 50 years by the Italian garments producer, Benetton. In fact, this technique is particularly useful for companies which operate in sectors where customer preferences are unstable and very difficult to be forecast such as in the fashion garments industry (Sheffi, 2005c). Since the most difficult forecast in terms of customer preference was regarding colors (Sheffi, 2005c), Benetton decided to invert the order of the conventional manufacturing process and therefore to implement, in 1964, a postponement strategy which is still used today. Benetton designs its products in order to manufacture them at the beginning in a generic undyed status called *greige* (Sheffi, 2005c). Then, when accurate information about customer preferences are obtained via test batches, Benetton dyes its garments and sends them to the stores in only five weeks (Sheffi, 2005c).

This technique allows Benetton to avoid excess inventories of some colors and a lack of the most popular ones (Dapiran, 1992). In this manner, the quantity of stock which is necessary to maintain in warehouse is reduced and customers can be effectively satisfied (Chopra & Sodhi, 2004). Regarding supply strategy, many scholars highlight the importance of building a deep relationship with suppliers through a continuous communication. Lee (2004) indicates, as a source of success, the alignment between all supply chain members which must be implemented through supplier participation in product and process design and the nonstop sharing of up-to-date information about supply and demand fluctuations, forecasts, sales data, and plans. Moreover, efforts should be focused on supply chain visibility increase to allow every member of the network to have a current knowledge of what is happening at every stage of the chain (Christopher & Peck, 2004).

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Lee (2004) states that to line up the interests of the firms involved in the same supply chain, roles and responsibilities should be specified and incentives aligned in order to maximize simultaneously the return of each member and of the whole supply network. This strategy certainly entails costs of data production, communication, and negotiation which increases as the number of members involved in the chain grows. Therefore, some people could embrace Sheffi's (2005c) argument who believes that the basic is not to be constantly lined up with all suppliers, but rather to build the alignment between the supply strategy and the type of relationship created with suppliers. According to Sheffi (2005c), single and multi-sourcing are both correct approaches. The essential issue is that when a company decides to adopt a single-sourcing strategy, it must build a deep relationship with its suppliers to reduce vulnerability. In this case, it is recommended that the focal firm works in a very close contact with suppliers in order to help them improving their risk management practices (Christopher & Peck, 2004) and, therefore, creating the tight alignment that Lee suggested.

Otherwise, when a company does not want to employ resources in the creation of tight synergies with its partners, the most cautious approach is represented by multi-sourcing (Sheffi, 2005c). The consequences of a disruption for a company essentially depend on the preventive measures put into practice before the unexpected event occurs (Sheffi, 2005c). However, an effective reaction during and immediately after disruptions can be very convenient for firms. An example is the dynamic pricing strategy adopted by the American personal computer producer Dell, when it faced a shortage of components in 1999 when an earthquake hit several suppliers in Taiwan. Dell offered the available components at special prices in order to dissuade customers from choosing the missing ones. Although the supply problems the company was facing were significant, the ability to influence customers' preferences allowed Dell to raise its profits of the 41% during 1999 (Tang, 2006), and to increase its market share (Lee, 2004) since its rivals were not enough fast in their reactions.

In conclusion, it is evident that radical transformations in organization and culture must be implemented in the companies which want to organize flexible operations (Sheffi, 2005c). Of course, these radical changes initially raise costs. However, flexibility should allow companies to cover the cost borne for its implementation thanks to increased efficiency in manufacturing operations and to the constant demand fulfillment. Furthermore, companies should consider that flexibility permits not only the ability to maintain continuity in case of disruptions, but also to improve the ordinary operations execution and the management of usual fluctuations in demand and supply (Sheffi & Rice, 2005). Finally, many firms could choose as solution to combine flexibility and redundancy (Rice & Caniato, 2003) to create the most suitable strategy considering their costs, the products and services provided to the customer, and other specific factors linked to the business where firms operate.

Organizational Culture as Support for the Resilience Building Process

When a company decides to build a resilient supply chain, great importance should be given to the organizational culture which can act as a facilitator of the resilience creation process. Since the diffusion of a risk management culture represents a deep change for many firms, the input should come from the highest hierarchical levels of the supply chain companies and then, this resilient approach should be spread to all firms' employees (Christopher & Peck, 2004). The majority of companies that positively and rapidly react to disruptions shares some common cultural traits. First, a nonstop communication of up-to-date information is implemented not only between the various firms which belong to the same supply chain, but primarily between the employees of the same company at every hierarchical level (Sheffi,

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2005a). Second, authority is organized in such a way that every employee even at the lowest level has the power to make some decisions and execute actions in case of emergency (Sheffi, 2005b). Moreover, companies can train their employees to deal with disruptions putting into practice stress testing to the purpose of evaluating the personnel's ability to react to unforeseen events.

Stress testing are exercises that are done by a group of employees and which allow managers to create a rank of supply chain risks, putting them in order of importance (Chopra & Sodhi, 2004). Managers evaluate the sources of risk and their impact on the supply chain, trying to answer some questions such as: "What would happen if a supplier would not deliver its products for a month?" (Chopra & Sodhi, 2004). Other companies develop Business Continuity Plans (BCPs), in order to assess, manage, and monitor risk (Ananth, 2007). A series of emergency procedures that should allow operations to continue in case of disruption are set in this plan (Ananth, 2007). Eventually, companies should give increasing importance to risk reduction and consider resilience during every decision making process; for instance, in the suppliers location choice and not only when they are explicitly engaging in risk management (Christopher & Peck, 2004).

SOLUTIONS AND RECOMMENDATIONS

By building on this analysis, it is possible to draw some recommendations for companies that desire to build resilience in order to keep on serving customers in case of disruption and remain competitive in the marketplace. There is probably not an optimal strategy to build resilience and every firm should choose the method, or the mixture of methods, that result in the most suitable situation, considering the available resources, the products and services provided, the relationships created with suppliers, the abilities shown by its managers, and the natural, political, economic, and social risks to which the territories where the company operates are exposed. Attempting to discover a general correct approach to build resilience makes it possible to state that a mixture of minimum redundancy and flexibility can be an excellent solution for many firms.

First, a small inventory of crucial, non-bulky and cheap components can allow companies to carry on operations in case of disruption (Lee, 2004), and therefore to continue serving customers. In fact, a small delay in deliveries can make a big difference as clients could switch to a firm's rival and never return to the original company. Second, for some companies operating without using the entire capacity can be a valuable solution. In this way, limited peaks in demand and certain unforeseen events can be managed. This is particularly useful for companies that operate in sectors where customer preferences are volatile such as in the fashion garments industry as illustrated through the Zara case study. Managers should make a cost and benefit assessment in order to analyze if the cost increase caused by the extra capacity is significantly higher than the revenues obtained due to fast responses to customers' requests.

In industries where the postponement technique and the standardization of components, equipments and plants are possible, supply chain design should be based on these tools. The matter becomes complicated when considering supply strategy. In fact, many companies have achieved success following very different supply approaches. The choice a firm makes regarding this topic is probably heavily influenced by the organization culture and tradition. It is clear that companies are not obliged to adopt only one supply policy for all its components. In fact, some firms could decide to use a single-sourcing strategy for some components and a multi-sourcing strategy for others.

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Companies can adopt a single-sourcing strategy, choosing the cheapest supplier, for non-customized products which are easily traceable on market, because in case of missing delivery the supplier can be rapidly replaced with a new one and operational continuity will be preserved. These companies may decide to adopt a multi-sourcing strategy for crucial and complex components to make sure the constant product availability and therefore reducing risk (Tang, 2006). Conversely, other firms could use a single-sourcing strategy for fundamental and customized components, because these products often require a deep synergy and a constant communication between the focal firm and the supplier, which are difficult to implement when more than two actors are involved.

With regards to supplier location, high customized, low volume products can be advisable to address towards specialized and close suppliers, while for high volume, standard components can be profitable to turn to low cost suppliers located in developing countries (Lee, 2004). Furthermore, considering suppliers' choice criteria, it is evident that commodities suppliers are chosen on the basis of price and that the suppliers of complex and crucial components are selected taking into account quality, speed and dependability, as well as price (Chopra & Sodhi, 2004). Eventually, it is possible to define a resilient supply chain as the one which is able, during and after disruptions, to preserve the same level of the five performance objectives that it had previously. Maintaining an unchanged level of the five performance objectives means that the resilient company is able, in case of disruption, to sell its products or services at the same price as in the past. It signifies that operations problems have been overcome without increasing costs, or at least, that the raise in expenses has not been felt by customers.

These companies will recover the money lost because of disruptions through revenues, which will not decrease thanks to customers' loyalty, preserved through the continuity of supply. Moreover, disruptions do not reduce the quality of the products or services provided by the resilient company, which has to be able to maintain the delivery time promised to customers. Additionally, product and service dependability must be guaranteed. Flexibility is surely the most important feature of a resilient supply chain which has to own the ability to face disruptions and to constantly adapt its offer to customers' needs.

LIMITATIONS

Unfortunately, it is not possible to state the perfect paradigm for resilience building. Every company should find its own best standard to create resilient operations and constantly adjust this model thanks to expertise. In fact, resilience creation is a nonstop process. Moreover, even the most resilient company can have problems in facing the unforeseen. Resilience building should help companies to overcome disruptions and major disasters such as earthquakes which often provoke damages so serious that even resilient firms could cease to exist. This problem affects especially small size companies whose activities are essentially based on one plant.

Finally, resilience building is surely one of the hardest challenges that companies have to face nowadays. Indeed, for small size firms can be hard to develop resilient measures because of the lack of capital. At the same time, for big multinational companies resilience creation can be difficult because the cultural change has to be implemented among hundreds of people located in many countries and with different backgrounds. Furthermore, the routines implemented by numerous multinational companies, in order to standardize tasks and increase efficiency, may have reduced their flexibility and, therefore, their ability to build resilience through this method.

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DIRECTIONS FOR FUTURE RESEARCH

Since resilience is a relatively unexplored research area, it would be interesting to discover, through the analysis of some firms, if there were other methods used to reduce vulnerability to unforeseen events. The techniques used by small size firms in which resilience creation is often a non-systematized process could be of particular interest. Some measures for resilience building surely have arisen over years only from the common sense of many entrepreneurs and many other firms could learn from their expertise. Another interesting path could be to analyze single and multi-sourcing. As scholars have very different opinions about the best supply strategy and successful companies adopt several methods, it would be fruitful to analyze a sample of companies in order to understand what the drivers of the supply strategy choice are. It would be significant to appreciate what is the most used method and why.

CONCLUSION

Resilience importance is often underrated by companies because many are only focused on margins increase through cost cut and waste elimination. The consequence is that, during supply chain design, many companies only consider lean principles to the detriment of resilience. The cause lies in the fact that, today, even firms following a differentiation strategy and not a cost-leadership one must contend with expenses reduction to be competitive on the market and the low cost requirement discourages firms from investing in resilience creation. Furthermore, there is the widespread misconception that preventive measures are waste and that a rapid reaction, only when the unforeseen event occurs, will be sufficient. However, this approach is incorrect because the majority of firms that have been able to successfully overcome disruptions has put into practice some preventive measures in advance (Sheffi, 2005c).

Expertise shows firms the importance of resilience; indeed, the likelihood that a firm invests in resilience creation measures will be higher if it has already experienced a major disruption (Sheffi, 2005c). Moreover, for companies it is easier to implement lean principles than resilience; in fact, the benefits of the former can be easily calculated while the advantages of the latter are very hard to be assessed. Therefore, it becomes essential to encourage managers to make an effort to evaluate, as far as possible, the benefits of resilience which are not only expressed in terms of the avoidance of the terrible consequences associated with disruptions. In fact, in this assessment, managers should consider that the advantages of resilience are also in the day-to-day operations execution.

Indeed, some measures such as postponement and standardization increase efficiency. Moreover, resilient practices help companies to successfully manage demand peaks and delays in supply deliveries. The minor problems frequently faced by managers can be successfully overcome by companies which are able to cope with major disruptions. In fact, a company which can manage high impact events is less vulnerable than the others to ordinary market fluctuations (Sheffi, 2005c). The resilient firm is also able to transform disruptions into opportunities (Sheffi, 2005c) due to its quick and positive reaction to unforeseen circumstances, a fact which differentiates the firm from its rivals. Today, resilience has become essential to avoid the significant losses caused by major disruptions and to mitigate the features of the modern supply networks, like complexity and interdependency, which make them more vulnerable than in the past.

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Furthermore, customer expectations are constantly growing and if years ago speed and cost reduction were the two performance objectives on which companies principally competed, currently they have become preconditions. Dependability and flexibility have got fundamental, therefore companies to be competitive have to provide customers with the most suitable product at the right quantity at all times. Otherwise, customers will immediately buy competitors' products since reconversion costs are null for them and brand loyalty is no more a sufficient incentive. As such, preserving the continuity of operations should be the most important goal of modern companies. If, in the past decades, lean principles focused on speed growth and cost control were the essential operations drivers, today they are simply prerequisite and resilience should be the new priority.

REFERENCES

- Ananth, P. (2007,). Business Continuity Planning. *ISSA Journal*, December, 22-24.
- Bukowski, L. A., & Feliks, J. (2012). Multi-Dimensional Concept of Supply Chain Resilience. Proceedings of CLC 2012: Carpathian Logistics Congress (pp. 33-40). Ostrava: TANGER.
- Chopra, S., & Sodhi, M. S. (2004, Fall). Managing Risk to Avoid Supply-Chain Breakdown. *MIT Sloan Management Review*, 46(1), 53–61.
- Christopher, M., & Lee, H. (2004). Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, 34(5), 388–396. doi:10.1108/09600030410545436
- Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management*, 15(2), 1–14. doi:10.1108/09574090410700275
- Christopher, M., & Rutherford, C. (2004). Creating supply chain resilience through agile six sigma. *Critical Eye*, 24, 28.
- Clay, K. (2013, August 9). *Forbes*. Retrieved from <http://www.forbes.com/sites/kellyclay/2013/08/19/amazon-com-goes-down-loses-66240-per-minute/>
- Collins English Dictionary. (2014). Retrieved from <http://www.collinsdictionary.com/dictionary/english>
- Dapiran, P. (1992). Benetton–global logistics in action. *International Journal of Physical Distribution & Logistics Management*, 22(6), 7–11. doi:10.1108/EUM00000000000416
- Ferdows, K., Lewis, M. A., & Machuca, J. A. (2004). Rapid-fire fulfillment. *Harvard Business Review*, 82(11), 104–117.
- Hendricks, K. B., & Singhal, V. R. (2003). The effect of supply chain glitches on shareholder wealth. *Journal of Operations Management*, 21(5), 501–522. doi:10.1016/j.jom.2003.02.003
- Hendricks, K. B., & Singhal, V. R. (2005). An Empirical Analysis of the Effect of Supply Chain Disruptions on Long-Run Stock Price Performance and Equity Risk of the Firm. *Production and Operations Management*, 14(1), 35–52. doi:10.1111/j.1937-5956.2005.tb00008.x

Supply Chain Resilience

- Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review*, 82(10), 102–113. PMID:15559579
- Ponis, S. T., & Koronis, E. (2012). Supply chain resilience: Definition of concept and its formative elements. *Journal of Applied Business Research*, 28(5), 921–930.
- Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. *The International Journal of Logistics Management*, 20(1), 124–143. doi:10.1108/09574090910954873
- Rice, J. B., & Caniato, F. (2003, September/October). Building a secure and resilient supply network. *Supply Chain Management Review*, 7(5), 22–30.
- Sheffi, Y. (2005a). Building a resilient supply chain. *Harvard Business Review Supply Chain Strategy*, 1(5), 1–4.
- Sheffi, Y. (2005b). Manage risk through resilience: CEOs should build a culture that copes with the unforeseen. *Chief Executive Group*. Retrieved from <http://www.arts.ac.uk/study-at-ual/library-services/e-library/>
- Sheffi, Y. (2005c). *The resilient enterprise: overcoming vulnerability for competitive advantage*. Cambridge, MA: MIT Press Books.
- Sheffi, Y., & Rice Jr, J. B. (2005). A supply chain view of the resilient enterprise. *MIT Sloan Management Review*, 47(1).
- Slack, N., Chambers, S., & Johnston, R. (2010). *Operations Management*. New York: Pearson Education.
- Snyder, L. V., & Shen, Z. J. M. (2007). Managing disruptions to supply chains. Proceedings of *Frontiers of engineering: reports on leading-edge engineering from the 2006 symposium*
- Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics: Research and Applications*, 9(1), 33–45. doi:10.1080/13675560500405584
- Yu, H., Zeng, A. Z., & Zhao, L. (2009). Single or dual sourcing: Decision-making in the presence of supply chain disruption risks. *Omega*, 37(4), 788–800. doi:10.1016/j.omega.2008.05.006

KEY TERMS AND DEFINITIONS

Adaptability: With regards to supply chains, this term describes the firms' ability to find a new configuration after a major, long-term change, for instance a variation in the technical standard.

Agility: With reference to supply chains, this term states the companies' ability to have quick reactions to sudden, short-term changes, like demand peaks.

Flexibility: With regards to firms' operations, it defines the ability to easily conform the manufacturing system to the variations in demand or supply, in order to constantly offer the quality and quantity of the products or services required by customers. Flexibility is considered as a method to build resilience, because it allows to easily move resources from one production to another in order to concentrate efforts on the priority manufacturing (concept linked to interchangeability) and to rapidly reconfigure products (concept linked to postponement).

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Interchangeability: Property which defines the possibility of substituting a resource with another, in order to focus the efforts on the most urgent production in a specific moment. Resources interchangeability is obtained thanks to their standardization which makes possible, for instance, to move the production from one plant to another. The resources involved generally are: workforce, plants, equipment and components.

Organizational Culture: The set of values, traditions and behavioral rules which are spread and shared among the members of an organization.

Postponement: Technique used in manufacturing activities which consists in delaying some operations in order to differentiate the product only when reliable information about customers' preferences are available.

Redundancy: Referring to companies' operations, it states the situation in which the available quantity of a resource is higher than the measure which is necessary to carry on operations in normal conditions. Redundancy can be considered as a method for resilience building, because it ensures the presence of available resources even during supply shortages, demand peaks, etc.

Resilience: In materials science, it describes the property of a material to come back to its original shape, after having suffered a deformation which does not exceed its elastic limit.

Resilient Supply Chain: Network of companies which own the ability to maintain the operations continuity thanks to fast and positive reactions to unexpected circumstances, from the mildest ones, like demand peaks, to the most serious, like natural disasters and terrorist attacks.

Chapter 10

Partnerships in Supply Chain Management

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ABSTRACT

This chapter considers one of the most important collaborations, namely that of partnership. In recent year's sophisticated and demanding consumer lead severe global competition between companies. So many companies seek to coordinate cross-firm activities and work mutually over time to produce outstanding performance. The main objective of the companies is to reach higher performance than would be achieved by managing individually. For any supply chain in the competitive environment, widening the boundaries of the firm via partnership formation would be the remedy and partnership creates a synergistic business environment for both sides. The objective of the chapter is to present a comprehensive and integrated view of the literature on all aspects of partnership.

INTRODUCTION

This chapter considers one of the most important collaborations, namely that of *partnership* in the supply chain. A partnership is an evolution of the relationships between buyers and suppliers (Maloni & Benton, 1997) and a supply chain comprising multiple partnerships (Menzter, Min, & Zacharia, 2000). For providing ordinary and basic requirements of a company, simple purchasing activities are sufficient and relevant and no deep relationship formation is essential with suppliers. However, when the requirements start to being complicated and complex, building a supply management system is essential. Evolving from purchasing – which is an operating level activity – to supply management which is a strategic one (Kraljic, 1983) requires some revolutionary change in the perspective of companies. The simple transactions to implement a supply management system necessitate establishing any kind of partnerships with counterparts.

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Partnerships in Supply Chain Management

The objective is to present a comprehensive, integrated view of the literature on all aspects of partnership. To meet this goal, we define partnership in a different perspective. Additionally, this chapter explains the following topics: boundary decisions of the firm; the characteristics of the partnerships in the Supply Chain Management (SCM); the importance of partnerships in the SCM; the role and relevance of partnering in the SCM; partnering versus outsourcing; most cited partnering model's in the literature; strategic role of partnering in SCM; quality of partnership; partner selection; and supply chain partnering in construction as an industry application. Finally, the conclusions and future remarks for researchers are discussed.

BOUNDARY DECISIONS OF THE FIRM

An organization can be characterized as its boundaries which are a physical, arbitrary, or imaginary line of demarcation acting like a cell membrane or a barrier to separate territories of organizations (Crowley & Karim, 1995). The aim of the theory of the firm is to provide an explanation of the conditions when a firm should do things by itself rather than provide them through the market to minimize production and transaction costs (Weigelt & Miller, 2013). In addition, the theoretical explanation of the boundary of the firm is diverse. To give an insight to the reader a narrow-scoped explanation will be provided. For more information, the following are suggested: Coase (1937), Williamson (1975, 1985), Crowley & Karim (1995), and Sousa (2010, 2014).

Contrary to what is generally known, Sousa (2014) stated that an economic activity of a firm may be actualized in three ways:

1. Firms do things by themselves within the boundaries of the firm (make).
2. Traded in markets: firms get things done by others (buy).
3. Exchanged mutually rewarding buyer-seller interaction: firms buy from or cooperate with counterparts (cooperate).

Make-or-buy-or cooperate decisions specify the boundaries of the firm. Boundaries can be kept the same or be changed according to requirements of the firm. The main questions to answer include which “resources, capabilities and activities” reside internally, and which are to remain outside and how as a purchasing activity or cooperating with counterparts (Sousa, 2014).

Firms' boundary choices more clearly saying widening and narrowing of corporate boundaries can be better understood by considering the pressure between the need for external resources and the need for risk controls (Kaufman, Wood & Theyel, 2000). Crowley and Karim, 1995 further pointed out that boundaries are interfaces of the firms which can be described as permeable and/or flexible. Flexible boundaries allow the firm to reorganize its resources. Permeable boundaries allow exchanging information and ideas through inside and outside of the boundary. Besides its benefits of cooperative activities, information exchanges between partners could cause some leakages and may ended up with unwillingly sharing proprietary information with competitors.

The seminal transaction cost theorist Coase (1937) emphasizes in his work titled, *The nature of the firm*, the significant role of the boundary of the firm and asked why firms exist? According to Coase (1937), firms decide the expansion of their boundaries according to transaction costs – the cost of using

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the price mechanism (market). More clearly, firms would perform an activity inside their boundary if the production cost is lower than the transaction cost. The field of transaction cost economics provides a theoretical framework for discussion of market structures and ensures theoretical concepts for supplier relationships (Kaufman, Wood, & Theyel, 2000).

Premkumar (2000) remarked that two vital questions asked by firms include:

1. “Which activities should a firm keep within its boundaries and which activities should it outsource?”
2. “How should it manage its relationship with its customers, suppliers, and other business partners?”

Firms make decisions on setting their organizational boundaries based on several factors, including transaction costs which explains not only boundaries of firms but also their existence, what investments must be made specific to the relationship, what activity is critical for effective business performance of the firm, uncertainty in the relationship with partners, and product complexity. A firm could manage all the activities within its boundary and perform as a hierarchy (actually for several industries it is impractical), or it could outsource most of the activities, except for its core competencies (Premkumar, 2000).

A FRAMEWORK FOR PARTNERING

In recent years, sophisticated and demanding consumers have caused severe global competition (Maloni & Benton, 1997), thus creating enormous pressure experienced by any supply chain. New production philosophies and techniques have been introduced during these years such as Total Quality Management (TQM), Kaizen, Just-in-Time (JIT), lean manufacturing, Six Sigma and SCM. Any such technique may be stronger by means of any collaborative approach between interested parties. As indicated in previous chapters, SCM consists of a set of complex components. To obtain successful, responsive, and profitable supply chain, each component should be coordinated, integrated and linked to each other. Although this is easy to say, it is not so easy to implement all these process alone. In recent years, many companies prefer outsourcing their non-core activities which is causing interdependency among supply chain parties. Thus, firms can easily concentrate on their core activities and also obtain an advantage through help from the outside.

Partnership is a form of alliance (Boddy, Machbeth, & Wagner, 2000) which is more cooperative relationship rather than adversarial to strengthen supply chain integration and it is claimed that partnership is a means to obtain best performance from a supply chain while providing sustainable competitive advantage. A “win-win” orientation and future orientation are prerequisite attributes to have a partnership beneficial to both sides. Partnership is a resource-intensive strategic approach to manage supply chain relationships while challenging opportunistic behavior which causes financial and strategic risks. Therefore, partnering lies at the heart of SCM to create a synergistic business environment. Companies must seek to optimize costs to obtain a particular purpose such as competing for the future via establishing useful internal and external relationships for strategic and/or operational reasons.

Partnering with key suppliers, not merely purchasing from them, requires a holistic coordination approach across multiple boundaries within companies and a new point of view how to interact with suppliers as partners (Hughes, 2008). Increasing importance is recognized by both academics and practitioners on partnerships in supply chains (Myhr, Robert, & Spekman, 2005). However there is very

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little research has done to explain the nature of supply chain partnership (He, et al., 2011). In order to understand the concept of the partnering in depth, standard definitions should be emphasized. Some of the most cited definitions are given below in chronologic order:

Ellram and Krause (1994) defined partnership as “an on-going relationship between firms which involves a commitment over an extended time period, and a mutual sharing of information and the risks and rewards of the relationships.” Egan (1998) stated that “partnering involves two or more organizations working together to improve performance through agreeing mutual objectives, devising a way for resolving any disputes and committing themselves to continuous improvement, measuring progress and sharing the gains.” Partnership can be defined as “the set of practices and routines that support economic exchanges between two firms the fact that firms have been doing business continuously for a given period of time” (Kotabe, Martin, & Domoto, 2003). Strategic supplier partnership refers to “the long-term relationship between the organization and its suppliers, which influences the strategic and operational capabilities of individual participating companies to help them achieve significant ongoing benefits” (Qrunfleh & Trafadar, 2013).

The partnership concept can be viewed from a variety of perspectives. Most of the studies focused on relationship and sharing limited information by considering the concept of partnering. Table 1 lists the most important terms which are related to partnering and its definition.

Based on the detail reviewed of the related studies, the new definition of *partnership* is one form of purposive, strategic, tailored alliance which is more cooperative rather than adversarial between independent firms striving for mutual benefit, mutual sharing of information, risks and rewards, and acknowledge a high level of interdependence while sharing compatible goals, involving a commitment

Table 1. Most used criteria in partnering

| Criteria | Ellram & Krause (1994) | Mohr & Spekman, (1994) | Ellram & Hendrick (1995) | Kotabe et.al. (2003) | Qrunfleh & Trafadar (2013) |
|--|------------------------|------------------------|--------------------------|----------------------|----------------------------|
| Relationship | x | x | x | | x |
| Time | x | | x | x | x |
| Commitment | x | | x | | |
| Sharing information | x | | x | | |
| Sharing risks and rewards | x | | x | | |
| Set of practices and routines | | | | x | |
| Economic exchange | | | | x | |
| Doing business | | | | x | |
| Strategic and operational capabilities | | | | | x |
| Mutual benefits | | x | | | x |
| Goals | | x | | | |
| Interdependence | | x | | | |

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over an extended time period (Boddy, Macbeth & Wagner, 2000; Mohr & Spekman, 1994; Ellram & Hendrick, 1995). Mentzer, Min, and Zacharia (2000) provided a useful summary to explain the nature roots and ingredients of partnerships.

According to them, a partnership appears naturally through extensive social, economic, service, and economic ties established over time among partners, but needs commitment, trust, goal congruence, communication, and cooperation as a bonding mechanism between parties. Partnership implementation requires dedication of time and as well as other resources and needs a holistic and systemic approach to build new structures between partners. Partnerships should be implemented in the right way and situation; otherwise, expected benefits will be ruined (Eriksson, 2010).

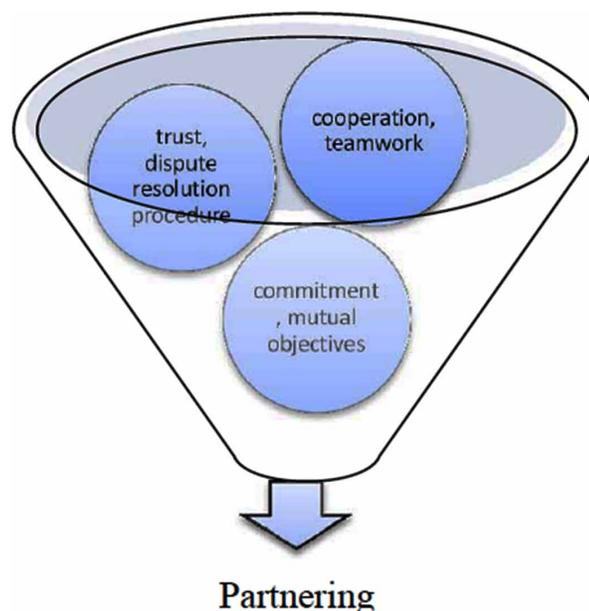
DIMENSIONS OF PARTNERSHIP

At this point, a more detailed discussion of the partnership is appropriate. Figure 1 presents a simplified partnering concept. Partnering can be viewed as a funnel composed of the ingredients of successful partnering dimensions; namely, trust, an agreed dispute resolution procedure, cooperation, teamwork, commitment and mutual objectives which merge to enable partnering. The coordination and integration of these dimensions is a challenge. Therefore, given the scope of this chapter, it is worthwhile to discuss briefly these dimensions and their relationship.

Trust

Trust must be a foundation of building any relationship (Koraltan & Dikbaş, 2002), so trust is the main element for the development of partnerships among the different partners of a supply chain, distinguished

Figure 1. Partnering funnel



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between interpersonal and inter-firm trust. Morrow, Hansen, and Pearson (2004) defined trust as *the extent to which one believes that others will not act to exploit one's vulnerabilities*. Another definition from Pruitt (1981) is the belief that any party's word is reliable and feeling no concern about fulfilling the obligation in an exchange. The creation of trust in inter-firm relationships can be considered related to a country's cultural context (Vieira, Paiva, Finger, & Teixeira, 2013). Trust helps avoid project problems that lead to litigation (Moore, Mosley, & Slagle, 1992). Trust develops confidence, encourages open communication, exchange of ideas and sharing resources (Crowley & Karim, 1995) and highly related to desire to collaboration (Mohr & Spekman, 1994). Lack of trust will decrease information exchange between parties and the effectiveness of joint problem solving activities (Mohr & Spekman, 1994).

Mutual Objectives

Mutual objectives have traditionally been given attention as an important dimension of partnering. Agreement on mutual aims is necessary at the beginning of the collaboration. Setting the mutual objectives and sub-objectives for the individual members that identify cooperative is markedly superior to the status (Simatupang & Sridharan, 2002).

Commitment

Commitment is the level of the pledge of relationship continuity between partners (Bensaou & Venkatraman, 1995). Organizational commitment is characterized by at least three factors: (1) a strong belief in and acceptance of the organization's aims and values; (2) a willingness to exert considerable effort on behalf of the organization; and (3) a definite desire to maintain organizational membership (Porter, Steers, Mowday, & Boulian, 1974). Commitment of all involved parties is required to exert effort on behalf of the relationship (Mohr & Spekman, 1994) to build robust partnership (Christopher & Jüttner, 2000). Long term commitment allows constant improvement of technology and methods, reinforces the mutuality of the parties, reduces the rivalry and litigation, and produces goodwill among parties (Crowley & Karim, 1995).

Information Sharing

Sharing data is the degree to which critical or proprietary information is communicated to one's partner (Lacity & Hirschheim, 1993). Information sharing is with regards to disseminate critical, generally proprietary information among the parties (Mohr & Spekman, 1994). Information sharing between partners shapes how relationships are maintained and developed (Klein & Rai, 2009) and associated with partner performance as an important predictor of success (Mohr & Spekman, 1994). Kotabe et al. (2003) mentioned knowledge transfer that involves grater scope of activities than information sharing because of technical knowledge is explicit and tacit and less codifiable. He et al. (2011) stated that supply chain partnerships are interpreted as an important means for knowledge transfer in the supply chain. Trust, commitment, interdependence, shared meaning and balanced power (some attributes of partnership) leads to knowledge transfer. Klein and Rai (2009) mentioned that firms are developing supply chain relationships for a variety of processes, such as contract manufacturing, distribution, or new product development, logistics relationships represent an especially interesting context to understand how information sharing behaviors can be promoted.

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Dispute/Conflict Resolution Procedure

Partnership conflict is the degree of incompatibility of activities, resource sharing, and goals between partners (Rai et al., 1996). Setting a procedure for resolutions of disputes are essential for partnerships; otherwise, the relationship may suffer (Crowley & Karim, 1995) from destructive effects of disputes and sometimes the support of arbitration techniques may be sought (Mohr & Spekman, 1994). Conflicts affect all kinds of organizations and managing them properly can lead to innovative techniques (Crowley & Karim, 1995) and productivity (Mohr & Spekman, 1994).

Shared Risk and Rewards

Another dimension scheme receiving increased attention is sharing both risks and rewards with the partners. The term is defined as the level of articulation and agreement on advantage and risk between partners (Fitzgerald & Willcocks, 1994). All partners should have an equal share in the profits of the partnership and equally responsible for its losses. In other words, sharing the gain and the pain ensure closer relationships and enhance the parties' commitment.

Classification of Inter-Organizational Relationships

Todeva and Knoke (2005) gave a broad classification of basic forms of inter-organizational relationships mentioned in the literature which is given below in detail. *Market relations*; it is the simplest relationship between organizations coordinated through the price mechanism. It can be also called an arm's-length relationship. *Buyer networks*; inter-linked firms where a buyer negotiates and decides its suppliers' prices. *Strategic cooperative agreements*; this relationship can be called partnering. *Hierarchical relations*; more clearly these relationships are acquisitions or mergers. *Joint ventures*; a jointly owned legal organization established for a specific purpose for its parties. *Equity investments*; a majority or minority equity holding by one firm through a direct stock purchase of shares in another firm. *Cooperatives*; a coalition of small enterprises or entrepreneurs that synergistically manage their resources. *R&D consortia*; inter-firm agreements for the purpose of jointly research and development. *Cartels*; large corporations conspiring to limit competition by controlling prices and excluding new entries within a specific industry. *Franchising*; implementing a business model of a franchiser to use of a brand's identity while the franchiser is holding the rights of control over pricing, marketing, and standardized service norms. *Licensing*; giving the production and selling the right of an intangible asset in exchange for royalties and fees. *Industry standards groups*; commissions to set technical standards for manufacturing and trade within a specific industry (Todeva & Knoke, 2005).

PARTNERING VERSUS OUTSOURCING

Most researchers used *outsourcing* and *partnering* terms to define the activity which is done by others. At first glance they may seem to have the same meaning, but there are significant differences between them. The general definition of outsourcing is contracting with another firm to do at least one non-core activity. On the other hand, partnering can be defined as a long-term, tailored, inter-firm business relationship based on components such as trust, mutual objectives, commitment, information sharing,

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dispute resolution procedures, and shared risk and rewards; resulting better collective performance than individual firm performance (Lambert, Emmelhainz, & Gardner, 1996). Additionally, the term *contract* should be defined that an agreement between two or more agencies. Therefore, the contractual relationship must be clearly defined and carefully managed.

Lysons and Farrington (2012) made a comparison between partnering and outsourcing as follows:

- If the relationship between any customer and supplier is purely transactional, it is outsourcing; however, strategic level relationships are more likely to merge into partnering.
- In the customer-supplier relationship, the emphasis in on cost minimization while partnering emphasizes on value enhancement and to achieve joint objectives.
- Contractual differences between outsourcing and partnering in which the former is based on clearly defined inputs and period of time and the latter is based on trust no contractual documentation is necessary.

Partnering is not the similar with joint venture or a strategic alliance which often requires a percentage of shared ownership between each side. Partnership may be thought of as a prior step to reach more complex relationship(s) between parties. Supplier collaboration is a type of partnering. The general rule is when logistics partnerships go beyond transactional exchange, partners share strategic information with one another, thus generating relationship-specific performance outcomes for each. Consistent with the relational perspective, flows of such information represent *information/ knowledge exchanges* between partners, and the resulting access to partners' strategic information represents *complementary strategic resources* (Klein & Rai, 2009).

THE PARTNERSHIP MODELS

The beginning of this chapter emphasized the meaning aspects of partnership concept. The remainder of this chapter, however, will highlight the various partnership models that can be used in the supply chain management and as a sectorial example; construction supply chain partnering will be given. The main purpose of the models is finding and explaining the stimulating factors of partnership formation and how to manage partnership relations (Tuten & Urban, 2001). According to Knoppen and Christiaanse (2007), the main criteria to decide formations of partnership include:

- Asset specificity
- Exchange uncertainty
- Frequency with which transactions reoccur

The Bensaou Model

Bensaou (1999) suggested a classification criterion of buyer-supplier relationships according to the dedication degree of the assets used to maintain and develop the partnership. These "dedicated assets" include the tangible assets purchased for the establishment and development partnerships such as the plant and equipment, and other assets such as personnel training and information sharing (Xu, Xiang, Zhao, & Li, 2012).

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The Bensaou model is based on his comprehensive study among three US and eleven Japanese automobile manufacturers. The purpose of the study is to provide assistance to senior managers who must answer the following two vital questions:

- Which governance structure or relational design should a firm choose under different external contingencies?
- What is the appropriate way to manage each different type of relationship?

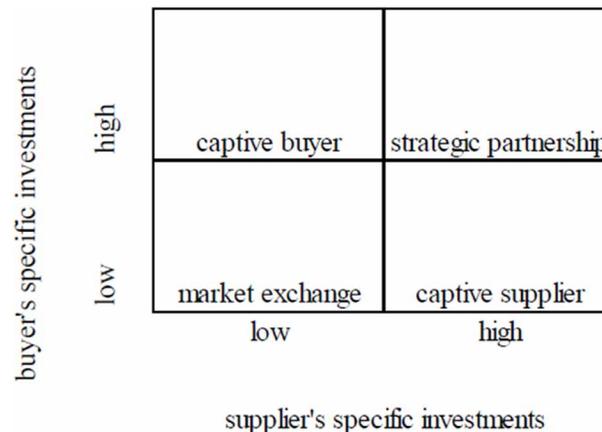
As seen in Figure 2, the model is represented via four generic cells with vertical and horizontal axes. While the vertical axis shows a buyer's specific investments which are tangible and intangible, the horizontal axis shows a supplier's specific investments. Tangible investments can be exemplified as buildings, tooling, and equipment dedicated to the supplier; and intangible investment is exemplified as people, time, and effort to learn suppliers' business practices. These are investments that are difficult or expensive to transfer to another relationship or that may lose their value when redeployed to another supplier or customer (Bensaou, 1999).

In the *strategic partnership* cell, both parties employ highly dedicated assets into the relationship, and these assets are called by practitioners as real commitment or tying their hands to each other. Mentzer, Min, and Zacharia (2000) additionally advocate that strategic partnerships should be exclusive and inimitable. In the *market exchange* cell, both buyer and supplier use general-purpose assets. Each party can easily shift to another business partner without barriers at low cost and minimal damage. The *captive buyer* cell refers to those asymmetric relationships in which the buyer is dedicated its assets and is held hostage by a supplier. Finally, in the *captive supplier* cell, the supplier sacrifices and makes tailored investments to sustain the business with customer (Bensaou, 1999).

The Cox Model

Cox (1996) offered a proactive approach as an effective tool to firms to recognize the boundaries of the firm based on analyzing relational competences. The firm boundaries need to change according to consumer preferences. Cox's approach offers to link competences, relationships, and asset specificity to procure a supply and value chain. Which type of external resource management should apply is one

Figure 2. The Bensaou's Model



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of the main tasks of Cox's (1996) work which stated that much of the discussion about purchasing and supply concepts is based on a theoretical and unscientific approach. According to Cox (1996), theoretical understanding of the firm and constructing a theory grounded scientific approach is needed. Procurement as a scientific discipline should be business and market process specific: predictive, abstractive, and theoretical.

To lay the foundations of procurement discipline, any discussion should start with transaction cost analysis of Williamson (1979) who analyzed internal structure and external boundaries of the firm with an emphasis on exchange rather than a system of production. According to Williamson (1979), make or buy decisions (vertical integration) is affected by degree of asset specificity which is arguable for strategic shifts, competitive conditions, and changing market conditions. Asset specificity can be defined as "in relation whether or not the specific skills or knowledge of the organization contribute to the maintenance or creation of sustainable positions for profit within specific supply and value chain" (Cox, 1996). Based on the definition the lower profit, the lower asset specificity is consistent with the degree of the contribution.

Cox (1996) presented a typology, a continuum and a stepladder of external and internal contractual relationships to explain efficient boundary of the firm. Based on the Cox's stepladder, contracts divided into two parts; external and internal. Three levels asset specificity described which are low, medium and high respectively. Finally, competences are classified as residual, complementary, and core. There are three main levels in Cox's stepladder to explain the following:

1. **Adversarial Leverage (Arm's length):** It represents adversarial relationships with low asset specificity and low supplier competences (residual competences) according to resource based theory. The contracts will be competitive, probably adversarial and external and based on market criteria.
2. **Partnership Relationship:** There are four steps, namely preferred supplier, single sourcing, network sourcing, and strategic alliances. This level varies from restricted number of suppliers (preferred) to negotiated single source relationships (strategic alliances). Medium asset specific skills lead to form partnerships due to need of complementary competences.
3. **Mergers and Acquisitions:** This level can be explained as the desire to vertical integration of the production of goods and services.

The Partnership Model by Lambert, Emmelhainz, and Gardner

Lambert, Emmelhainz, and Gardner (1996) developed their partnership model by analyzing 18 different case studies of relationships. Consequently, the study proved there is considerable confusion about not only the definition but also the use of partnership. When and with whom building a partnership is appropriate, and which type of partnership will provide the best outcome? While these questions are answered with the model, the model offers developing and managing partnerships systematically for the common good of both partners.

Lambert, Knemeyer, and Gardner (2004) stated that the model is comprised of four steps:

1. Examination of the drivers of partnership
2. Examination of the facilitators of partnership
3. Calibration of the components of partnership
4. The measurement of outcomes

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Lambert et al. (1996) classified types of relationships as the following:

- **Arm's Length:** Predominantly, relationships are arm's length because lack of joint commitment between the two sides. Arm's length relationship does not contain any tailored products or services contrarily standard procedures have been implying to anyone. It is the simplest exchange and at the end of the exchange relationship end without a trace.
- **Type I Partnership:** Partners recognize each other as a partner with a limited basis and short term focus. Type I involves only one division or functional area in each organization. Among all types the largest portion is type I partnership.
- **Type II Partnership:** This is a more sophisticated (from coordination to integration) relationship in which multiple functions involve in each organization with longer term focus.
- **Type III Partnership:** This is the least used type of partnering. Firms share high level of operational integration. A limited number of partnerships can be evaluated as type III.
- **Vertical Integration:** All organizations are interrelated in various configurations of supply chains. They are related by different supply chain structure and integration levels. Some organizations decide to do everything by themselves when purchasing other supply chain members or developing the analogical function within their organizations (vertical integration).

Lambert et al. (1996) developed their partnership model of business relationships in a supply chain. The model was especially designed as a developing tool to establish new partnerships and evaluates drivers, facilitators, and components that lead to the outcomes of partnerships via assessments. The partnership model has three main elements which are mentioned below (Lambert et al., 1996).

1. **Drivers:** Factors that encourage firms to enter into a partnership in other words drivers provide motivation to partner. Primary potential benefits (drivers) which lead firms to establish partnerships include *asset/cost efficiencies, customer service improvements, marketing advantage, and profit stability/growth*. Drivers must exist for both parties and must be strong enough to establish and sustain partnering (Lambert et al., 1996) work ensure an assessment guide for drivers which consists of four questions related to the aforementioned potential benefits.
2. **Facilitators:** Environmental factors that facilitate and support the growth and maintenance of a potential partnership. Facilitators of the partnership formation are: *corporate compatibility, managerial philosophy and techniques, mutuality, and symmetry*. To evaluate the facilitators, both parties should participate the assessment jointly these four areas and additional factors which is given.
3. **Components:** These are joint activities and processes that build and sustain the relationship and should be controlled throughout the partnership's life cycle. Components of partnerships include: (1) planning, (2) joint operating controls, (3) communications, (4) risk/reward sharing, (5) trust and commitment, (6) contract style, (7) scope and (8) financial investment. Regardless of type each of eight components evident in every partnership in some degree. While for Type 1 partnerships low level of component implementation is relevant, for Type 3 the implementation of components predominantly is appropriate.

Outcomes should also be discussed. If a partnership is established and managed properly superior performance for both parties should be reached. Profit enhancement, process improvements and increased competitive advantage are probable outcomes of an effective partnership. Having decided on

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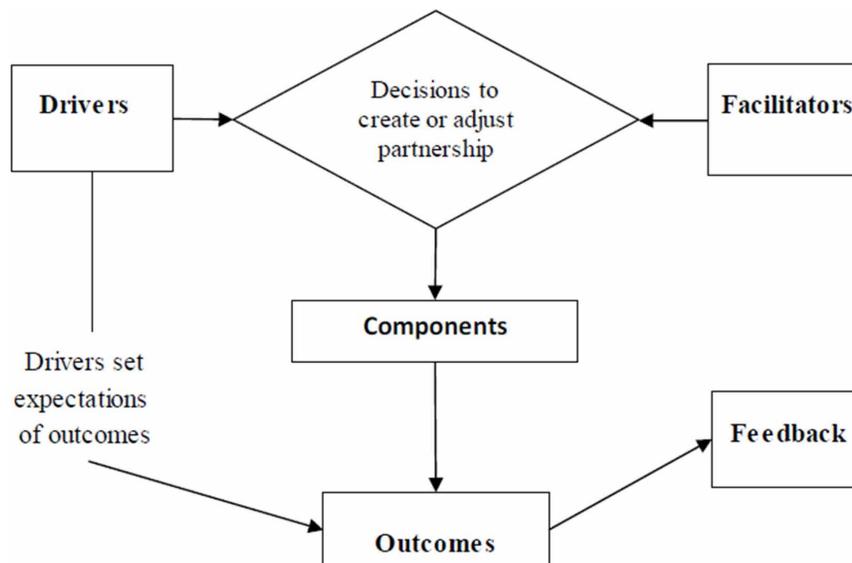
an appropriate type of partnership as mentioned above, both partners should run a self-assessment after that, suitable components are implemented (Lambert, Knemeyer, & Gardner, 2004). Outcomes are then determined (and evaluated) on the basis of the preceding factors (including the drivers, facilitators, and components). The graphical representation of the model is shown in Figure 3.

Liker and Choi Model

According to Liker and Choi (2004), two factors made “the cost” as a main criterion in supplier selection. First, companies are easily able to source globally. Then, the advent of internet based technologies make it possible to tender on cost efficiently; however, cost-based supplier selection damaged collaborative relationships and causes adversarial ones. Liker and Choi (2004) examined Toyota’s and Honda’s partnering models and found that while the two have different tools for partnering implementation, they also have similar structure. To explain the similar partnering system of the aforementioned Japanese producers, Liker and Choi (2004) organized a six step “*the supplier-partnering hierarchy*”.

1. Understanding suppliers’ way of working.
2. Developing from transactional arm’s length relationship to sharing opportunities.
3. Supervising the suppliers via ensuring feedbacks and helping to solve the supplier’s problems.
4. Developing the suppliers’ technical capabilities by developing a common lexicon, teaching problem solving techniques and innovation.
5. Sharing information by a systematic and structured way.
6. Conducting joint improvement activities such as kaizen projects and exchanging best practices.

Figure 3. Lambert et al’s (1996) partnership model



Partnerships in Supply Chain Management**STRATEGIC ROLE OF PARTNERING IN SUPPLY CHAIN MANAGEMENT**

Mohr and Spekman (1994) provided an inclusive list of theories to explain why firms enter into closer business relationships; namely, transaction cost theory, competitive strategy, resource dependence, political economy, and social exchange theory. Partnering has many forms such as among competitors or non-competitors (Ellram & Hendrick, 1995) which will change the engagement conditions. Being partners with competitors is called “coopetition”, which fundamentally means while collaborating with competitors, competition for market share exists.

Supplier partnerships refer to the cooperative and more exclusive relationships between organizations and their upstream suppliers and downstream customers. Today, many firms have taken bold steps to break down both inter and intra-firm barriers to form alliances, with the objective of reducing uncertainty and enhancing control of supply and distribution channels. Such alliances are usually created to increase the financial and operational performance of each channel member through reductions in total cost and inventories and increased sharing of information (Maloni & Benton, 1997).

The fundamental reason to collaborate is that a single company cannot properly compete by itself without inter-firm relations. Thus many firms seek to coordinate cross-firm activities and work mutually over time to produce outstanding performance. Firms enter into inter-firm collaborative arrangements in order to share all the benefits and burdens. The main objective is to reach higher performance than would be achieved by managing individually (Min et al., 2005).

For example, resource-dependence theory primarily emphasizes the opportunity side of securing external resources as a major motivation for firms to ally or acquire, while paying less attention to the risks involved in the process. In contrast, transaction cost economics has emphasized the cost side of transacting with external partners, while paying less attention to the opportunity side of distinct external technology and trust-based collaboration (Yang, Lin, & Lin, 2010). Hampson and Kwok (1997) emphasized strategic alliances to discover the reasons of firms to establish closer business relationships:

1. Efficiency creation through economies of scale specialization
2. Maximize use of facilities
3. Complementary capabilities
4. Growth and improvement in competitiveness
5. Beat competitors
6. Spreading financial risk and sharing costs

The other motives for any partnership formation are cost minimization and speed to market (Boddy, Macbeth, & Wagner, 2000). According to transaction cost economics, firms form partnerships to reach the efficiency or minimization of transactions cost. The resource-based view claimed that firms may establish any collaborative relationship to gain access to other firms’ resources and obtain resources they lack and which are valuable and essential to achieving competitive advantage. Inter-firm partnering relationships or, in other words, flow of resources among organizations, can generate growth and will improve current competencies of interested parties. Resources or assets can be tangible or intangible. For instance, when knowledge is lacking as intangible asset collaborative relationships could be the remedy (Das & Teng, 2000).

The other perspective on alliance formation is that alliances are formed for sociological, structural or strategic reasons. Especially new firms prefer establishing partnerships with other companies in order to

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facilitate entry and acceptance into an industry. Alliances may be used to create legitimacy, reach better social status, and recognition (Beekman & Robinson, 2004). Pryke (2009) stated that SCM is inextricably linked with partnering, but whether partnering creates the need for SCM or vice versa is debatable. Partnership formation is vital in supply chain operations and, as such, for efficient and effective sourcing. Partnership maintenance is no less important. Performance evaluation of buyers or suppliers is simply not enough relationships must be evaluated (Gunasekaran, Patel, & McGaughey, 2004).

Strategic supplier partnerships will:

- Improve quality enhancement both part and operations
- Eliminate waste
- Improve time efficiency
- Reduce inventory
- Improve innovation
- Speed up product development cycles
- Improve efficiency of asset
- Make advantage of customer service marketing
- Make profit stability growth
- Reduce input costs
- Increase stability in core business
- Improve core capabilities to gain more business
- Improve cost competitive among other suppliers
- Make more security of supply
- Add value for customer
- Reduce duplications

While partnership creates a synergistic business environment in supply chain, there are also some limitations. Chan and Chan (2005) itemized the most important barriers in the supply chain partnering:

- Underestimating the scale of change that partnering involves
- Underestimating the chaos surrounding partnering
- Priority conflicts left unresolved
- Over-reliance on good interpersonal relations
- Cost, benefit, and value adding models not defined.

QUALITY OF PARTNERSHIP

The success of outsourcing is defined as the quality of the partnering. Lee and Kim (1999) defined partnership quality as how well the output of collaboration became matches the participant's desire. Latham (1994) stated that the main motivation of partnering success is caused by endless improvement and the making the long-term agreement with both part of the partners. Over performance qualities partnerships with partner are more flexible to adapt to unexpected changes identify and find solutions to organizational

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problems, and minimize monitoring costs, all of which increase the economic outcomes (Ryu, Park, & Min, 2007). Clear common vision and goals for partnership can be also termed as a partnership quality (Lee & Kim, 1999).

In recent years, most researchers try to answer to how the quality of partnership between the firms and their suppliers influences the supply chain performance. Davis (1993) and Lahiri and Kedia (2011) stated that regarding performance qualities, both sides of partnering leads to maximized performance of the supply chain. Many techniques can be used to measure supply chain performance, but the most commonly used metrics include time, cost, quality, and other supporting metrics. A good partnership quality should be obtained using these performance metrics. Dyer (1996), Fyness et al. (2004), Lado et al. (2008), and Srinivasan et al. (2011) found there is a positive relationship between partnership quality and supply chain performance. McFarlan and Nolan (1995) stated that many firms have been faced with the problems in forming and managing a successful partnership relationship with their participations.

Therefore, another important factor which affects partnership is quality. Bennett and Jayes (1995, 1998) argued that some factors can be dramatically improved supply chain collaboration. Grover et al. (1996) figured out the main three criteria (trust, cooperation and communication) which defined the relationship between partnering quality with outsourcing success. Lee and Kim (1999) examined those criteria with their magnitude. Based on their analysis, while participation, communication, information sharing and top management support criteria have positive influence with the quality of partnering, the mutual dependency and the age of relationship criteria negatively affected the partnering quality.

Zaheer and Venkatraman (1995) made a good partnership quality between the buyer and its partner based on the joint problem solving and fulfillment of promises and lengthy agreements. Lee (2001) found that information sharing is the key between partnership success and quality. Partnering is another way of implementing quality management by attempting to improve the communication flow in a project (Chini & Valdez, 2003). Lahiri and Kedia (2011) argued that benefits deal with like close partnerships between the partners may include satisfaction of customer, perception of courtesy and amends, customer reputation, relationship satisfaction, positive word-of-mouth, repeat transactions, and business continuity.

PARTNER SELECTION

Supply chain management is the synergetic effort of various channel partnership to build, apply, and control seamless value added processes to meet the expectation of the last customer. During the chain, horizontal collaboration is required between each partner to obtain competitive advantage in order to achieve targets. Despite the advantages gained by the partners from the application of partnering, coordination and integration of successful relationship in a complicate supply chain is a challenge. Design partnering may significantly raise the cost of variety if it is failure. Thus, partner selection is vital importance for the supply chain to reach its expected benefits. In order to generate the best partnership, it is essential to make compromise between subjective and objective factors.

Critical success factors as a few main criteria that are absolutely necessary to reach goals (Rockart, 1982). The concept of partnering also has some critical success factors that should be considered by the parties to maintain a successful partnership throughout its lifecycle. The extant literature has outlined many motivational factors that influence partnering decisions in a different manner. Geringer (1991) identified critical success factors in partnering into two important sections; partner- and task-related criteria. Partner-related criteria are specific to the reputation, past experience and style of the involved

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partners. Task-related criteria apply to the performance ability, capability, and resources needed by a partnership to achieve project success including technical knowledge, market contacts, complementary resources, and relations with local authorities (Geringer, 1991).

Tatoglu (2000) studied collaboration selection criteria using Geringer's typology that found the differences between partner-related and task-related selection factors. Angeles and Nath (2000) identified six critical criteria that may be used to select best partner alternatives, including strategic commitment, trading partner flexibility, joint partnering, readiness, infrastructure, and communications. A detailed literature review indicates that common factors can be seen in various research papers: mutual trust, win-win attitude, effective communication, financial advantage, management support, monitoring partnering process, coordination, creativity, flexibility and capability, and the desire to focus on core capability, achieve cost benefits, and obtain right information.

After determining the selecting criteria, firms should select the any multi-criteria decision making technique. In the 1990s, there was a very limited research based on mathematical or numeric decision-making methods on partnership selection. Evaluating current and potential partners is very important for firms. Partner's performance should be rated based on some factors with the common listed as performance, flexibility, quality, pricing terms, information coordination, and capability. Ren et al. (2009) developed a decision support system framework that evaluates and selects the business partnership.

According to the Institute of Supply Chain Management Intuition, there is one important evaluation model to evaluate partners: in the *Categorical Method*, firms build a decision maker team to categorize each partner's performance in specific areas defined by a list of relevant supply chain performance factors. The method is easy to implement but the evaluation scores are very personal. In the literature review, some researchers used critical success factors in their analytical modelling approaches to select the best partner. Analytic network process (ANP), data envelopment analysis (DEA), analytic hierarchy process (AHP), the technique for order of preference by similarity to ideal solution (TOPSIS), and the fuzzy versions of these methods have been receiving increased attention by the both researcher and firms. The AHP method was developed by Saaty (1980) to select and evaluate partners when multiple and sub-performance criteria are available. Yusuff et al. (2001), Tam and Tummala (2001), Mikhailov (2002), Muralidharan et al. (2002), Chan (2003), Chan and Chan (2005), Liu and Hai (2005), Chan and Kumar (2007), Hou and Su (2007), Aktepe and Ersoz (2011) are used to select partnering problems.

As seen in the critical success factors, most of the decision factors are subjective and qualitative. Thus, the decision maker can be faced with strength of his/her feelings while making pairwise comparisons in the AHP. Saaty (1996) generalized analytic hierarchy process model and developed the ANP for the decisions problems which some criteria can be interact with the other criteria. ANP gives more realistic results and provides different feedback in a decision system. Meade et al. (1997), Sarkis and Tarulli (2002), and Bayazit (2006) used the ANP to examine the strategic partnership relationship.

The TOPSIS method was first introduced by Hwang and Yoon (1981) to find the similarity of the ideal positive and negative solution from a finite set of points. The TOPSIS method considered all (the best and worst) alternatives simultaneously. Hosseinzadeh et al. (2007), Markovic (2010), Chen (2000), and Wang et al. (2009) decided the most preferable partner choice among all possible alternatives in actual business problems. Kasilingam and Lee (1996) developed a first mixed integer programming model which is cost-oriented. Talluri et al. (1999) developed a linear goal programming model to select the best partnership. Mathematical programming models are becoming increasingly attractive to select suitable partners in the supply chain such as those by Yu and Jing (2004), Wu and Olson (2008), Moghadam et al. (2008), Kheljani et al. (2009), Bhattacharya et al. (2010), and Lin et al. (2011).

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SUPPLY CHAIN PARTNERSHIPS IN THE CONSTRUCTION INDUSTRY

Supply chain partnership has been used in many industries to gain and sustain competitive advantage. The construction industry should take advantage of partnering as well as the production and service industry. While manufacturing firms are permanent and continuing organizations over time, the construction industry has a temporary operational nature and is project-based. The uniqueness and temporariness of construction projects make it difficult to establish sustainable, cohesive, and vertical relationships and collaboration between supply chain parties. This industry essentially requires development of specific supply chain solutions such as partnering because project-oriented approaches interfere with the application of contemporary SCM techniques.

Traditionally in the construction industry, main contractors prefer outsourcing tasks which are not their core competencies. In this respect, the construction contractors and subcontractors have usually demonstrated opportunistic behaviors to compensate and try to recover from unacceptably low tendered profit margins. Unfortunately, most of the construction industry firms did not perceive the drawbacks and disadvantages of this approach. To remedy the problems created with these adversarial behaviors, waves of partnering and reforming in the construction industry have been studied by many researchers (e.g., Koçtaş & Tek, 2013). According to Eriksson (2010), partnering should be used in complex and customized projects with fuzzy environment situation and long-time interval coupled with negative time pressure. This means small, one-off and simple projects are not worthy any partnering arrangements and efforts between parties. Partnering is an approved approach to construction project management (Koraltan & Dikbaş, 2002).

The main motive behind construction partnering is to maximize the performance of a construction project using a partnering relationship in which the better value is preferred rather than minimum cost. These principles have been using for many decades predominantly in the manufacturing and automotive industries. The USA acknowledged these principles and transferred them successfully into the construction industry during the period 1970-1980. Latham's (1994) report, *Constructing the Team*, and Egan's (1998) report, *Rethinking Construction*, dramatically affected the construction industry in the United Kingdom and revealed the inefficiency of the construction industry compared to other sectors.

Root causes for the reasons for economic and managerial inefficiency have been directed to the fragmented nature of the industry, the uniqueness of construction as a product, the divorce between design and construction, the role of the consultants, and procurement methods (Naoum, 2003). Partnering is a relatively new organizational structure (Crowley & Karim, 1995) and according to Latham (1994) and Egan (1998), partnering could be a remedy for the ineffective and fragmented construction industry by improving procurement, equity, teamwork, and communication between chain members. Partnering in construction is often determined by good faith more clearly via simply handshakes rather than formal contracts (Lu & Yan, 2007).

Partnering was adopted as an effort to minimize or eliminate the opponent relationships between both sides involved in the any construction projects. Key elements of construction partnering through cooperation and teamwork include: commitment, mutual trust and respect, communication, equity, and joint problem resolution (Hong, Chan, Chan, & Yeung, 2012). Partnering is in contrast to adversarial relationships in construction and encourages better integration and cooperation between partners which are bounded by contract (Gadde & Dubois, 2010). Larson (1995) stated that 280 construction-partnered projects recorded outstanding performance in technical performance, controlling costs and customer satisfaction compared to projects which are executed in other ways. Lönngren, Rosenkranz, and Kolbe

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(2010) claimed that construction supply chains have a tendency to waste and inefficiency and establishment of strategic partnership can be a panacea. Naoum (2003) suggested that partnering helps improving productivity, lowering costs and providing better standards and time for construction.

CONCLUSION

Transaction cost economics (TCE) ensures theoretical concepts for supplier relationships. According to TCE, companies need to specify boundaries of the firm; in other words, they determine the “make or buy” or “cooperate” decision. For both make versus buy decisions, companies look outside their boundaries and establish collaboration with multiple supply chain members. The special name of that cooperation is called partnership during the supply chain. The success of each partner depends in part on the other partner, so partnership is extremely important for firms. This chapter suggests a strong relationship among partners to achieve two important objectives: maximize effectiveness while minimizing cost.

Additionally, supply chain partnership provides a panacea to integrate supply chain while gaining sustainable competitive advantage, reducing time, improving product/service quality, and focusing on core activities. We mentioned four different relationship models in this chapter. Each partnering models provides an insight to classify the relationships. In future work, empirical analysis of partnering relations should spread different industries and comparisons should be made. To summarize, partnership creates a synergistic business environment and that environment effect many factors. The goal of both sides is to maximize their benefit in terms of cost and customer satisfaction.

REFERENCES

- Aktepe, A., & Ersoz, S. (2011). A fuzzy analytic hierarchy process model for supplier selection and a case study. *International Journal Research Development*, 3(1), 33–37.
- Angeles, R., & Nath, R. (2000). An empirical study of EDI trading partner selection criteria in customer-supplier relationships. *Information & Management*, 37(5), 241–255. doi:10.1016/S0378-7206(99)00054-3
- Applegate, L., & Gogan, J. (1995). Electronic commerce: trends and opportunities. Harvard Business School Background Note (196-006), July.
- Bayazit, O. (2006). Use of analytic network process in vendor selection decisions. *Benchmarking: An International Journal*, 13(5), 566–579. doi:10.1108/14635770610690410
- Beekman, A. V., & Robinson, R. B. (2004). Supplier partnerships and the small, high-growth firm: Selecting for success. *Journal of Small Business Management*, 42(1), 59–77. doi:10.1111/j.1540-627X.2004.00097.x
- Bennet, J., & Jayes, S. (1995). *Trusting the Team: The Best Practice Guide to Partnering in Construction*. Centre for Strategic Studies in Construction Forum, Reading.
- Bennett, J., & Jayes, S. (1998). *The Seven Pillars of Partnering*. ICE Publishing.
- Bensaou, M. (1999). Portfolios of buyer-supplier relationships. *Sloan Management Review*, 40(4), 35–44.

Partnerships in Supply Chain Management

- Bensaou, M., & Venkatraman, N. (1995). Configurations of inter-organizational relationships: A comparison between U.S. and Japanese automakers. *Management Science*, 41(9), 1471–1492. doi:10.1287/mnsc.41.9.1471
- Bhattacharya, A., Geraghty, J., & Young, P. (2010). Supplier selection paradigm: An integrated hierarchical QFD methodology under multiple-criteria environment. *Applied Soft Computing*, 10(4), 1013–1027. doi:10.1016/j.asoc.2010.05.025
- Boddy, D., Macbeth, D., & Wagner, B. (2000). Implementing collaboration between organizations: An empirical study of supply chain partnering. *Journal of Management Studies*, 37(7), 1003–1017. doi:10.1111/1467-6486.00214
- Chan, F. T. S. (2003). Interactive selection model for supplier selection process: An analytical hierarchy process approach. *International Journal of Production Research*, 41(15), 3549–3579. doi:10.1080/0020754031000138358
- Chan, F. T. S., & Chan, H. K. (2005). The future trend on system-wide modelling in supply chain studies. *International Journal of Advanced Manufacturing Technology*, 25(7-8), 820–832. doi:10.1007/s00170-003-1851-3
- Chan, F. T. S., & Kumar, N. (2007). Global supplier development considering risk factors using fuzzy extended AHP-based approach. *Omega*, 35(4), 417–431. doi:10.1016/j.omega.2005.08.004
- Chen, C. T. (2000). Extensions of the TOPSIS for group decision-making under fuzzy environment. *Fuzzy Sets and Systems*, 114(1), 1–9. doi:10.1016/S0165-0114(97)00377-1
- Chini, A. R., & Valdez, H. E. (2003). ISO 9000 and the U.S. construction industry. *Journal of Management Engineering*, 19(2), 69–77. doi:10.1061/(ASCE)0742-597X(2003)19:2(69)
- Christopher, M., & Jüttner, U. (2000). Developing strategic partnership in the supply chain: A practitioner perspective. *European Journal of & Supply Management*, 6(2), 117–127. doi:10.1016/S0969-7012(99)00038-6
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386–405. doi:10.1111/j.1468-0335.1937.tb00002.x
- Cox, A. (1996). Relational competence and strategic procurement management. *European Journal of Purchasing Supply Management*, 2(1), 57–70. doi:10.1016/0969-7012(95)00019-4
- Crowley, L. G., & Karim, A. (1995). Conceptual model of partnering. *Journal of Management Engineering*, 11(5), 33–39. doi:10.1061/(ASCE)0742-597X(1995)11:5(33)
- Das, T. K., & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, 26(1), 31–61. doi:10.1177/014920630002600105
- Davis, T. (1993). Effective supply chain management. *Sloan Management Review*, 35, 46.
- Dyer, J. H. (1996). Specialized supplier networks as a source of competitive advantage: Evidence from the auto industry. *Strategic Management Journal*, 17(4), 271–291. doi:10.1002/(SICI)1097-0266(199604)17:4<271::AID-SMJ807>3.0.CO;2-Y

Partnerships in Supply Chain Management

- Egan, J. (1998). *Rethinking construction. The Report of the Construction Industry Task Force*. London: DETR.
- Ellram, L. M., & Hendrick, T. E. (1995). Partnering characteristics: A dyadic perspective. *Journal of Business Logistics*, 16(1), 41–64.
- Ellram, L. M., & Krause, D. R. (1994). Supplier partnership in manufacturing versus non-manufacturing firms. *The International Journal Management*, 5(1), 43–54.
- Eriksson, P. E. (2010). Partnering: What is it, when should be used, and how should it be implemented? *Construction Management and Economics*, 28(9), 905–917. doi:10.1080/01446190903536422
- Fitzgerald, G., & Willcocks, L. (1994, December 9). Contract and partnerships in the outsourcing of IT. *Proceedings of the Fifteenth International Conference on Information Systems*, Vancouver, British Columbia (pp. 1-98).
- Fynes, B., De Búrca, S., & Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, 10(4-5), 179–190. doi:10.1016/j.pursup.2004.11.003
- Gadde, L. E., & Dubois, A. (2010). Partnering in the construction industry: Problems and opportunities. *Journal of Purchasing and Supply Management*, 16(4), 254–263. doi:10.1016/j.pursup.2010.09.002
- Geringer, J. M. (1991). Strategic determinants of partner selection criteria in international joint ventures. *Journal of International Business Studies*, 22(1), 41–62. doi:10.1057/palgrave.jibs.8490291
- Gheidar Kheljani, J., Ghodsypour, S. H., & O'Brien, C. (2009). Optimizing whole supply chain benefit versus buyer's benefit through supplier selection. *International Journal of Production Economics*, 121(2), 482–493. doi:10.1016/j.ijpe.2007.04.009
- Grover, V., Cheon, M. J., & Teng, J. T. C. (1996). The effect of service quality and partnership on the outsourcing of information systems functions. *Journal of Management Information Systems*, 12(4), 89–116.
- Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, 87(3), 333–347. doi:10.1016/j.ijpe.2003.08.003
- Hampson, K. D., & Kwok, T. (1997). Strategic alliances in building construction: A tender evaluation tool for the public sector. *Journal of Construction Procurement*, 3(1), 28–41.
- He, Q., Gallea, D., & Ghobadian, A. (2011). Knowledge transfer: The facilitating attributes in supply-chain partnerships. *Information Systems Management*, 28(1), 57–70. doi:10.1080/10580530.2011.536114
- Hong, Y., Chan, D. W. M., Chan, A. P. C., & Yeung, J. F. Y. (2012). Critical Analysis of Partnering Research Trend in Construction Journals. *Journal of Management Engineering*, 28(2), 82–95. doi:10.1061/(ASCE)ME.1943-5479.0000084
- Hosseinzadeh, F. L., Allahviranloo, T., Alimardani, M., & Kiani, N. A. (2007). A New method for complex decision making based on TOPSIS for complex decision making problems with fuzzy data. *Applied Mathematical Sciences*, 1(60), 2981–2987.

Partnerships in Supply Chain Management

- Hou, J., & Su, D. (2007). EJB–MVC oriented supplier selection system for mass customization. *Journal of Manufacturing Technology Management*, 18(1), 54–71. doi:10.1108/17410380710717643
- Hughes, J. (2008). From vendor to partner: Why and how leading companies collaborate with suppliers for competitive advantage. *Global Business and Organizational Excellence*, 27(3), 21–37. doi:10.1002/joe.20201
- Hwang, C. L., & Yoon, K. (1981). *Multiple attribute decision making methods and applications*. Berlin, Heidelberg: Springer. doi:10.1007/978-3-642-48318-9
- Kasilingam, R. G., & Lee, C. P. (1996). Selection of vendors—a mixed integer programming approach. *Computers & Industrial Engineering*, 31(1-2), 347–350. doi:10.1016/0360-8352(96)00148-9
- Kaufman, A., Wood, C. H., & Theyel, G. (2000). Collaboration and technology linkages: A strategic supplier typology. *Strategic Management Journal*, 21(6), 649–663. doi:10.1002/(SICI)1097-0266(200006)21:6<649::AID-SMJ108>3.0.CO;2-U
- Klein, R., & Rai, A. (2009). Inter-firm strategic information flows in logistics supply chain relationships. *Management Information Systems Quarterly*, 33(4), 735–762.
- Knoppen, D., & Christiaanse, E. (2007). Supply chain partnering: A temporal multidisciplinary approach. *Supply Chain Management: An International Journal*, 12(2), 164–171. doi:10.1108/13598540710737343
- Koçtaş, Ö., & Tek, Ö.B. (2013). Construction supply chains: a proposal to develop a new conceptual model. *Proceedings of the XI International Logistics & Supply Chain Congress*. Kayseri & Cappadokia, Turkey.
- Koraltan, S. B., & Dikbaş, A. (2002). An assessment of the applicability of partnering in the Turkish construction sector. *Construction Management and Economics*, 20(4), 315–321. doi:10.1080/01446190210125554
- Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance improvement in the US. and Japanese automotive industries. *Strategic Management Journal*, 24(4), 293–316. doi:10.1002/smj.297
- Kraljic, P. (1983, September-October). Purchasing must become supply management. *Harvard Business Review*.
- Lacity, M. C., & Hirschheim, R. (1993). *Information systems Outsourcing: Myths, Metaphors and Realities*. New York: John Wiley and Sons.
- Lado, A. A., Dant, R. R., & Tekleab, A. G. (2008). Trust-opportunism paradox, relationalism, and performance in inter-firm relationships: Evidence from the retail industry. *Strategic Management Journal*, 29(4), 401–423. doi:10.1002/smj.667
- Lahiri, S., & Kedia, B. L. (2011). Co-evolution of institutional and organizational factors in explaining offshore outsourcing. *International Business Review*, 20(3), 252–263. doi:10.1016/j.ibusrev.2011.01.005
- Lambert, D. M., Knemeyer, A. M., & Gardner, J. T. (2004). Supply chain partnerships: Model validation and implementation. *Journal of Business Logistics*, 25(2), 21–42. doi:10.1002/j.2158-1592.2004.tb00180.x

Partnerships in Supply Chain Management

- Lambert, D. N., Emmelhainz, M. A., & Gardner, J. T. (1996). Developing and implementing supply chain partnerships. *The International Journal of Logistics Management*, 7(2), 1–17. doi:10.1108/09574099610805485
- Larson, E. (1995). Project Partnering: Results of study of 280 construction projects. *Journal of Management Engineering*, 11(2), 30–35. doi:10.1061/(ASCE)0742-597X(1995)11:2(30)
- Latham, M. (1994). *Constructing the team: Final Report on Joint Review of Procurement and Contractual Agreements in the UK Construction Industry*. London: HMSO.
- Lee, J. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management*, 38(5), 323–335. doi:10.1016/S0378-7206(00)00074-4
- Lee, J.-N., & Kim, Y.-G. (1999). Effect of partnership quality on IS outsourcing success: Conceptual framework and empirical validation. *Journal of Management Information Systems*, 15(4), 29–61. doi:10.2307/249407
- Liker, J. K., & Choi, T. Y. (2004). Building deep supplier relationships. *Harvard Business Review*, 82(12), 104–113.
- Lin, C. T., Chen, C. B., & Ting, Y. C. (2011). An ERP model for supplier selection in electronics industry. *Expert Systems with Applications*, 38(3), 1760–1765. doi:10.1016/j.eswa.2010.07.102
- Liu, F. H. F., & Hai, H. L. (2005). The voting analytic hierarchy process method for selecting supplier. *International Journal of Production Economics*, 97(3), 308–317. doi:10.1016/j.ijpe.2004.09.005
- Lönngren, H., Rosenkranz, C., & Kolbe, H. (2010). Aggregated construction supply chains: Success factors in implementation of strategic partnerships. *Supply Chain Management: An International Journal*, 15(5), 404–411. doi:10.1108/13598541011068297
- Lu, S., & Yan, H. (2007). A model for evaluating the applicability of partnering in construction. *International Journal of Project Management*, 25(2), 164–170. doi:10.1016/j.ijproman.2006.09.009
- Lysons, K., & Farrington, B. (2012). *Purchasing and supply chain management* (8th ed.). Harlow: Pearson.
- Maloni, M. J., & Benton, W. C. (1997). Supply chain partnerships: Opportunities for operations research. *European Journal of Operational Research*, 101(3), 419–429. doi:10.1016/S0377-2217(97)00118-5
- Markovic, Z. (2010). Modification of TOPSIS method for solving of multi criteria tasks. *Yugoslav Journal of Operations Research*, 20(1), 117–143. doi:10.2298/YJOR1001117M
- McFarlan, B., & Nolan, R. L. (1995). How to manage an IT outsourcing alliance. *Sloan Management Review*, 35(4), 9–23.
- Meade, L., Liles, D., & Sarkis, J. (1997). Justifying strategic alliances and partnering: A prerequisite for virtual enterprising. *Omega*, 25(1), 29–42. doi:10.1016/S0305-0483(96)00034-5
- Mentzer, J. T., Min, S., & Zacharia, Z. G. (2000). The nature of interfirm partnering in supply chain management. *Journal of Retailing*, 76(4), 549–568. doi:10.1016/S0022-4359(00)00040-3
- Mikhailov, L. (2002). Fuzzy analytical approach to partnership selection in formation of virtual enterprises. *Omega*, 30(5), 393–401. doi:10.1016/S0305-0483(02)00052-X

Partnerships in Supply Chain Management

- Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Glenn Richey, R. (2005). Supply chain collaboration: What's happening? *The International Journal of Logistics Management*, *16*(2), 237–256. doi:10.1108/09574090510634539
- Mohr, J., & Spekman, R. (1994). Characteristics of partnership success: Partnership attributes, communication behavior and conflict resolution techniques. *Strategic Management Journal*, *15*(2), 135–152. doi:10.1002/smj.4250150205
- Moore, C., Mosley, D., & Slagle, M. (1992). Partnering guidelines for win-win project management. *Project Management Journal*, *22*(1), 18–21.
- Morrow, J. L. Jr, Hansen, M. H., & Pearson, A. L. (2004). The cognitive and affective antecedents of general trust within cooperative organizations. *Journal of Managerial Issues*, *16*(1), 48–64.
- Muralidharan, C., Anantharaman, N., & Deshmukh, S. G. (2002). A multi-criteria group decision-making model for supplier rating. *Journal of Supply Chain Management*, *38*(4), 22–33. doi:10.1111/j.1745-493X.2002.tb00140.x
- Myhr, N., Robert, E., & Spekman, R. E. (2005). Collaborative supply chain partnerships built upon trust and electronically mediated exchange. *Journal of Business and Industrial Marketing*, *20*(4-5), 179–186.
- Naoum, S. (2003). An overview into the concept of partnering. *International Journal of Project Management*, *21*(1), 71–76. doi:10.1016/S0263-7863(01)00059-X
- Porter, L. W., Steers, R. M., Mowday, R. T., & Boulian, P. V. (1974). Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *The Journal of Applied Psychology*, *59*(5), 603–609. doi:10.1037/h0037335
- Premkumar, G. P. (2000). Interorganization systems and supply chain management. *Information Systems Management*, *17*(3), 56–69. doi:10.1201/1078/43192.17.3.20000601/31241.8
- Pruitt, D. G. (1981). *Negotiation Behavior*. New York: Academic Press.
- Pryke, S. (Ed.), (2009). *Construction Supply Chain Management* (1st ed.). Chichester: Blackwell Publishing. doi:10.1002/9781444320916
- Qrunfleh, S., & Tarafdar, M. (2013). Lean and agile supply chain strategies and supply chain responsiveness: The role of strategic supplier partnership and postponement. *Supply Chain Management: An International Journal*, *18*(6), 571–582. doi:10.1108/SCM-01-2013-0015
- Rai, A., Borah, S., & Ramaprasad, A. (1996). Critical success factors for strategic alliances in the information technology industry: An empirical study. *Decision Sciences*, *27*(1), 141–155. doi:10.1111/j.1540-5915.1996.tb00848.x
- Ren, J., Yusuf, Y. Y., & Burns, N. D. (2009). A decision-support framework for agile enterprise partnering. *International Journal of Advanced Manufacturing Technology*, *41*(1-2), 180–192. doi:10.1007/s00170-008-1443-3
- Rockart, J. F. (1982). The changing role of the information systems executive: A critical success factors perspective. *Sloan Management Review*, *24*(1), 3–13.

Partnerships in Supply Chain Management

- Ryu, S., Park, J. E., & Min, S. (2007). Factors of determining long-term orientation in interfirm relationships. *Journal of Business Research*, 60(12), 1225–1233. doi:10.1016/j.jbusres.2006.09.031
- Saaty, T. L. (1980). *The Analytic Hierarchy Process*. New York: McGraw-Hill.
- Saaty, T. L. (1996). *Decision Making with Dependence and Feedback: The Analytic Network Process*. Pittsburgh, PA: RWS Publications.
- Sadeghi Moghadam, M. R., Afsar, A., & Sohrabi, B. (2008). Inventory lot-sizing with supplier selection using a hybrid intelligent algorithm. *Applied Soft Computing*, 8(4), 1523–1529. doi:10.1016/j.asoc.2007.11.001
- Sarkis, J., & Talluri, S. (2002). A model for strategic supplier selection. *Journal of Supply Chain Management*, 38(1), 18–28. doi:10.1111/j.1745-493X.2002.tb00117.x
- Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *The International Journal of Logistics Management*, 13(1), 15–30. doi:10.1108/09574090210806333
- Sousa, F. (2010). Business relationships and corporate nature and scope: a critical realist analysis. Saarbrücken, Lambert: Academic Publishing.
- Sousa, F. J. (2014). Boundary decisions of the firm: Make, buy, cooperate. *The IMP Journal*, 8(1), 13–21.
- Srinivasan, M., Mukherjee, D., & Gaur, A. S. (2011). Buyer-Supplier partnership quality and supply. *European Management Journal*, 29(4), 260–271. doi:10.1016/j.emj.2011.02.004
- Talluri, S., Baker, R., & Sarkis, J. (1999). A framework for designing efficient value chain networks. *International Journal of Production Economics*, 62(1-2), 133–144. doi:10.1016/S0925-5273(98)00225-4
- Tam, M., & Tummala, V. M. R. (2001). An application of the AHP in vendor selection of a telecommunications system. *Omega*, 29(2), 171–182. doi:10.1016/S0305-0483(00)00039-6
- Tatoglu, E. (2000). Western joint ventures in Turkey: Strategic motives and partner selection criteria. *European Business Review*, 12(3), 137–147. doi:10.1108/09555340010371809
- Todeva, E., & Knoke, D. (2005). Strategic alliances and models of collaboration. *Management Decision*, 43(1), 123–148. doi:10.1108/00251740510572533
- Tuten, T. L., & Urban, D. J. (2001). An expanded model of business-to-business partnership formation and success. *Industrial Marketing Management*, 30(2), 149–164. doi:10.1016/S0019-8501(00)00140-1
- Vieira, L.M., Paiva, E.L., Finger, A.B., & Teixeira, R. (2013). Trust and supplier-buyer relationships: An empirical analysis. *Brazilian Administration Review*, 10(3-2), 263-280.
- Wang, J.-W., Cheng, C.-H., & Huang, K.-C. (2009). Fuzzy hierarchical TOPSIS for supplier selection. *Applied Soft Computing*, 9(1), 377–386. doi:10.1016/j.asoc.2008.04.014
- Weigelt, C., & Miller, D. J. (2013). Implications of internal organization structure for firm boundaries. *Strategic Management Journal*, 34(12), 1411–1434. doi:10.1002/smj.2074
- Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law & Economics*, 22(2), 233–261. doi:10.1086/466942

Partnerships in Supply Chain Management

Williamson, O. E. (1975). *Markets and hierarchies: Analysis and anti-trust Implications: a study in the economics of internal organization*. New York: Free Press.

Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: Free Press.

Wu, D., & Olson, D. L. (2008). Supply chain risk, simulation, and vendor selection. *International Journal of Production Economics*, 114(2), 646–655. doi:10.1016/j.ijpe.2008.02.013

Xu, L., Xiang, W., Zhao, H., & Li, J. (2012). Supply chain partner relationships classification: An empirical study on Leg model. *Advanced Materials Research*, 468-471, 2341–2347. doi:10.4028/www.scientific.net/AMR.468-471.2341

Yang, H., Lin, Z. J., & Lin, Y. L. (2010). A multilevel framework of firm boundaries: Firm characteristics, dyadic differences, and network attributes. *Strategic Management Journal*, 31(3), 237–261. doi:10.1002/smj.815

Yu, X., & Jing, S. (2004). A decision model for supplier selection considering trust. *The China Business Review*, 3(6), 15–20.

Yusuff, R. D., Yee, K. P., & Hashmi, M. S. J. (2001). A preliminary study on the potential use of the analytical hierarchical process (AHP) to predict advanced manufacturing technology (AMT) implementation. *Robotics and Computer-integrated Manufacturing*, 17(5), 421–427. doi:10.1016/S0736-5845(01)00016-3

Zaheer, A., & Venkatraman, N. (1995). Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic Management Journal*, 16(5), 373–392. doi:10.1002/smj.4250160504

Chapter 11

Strategic Value Creation in a Supply Chain

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ABSTRACT

This chapter is designed to give the readers a concise understanding of supply chain strategies and the process involved in its formation. It is a background study on the changing role of supply chain in gaining competitive advantage for the firm. The chapter discusses on traceability and integration along a supply chain, its inception and the advantages to the corporate world through its implementation. The chapter focuses on the topic of value creation in a supply chain through strategic management decisions like vertical and horizontal integration. The value chain analysis model for competitive advantage is covered in this chapter. A discussion on the differences between vertical and horizontal integration systems and the best strategic decision among them is provided. The concepts of sustainable supply chain integration, traceability, and the limitations to their implementation have also been discussed. The best examples on practitioners of supply chain strategy and integration are provided along the chapter.

INTRODUCTION

Globalization and market fluctuations have created the need for flexible, responsive supply chain networks. Along with reducing operational inefficiencies, such supply chain designs also help in implementation of sustainability and traceability processes along the value chain. The vast advantages from its differentiation have molded supply chains into a strategic weapon for market competitiveness among firms. This chapter gives a summarized view on the process of strategic decision making for supply chain integration. The chapter further discusses corporate examples on supply chain designs for value creation.

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Strategic Value Creation in a Supply Chain

Learning Objectives

After reading this chapter, readers will be able to:

1. Trace the decision phases of value creation in supply chain
2. Understand the concepts of competitive advantage and value creation
3. Summarize the value chain model for competitive advantage
4. Identify the supply chain processes for differentiation
5. Familiarize with the concepts of horizontal and vertical integration
6. Understand the concept of sustainable supply chain integration and its limitations
7. Familiarize traceability in the supply chain and its limitations

BACKGROUND

We are currently in the era of supply chain-supply chain competition among corporates (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). Competitive advantage now depends on the ability of a firm to leverage the intelligence inherent in supply chain networks in order to transform existing business processes (Horvath, 2001). An optimized supply chain requires a certain level of information sharing and collaboration among enterprises. This requires the acknowledgement of the role played by all the stakeholders in a supply chain like transporters, distributors, customers, and suppliers (Sahay, 2003). Coordination forms, their complexity, and a firm's willingness to create long-run relationships with other actors in its supply chain all heavily affect the opportunities to collect and manage information.

Globalization and open trade policies have further complicated supply chain networks worldwide. Meeting of market demands and simultaneously assuring the quality of products require integration of the highest order along the supply chain. Strategic initiatives like traceability, horizontal, and vertical integrations help in supply chain integration and sustainable business operations. They also act as P-O-P (Points of Parity) for business differentiation in markets. The European Community regulation 178/20002 of the European Union (EU) defines traceability as "The ability to trace and follow a food, feed, food-producing animal or substance intended to be, or expected to be incorporated into a food or feed, through all stages of its production, processing and distribution" (Canavari et al., 2010, p. 172). Traceability is crucial for product recalls, especially in cases of contamination or product malfunctions. This requires the establishment of a transparent system within the supply chain and the use of tracking technology like RFIDs (Radio Frequency Identification) to support immediate product pull-offs from the markets. Traceability also plays a vital role in product quality assurance and sustainable management of resources.

While traceability concerns product responsibility, vertical and horizontal integration concentrates on streamlining the supply chain. Vertical integration is a major corporate level strategy that many companies use to gain control over their industry's value chain. Vertical integration differs from horizontal integration, wherein a corporate usually acquires, or merges with a competitor in the same industry. Both vertical and horizontal integration leads to monopolistic or even oligopolistic market development (Katie, 2013).

Traceability and integration models like vertical and horizontal integration are created based on future expectations of the market. Such initiatives ensure transparency across the entire supply chain and the industry as well as meeting quality specifications and adaptation of sustainability across the supply

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chain segments. The multi-format nature of industries and complexity of supply chains often reduce the speed of diffusion of these strategies across industries. There is a need to study the genesis of such supply chain strategies in order to select the most effective strategy for sustainable business development.

SUPPLY CHAIN MANAGEMENT

A supply chain (SC) consists of all parties involved in fulfilment of a customer request; namely, suppliers, manufacturers, transporters, distributors, retailers, warehouses, and customers. The end objective of every product/service supply chain is to generate profits through customer satisfaction. The integrated effort of all the above concerned supply chain parties to fulfil this mission is termed Supply Chain Management (SCM). Globalization and open markets across the globe necessitated the development of this synchronized effort by supply chain players. The term “supply chain management” was coined in 1982 by Keith Oliver who was a consultant for Booz & Company at the time. SCM derives its applicability from combining operations management, logistics, procurement, and information technology (IT) towards development of an integrated and efficient supply chain (Chopra & Meindl, 2010).

Lambert et al. (1998) state that SCM is the integration of key business processes across the supply chain, in order to generate value for stakeholders (including customers). Mentzer et al. (2001) argue that SCM could be defined either as a management philosophy, the implementation part of the philosophy, or as a set of processes. SCM is thereby described by Mentzer et al. (2001) as a strategic and systematic integration of business functions and strategies, with the intentions of long term performance of the business and viability of the supply chain. However, Svensson (2002) focuses on the philosophical aspect of SCM and describes it as a business that must address the bi-directional flow of resources and information between the players, at the tactical, strategic as well as operational level, from point or origin to point of consumption.

In layman terms, SCM can be defined as the coordinated involvement of organizations related by functions and activities, to produce and deliver a single product or service.

A typical supply chain comprises of the bi-directional flow of products, information and cash between customers, retailers, wholesalers, distributors, manufacturers, and raw material suppliers (Chopra & Meindl, 2010). The number of stages depends on the consumer needs and the roles played by the involved stages. The best example of a customer specified supply chain is Texas-based Dell Computers which has two supply chains – one for its corporate clients and individuals who prefer customized computers, and another for computer sales through retailers like Wal-Mart. For customized computers, Dell does not involve any distributors or wholesalers and deals personally with its customers. The supply chain is thereby all about maximizing the experience of customers and creating overall value. Successful supply chain management requires the implementation of supply chain strategies based on identified competitive advantage of firms over their competitors.

COMPETITIVE ADVANTAGE

A company is said to have competitive advantage, when an attribute or a group of attributes allow it to outperform its competitors. Porter (2004) defined competitive advantage in terms of lower cost and differentiation, and stated that strategic management should be linked with building and sustaining

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competitive advantage of a firm. Clulow et al. (2003, p. 221) state “a firm is said to have a competitive advantage when it implements value generating strategies which are unique to that industry”. Li et al. (2006) contend that competitive advantage is about the organizational capability to create a defensible position over its competitors.

In order to achieve competitive advantage, a firm must perform more value creation activities that generates greater overall value than its competitors. Competitive advantage relates to maximizing economies of scale in goods and services. Competitive advantage aids companies to not only outperform their competitors, but also to self-improve their performance along the way. Competitive strategies / advantage can be attained from cost leadership, differentiation, innovation, and operational effectiveness along the supply chain (Figure 1).

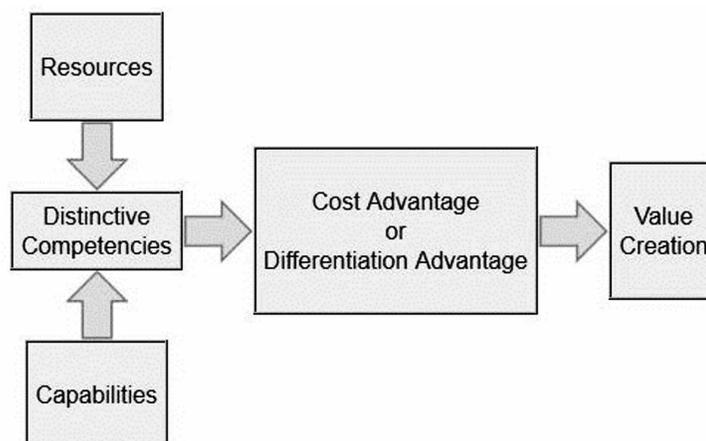
The five supply chain dimensions of resource, output, flexibility, innovativeness, and information have an effect on the competitive advantage of firms (Bratić, 2011). Gunasekaran & Yusof (2002) argue that responsiveness and effectiveness are critical to the competitiveness of a supply chain. High correlation was also found between responsiveness, time to markets, dependability, product quality, and innovation (Yusof et al., 2003). In order to achieve this, a closer inspection of the value chain of the industry is essential. This is supported by Kotler et al. (2003), wherein they stated that in order for a firm to be successful, they need to look for competitive advantage beyond its own operations and into the value chains of its suppliers, distributors, and customers.

VALUE CHAIN MODEL

In the extremely competitive markets of today, supply chains are competing against supply chains for competitive advantage. It is therefore necessary to incorporate competitive strategies into the value chain of a firm. Supply chain value is the difference between the worth of final product to customer and the costs borne by the supply chain to fulfil its customers' needs. Porter popularized the concept of value chain in 1985 and states that a value chain is a set of activities performed by a firm to create value from

Figure 1. A model of competitive advantage

Source: <http://www.jbdon.com/porters-sustainable-competitive-advantage-model.html>



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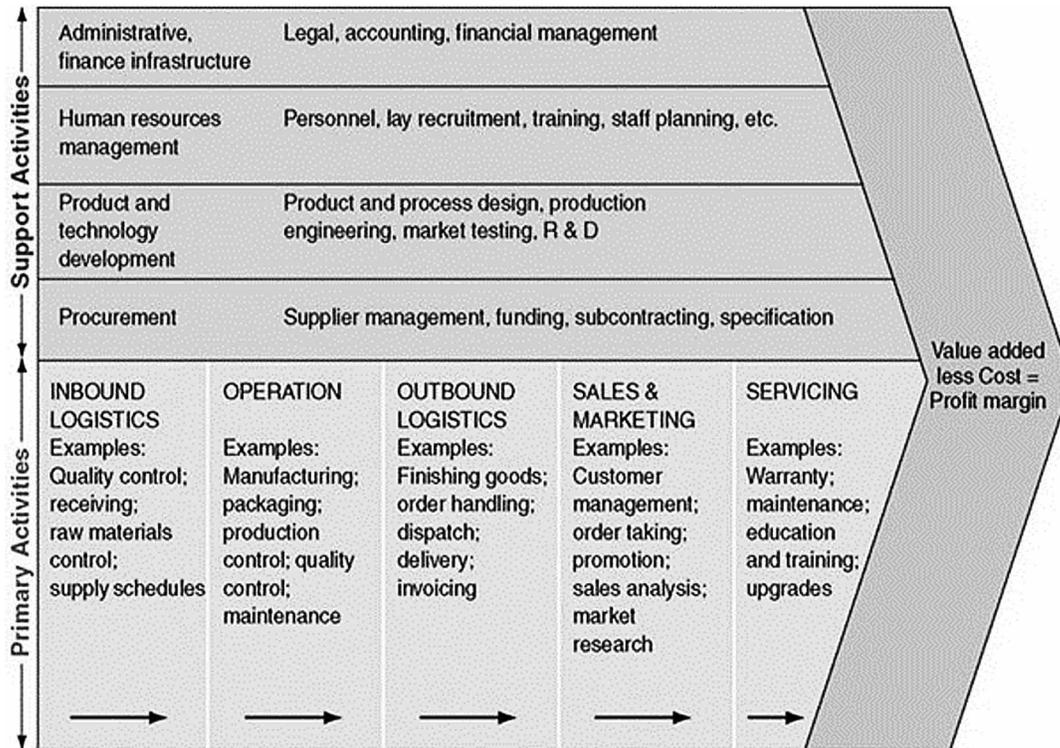
delivery of a product or service to the market (Porter, 2004). The competitive strategy paradigm Porter developed categorized the supply chain operations into primary and secondary activities. The activities of inbound logistics, operations, outbound logistics, marketing and sales, and services were classified as primary activities, while procurement, human resource management, infrastructure, and technology development were grouped as support activities (Figure 2).

A value chain starts with the development of a new product which is marketed and publicized based on the customer needs that will be satisfied by this product. The results of marketing are re-assessed before starting the operations to create the actual product. Distribution deals with customers meeting the products, while service looks into customer requests during and after sales. The secondary functions facilitate functioning of the value chain. Value chain analysis (VCA) is the strategy tool wherein a firm identifies the primary and support activities that adds value to the final product and analyzes them to either reduce costs (Figure 3) or increase differentiation (Figure 4). The VCA is especially useful in the automobile manufacturing and chemical processing industries, wherein the interdependencies are sequential and tasks are conducted sequentially.

The value chain concept is not restricted to firms and can be applied to entire supply chains and distribution networks. This series of value chains of the firm’s suppliers, the firm’s distributors, the firm’s buyers, and the firm itself is collected termed the ‘Value system’. The firms can combine the value chain model with other models in order to identify the areas for improvement. For instance, the SWOT analysis (Strength-Weakness-Opportunities-Threats) of any of the value chain functions could give a better

Figure 2. Porter’s value chain

Source: <http://www.mbaskool.com/business-concepts/marketing-and-strategy-terms/2516-porter-value-chain.html>



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Figure 3. Using VCA for cost advantage

Source: Adapted from <http://www.strategicmanagementinsight.com/tools/value-chain-analysis.html>

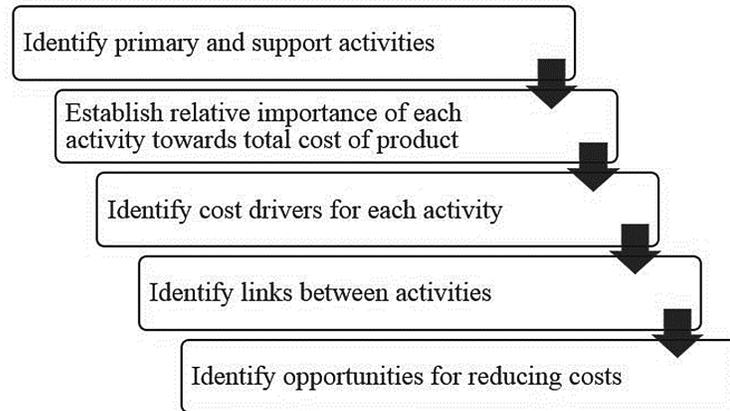
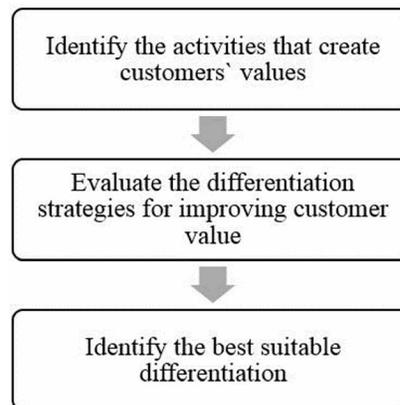


Figure 4. Using VCA for differentiation advantage

Source: Adapted from <http://www.strategicmanagementinsight.com/tools/value-chain-analysis.html>



understanding of the opportunities and threats to the firms. Other supply chain models like the Supply Chain Operations Reference (SCOR), and the Value Reference Model (VRM) have been developed to assess the supply chain performance, and value process guiding frameworks respectively (Nassar, 2011).

The value chain focuses on close relationships between the functional strategies within a firm, as each function is crucial to value creation. Therefore, selective implementation of strategies across functions is not going to lead to uniform surplus or value creation, nor customer satisfaction. A product development strategy focuses on new product development, while a marketing and sales strategy focuses on market segmentation, product positioning, pricing, and promotion. A supply chain strategy determines the nature of procurement, manufacture, transportation, distribution, and follow up services along the value chain. It is the pattern of decisions taken up on supplier and customer management, based on product sourcing, capacity planning, demand, communication and delivery of products (Salam, 2005). Supply chain strategy not only explains the operations to be taken up by firms but also the roles to be played by

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the involved entities. It is a combination of logistics, operations, and supplier strategies. Supply chain design decisions related to inventory management, transportation, operations, and information flow also comes under supply chain strategy.

For instance, Amazon's decisions to use warehouses and distributors for different products and Dell's decision to sell their computers through retailers' post 2007 are part of their supply chain strategies. All supply chain strategies are therein created with the intention to create supply chain value and involves decision making phases and processes.

DECISION PHASES FOR CREATING SUPPLY CHAIN VALUE

The supply chain value is also known as *supply chain surplus* which is closely associated with supply chain profitability (i.e., the difference between the revenue from product sales and the costs across the supply chain). For the value / surplus / profitability of a supply chain, the single source of revenue is the positive cash flow from customers. Stabilization of supply chain value requires increase in the positive cash flow, with simultaneous reduction in the negative cash flow from cost activities. Thus, the decisions on management of these flows, and supply chain designs are key to the success of any supply chain. A successful supply chain requires a magnitude of decision-making processes behind the flow of information, products, and cash. All the decisions should be made keeping in mind the objective of supply chain surplus / value / profitability. Depending on the period and the frequency of each decision, the decision making process can be categorized into the three phases given below (Chopra & Meindl, 2010):

PHASE1 - Design or Strategy: In this phase, the supply chain is structured and designed to last for several years. The supply chain will be broken down and analyzed for its configuration, resource allocation, stages of supply chains, and its functionality. Strategic decisions on resource outsourcing, production, warehousing facilities, locations, transportation and other supply chain functions will be made based on the objectives of the company for customer satisfaction and supply chain value / surplus. This phase of the decision making process is critical, particularly since its` for a long term, and could be expensive to undergo modification later. Thereby, market uncertainty is often accounted for while making these decisions to prevent rigidity of the supply chain towards change.

PHASE 2 - Planning: Set for a time framework of up-to an year, this phase uses the supply chain configuration developed in Phase I as the basis for planning. At this stage, the goal for the decision makers is to increase the supply chain surplus / value within the constraints provided by the fixed configuration. The planning is initiated with demand forecast from different markets in the coming year. The decisions on location, production, inventory, marketing, price promotions, and other activities on the fixed supply chain are made based on this future demand prediction. Such pre-planning provides parameters on which the supply chain can function for the predestined short period. However, companies require uncertainty, market fluctuations, exchange rates, and competition parameters into their planning equation for successful execution of the operations. The flexibility of the supply chain as designed in Phase I can also be tested for optimized performance during this phase. Companies are therein in a position to establish operating policies for short-term planning.

PHASE 3 - Operations: The time frame here is either daily or weekly, with corporate decision making based on individual customer orders. By now, the supply chain configuration and operating policies have already been defined, and the remaining duty is to handle incoming customer orders in the most

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optimal manner. Order filling, inventory allocation for customer orders, delivery schedules, and stock replenishment are some of the supply chain activities on which decisions are made by companies at this stage. The main goal at this stage is to reduce uncertainty so as to increase performance.

The three phases are key to the success of a firm's supply chain since supply chain value is generated better by following the above three stages (Chopra & Meindl, 2010). The secret to the success of companies like Wal-Mart and Dell lies in their extensive supply chain management strategies based on the above three phases. These decision phases give a better understanding of the supply chain processes to firms in order to strategize for competitive advantage.

SUPPLY PROCESS DIFFERENTIATION

Supply chain strategies for competitive advantage and value creation are based on the basic concepts of supply chain processes. Any differentiation in the process or reduction in linkages, not only provides an edge to the firm, but also creates markets for its products. The supply chain processes across these SCM components could be explained in terms of its marketing outlook, and the cycle of movement of products across the players. The marketing outlook consists of the Push and Pull processes of marketing. While the pull process of SCM is initiated by a customer order, the push process is triggered in anticipation of customer orders. Therefore, the pull process is based on actual demand, while the push process is based on predicted demand. Dell is a perfect example of a push/pull strategy.

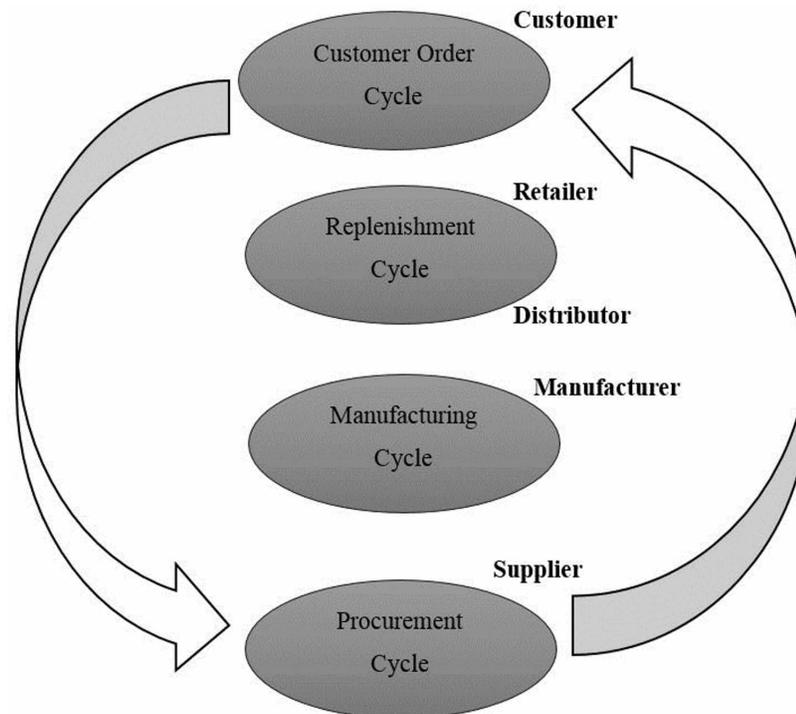
The customer order and manufacture system of Dell is an example of the pull process, wherein arrival of a customer order triggers the production process for the computer. However, the procurement process of Dell is a push process, with inventory replenished in anticipation of order. This allows Dell to streamline its supply process as per customer segments, and move its products faster down the supply chain.

The four main cycles of SCM include customer order cycle, replenishment cycle, manufacturing cycle, and procurement cycle (Figure 5). Each cycle occurs at the interface between two successive cycles, and need not include all the 4 stages in its supply chain. In the customer order cycle, the demand is external, and uncertain, while order placement is predicted based on policies in the other cycles. The scale of an order also differs across the order cycles. A cycle view of the supply chain specifies the role of every stage in the supply chain, making it a very useful tool for decision making.

The responsiveness and speed of a supply chain can only be increased by reducing the completion time of above cycles (Towill, 2002). Supply chain responsiveness is all about the management of product movement along the supply chain (Christopher, 1992; Vastag *et al.*, 1994; Christopher & Peck, 2004). Zara, an apparel brand with Inditex, Spain is an example of supply chain responsiveness based on reduced cycle period. The design-to-stock cycle of Zara is around four to six weeks, with is a far cry from the traditional six months in this industry. This reduced time period allows Zara to bring out new designs almost every week, and change its product catalogue every three to five weeks. The product outsourcing is based on certainty of the product design. The uncertain demands are outsourced within Europe, while the confirmed demands are outsourced to Asian locations. The main in-house productions also occur only after starting of the sales season, thereby confirming the trends for that season before production. This is possible only because of their reduced time cycle of production, which leads to reduced inventories and forecast errors. The responsiveness of the Zara supply chain to fashion trends has not only made it a leader in fashion apparel, but also a global example of supply chain decision making and flexibility.

Strategic Value Creation in a Supply Chain*Figure 5. Supply chain process cycles*

Source: <http://mandarmalshe.wordpress.com/2009/08/19/challenges-facing-logistics-and-supply-chain-management-in-slow-down/cycle-chain-view-of-scm-3/>

**SUPPLY CHAIN INTEGRATION**

In today's highly competitive market, the arrival of economic globalization, information technology, and global supply networks have pushed focus onto supply chains for performance efficiency. However, uncertainty in supply and demand, incomplete product life cycles, and complex product structures prevent supply chains from acquiring faster responsiveness and flexibility (Du, 2007). Supply chain integration (SCI) was designed to accommodate the competitive markets and their demands by increasing the flexibility and responsiveness of the supply chain. SCI is explained as the degree of integration between the firm, its suppliers, distributors / retailers, and customers (Stevens, 1989).

It is based on the pillars of trust, understanding, communication, and common goals between the partners along the supply chain. SCI is classified into two types, based on the integration of partners along the value and supply chains, namely vertical integration and horizontal integration.

Vertical Integration

Vertical integration (VI) is a strategy used by firms to increase their power over marketplaces through control of their upstream or downstream supply chain. This is aided by the coming together of parties with common objectives, working on pre-agreed standards, and following pre-decided reporting methods. The sharing of goals along SC creates better opportunities for maximization of efficiency, and costs

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reduction. This also leads to improved sustainability and secured distribution channels for the firm. Generally, a monopoly occurs when a single firm controls the vertical supply chain (Katie, 2013; Fan, Huang, Morck, & Yeung, 2014). When the entire supply chain is vertically owned by a single entity, it is called a vertical monopoly.

Two issues must be considered before integration; namely, costs and the scope of the firm. It is advisable for an organization to vertically integrate only when the costs of production can be reduced through monopoly. Simultaneously, the firm should also consider whether it is worthwhile to dilute its current competencies. Apple Inc. is an example of a vertically integrated company as it controls the elements of its products such as the processor and hardware designs, operating system, application software, and related cloud services. While the hardware is outsourced to be prepared per Apple specifications, the products themselves are directly sold to consumers through Apple's own brick-and-mortar and e-retail stores. This not only gives them the competitive advantage through monopoly, but also ensures product quality and delivery.

VI can be divided into three types based on its strategic location along the supply chain; namely:

1. **Forward Integration:** Focuses on VI along the downstream of a firm's supply chain. This strategy is implemented when the firm aspires to achieve higher economies of scale, and market share. Forward integration is most effective under situations wherein, the distributors and retailers are less in number, are unreliable, are unproductive, or the industry is growing rapidly, or the company is efficient enough to manage the downstream supply chain on its own. The apparel giant American Apparel is an example of forward integration. This company controls every stage of its distribution process, starting from warehousing and distribution through their factory to selling through their brick-and-mortar and e-retail stores.
2. **Backward Integration:** Focuses on VI along the upstream of a firm's supply chain. This strategy is implemented to secure and manage an efficient supply of resources for the firm. Backward integration is the most effective under situations wherein there is a limited number of suppliers but many competitors, inputs prices are unstable, higher profit margins for suppliers, current suppliers are inefficient and unreliable, or the company is capable enough to manage its upstream supply chain. The Indian petrochemical giant Reliance Inc. is an example of backward integration company. Reliance integrated backwards into polyester fibers from textiles, then into petrochemicals, and retail. The vertical portfolio of this company includes oil and gas production, refining, petrochemicals, synthetic garments, and retail outlets.
3. **Balanced Integration:** It is a combination of forward and backward integration, taken up to maximize the value creation throughout the firm's supply chain.

The type of VI used depends entirely on the company objective and capability for management. An ill-managed or ill-planned VI could not only lead to loss in resources, but also waste of time, confusion, productivity, and customers. The advantages and disadvantages of using VI are given in Table 1.

Horizontal Integration

Horizontal integration (HI) is the strategy used by firms to strengthen their position in the industry, through acquisitions, mergers, and hostile takeovers of their competing firms in the same value chain. When two similar sized and independent firms join together, it is called a Merger. While acquisition is

Strategic Value Creation in a Supply Chain*Table 1. Advantages and Disadvantages of VI*

| Advantages | Disadvantages |
|---|--|
| <ul style="list-style-type: none"> • Lower transaction costs • Less uncertainty • Strategic independence • Better positioning of local companies against foreign competition • Synchronization of supply and demand along the supply chain | <ul style="list-style-type: none"> • Increased costs to company to manage new activities • Chances of reduced efficiency and quality of products because of competition • Higher investments lead to reduced flexibility • Clash between new and old scopes of the firm, leading to confusion and disarray • Rigidity of organizational structure |

Source: Katie (2013)

the buying of another company, hostile takeover is the forceful acquisition of a company which does not want to be bought. HI leads to increase in the size of the strategic firm, with better product differentiation, larger economies of scale, reduced competition, and access to new markets. This situation results in oligopoly or monopoly, when many firms in the same industry follow HI strategy, leading to industry consolidation (Katie, 2013). HI is an effective strategy in situations wherein, the industry is growing, lack of skilled competitors, monopoly through HI has government support, the change in economies of scale through HI would be huge, and the organization is capable enough to manage mergers / acquisitions / hostile takeovers. The advantages and disadvantages of HI are given in Table 2.

Some of the most common examples of HI are PepsiCo's acquisition of Quaker Oats, HP's acquisition of Compaq, Kraft Foods' purchase of Cadbury, and Porsche's acquisition of Volkswagen. HI should be considered only by firms who have the monetary backing for mergers / acquisitions / hostile takeovers. Careful consideration should also be given to not dilute the scope of the firm since it might create disparity and disarray in its operations.

Vertical Integration or Horizontal Integration: Which is Better?

The decision to follow VI or HI totally depends on the company policy and value proposition. This is critical since the firm's decision will determine its operating strategy on supply chain designing, segmentation, and customer value proposition. The questions to ask are which model gives the best product? The best experience? Maximize availability? Best price? Excellent service? Support for customers? An understanding of the differences between VI and HI, and focusing on the key points mentioned above will help firms to finalize the better strategy out of the two. The differences between HI and VI are provided in Table 3.

Table 2. Advantages and Disadvantages of HI

| Advantages | Disadvantages |
|---|---|
| <ul style="list-style-type: none"> • Greater economies of scale leading to lower costs, and higher efficiency in operations • Increased product differentiation • Increased market power over its upstream and downstream partners • Reduced competition due to industry consolidation • Entry to new markets used by the acquired firms • Monopoly pricing | <ul style="list-style-type: none"> • Mergers and acquisitions don't add value to the companies. Often, the expected synergies don't materialize • Monopoly due to HI is highly discouraged by many governments due to price control, and lack of competition. This necessitates governmental approval before any large HI taking place. • The flexibility of the supply chain suffers due to sheer size of the operations, reduced introduction of innovations to market |

Source: Katie (2013)

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Table 3. Differences between HI and VI

| VI | HI |
|--|---|
| <ul style="list-style-type: none"> • More control due to control over upstream and downstream • Higher leverage due to increased benefits from success of a product • Collaboration is less rigorous • Maximum efficiency over flexibility • Higher risks, and disruptions • Increased capital requirement for finishing and distributing the product • Attitude is scarcity, meaning taking everyone else's share from the same value chain | <ul style="list-style-type: none"> • Less control due to dependency upon the upstream and downstream members • Leverage based on benefits from success of partners in the value chain • Requires frequent, open partner collaborations, and trust is critical to the success of this model • Maximum flexibility over efficiency • Lower, and mitigated risks • Decreased capital requirement since upstream and downstream functions are not controlled by single firm • Attitude is abundant, meaning helping upstream and downstream partners succeed, and compete with other value chains |

Source: Katie (2013)

HI, with more interaction among the supply chain partners, appears to be a more appropriate choice for business due to its collaboration-friendly setting. However, the selection of integration depends on the plans for the company. With sustainability becoming a standard of life, “green concepts” such as sustainable supply chain integration and traceability have become the competitive positioning strategies utilized by companies to capture the green consumer segments and markets. The supply chain strategies on integration and process differentiation are now being incorporated with the sole intention of sustainability across the value chain. Sustainable supply chain integration and traceability are being discussed in the following sections.

SUSTAINABLE SUPPLY CHAIN INTEGRATION

Sustainable supply chain management (SSCM) encompasses a set of sustainable logistics practices designed to include environmental parameters into the forward and reverse logistics supply chains. SSCM is defined as the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains (Carter & Rogers, 2008).

Another definition focuses on the critical difference between SCM and SSCM through the pillars of environmental and social aspects, stating SSCM as SCM with added values of environmental and social/ethical angles (Wittstruck & Teuteberg, 2011). The objective of supply chain sustainability is to create, protect and grow long-term environmental, social and economic value for all stakeholders involved in bringing products and services to markets. Sustainability is often measured in terms of the triple bottom line of economic, social, and environmental impacts, while supply chain sustainability is rated using social, ethical, cultural, and health footprints (SECH).

The increasing awareness among customers regarding SECH ratings and its' significance, combined with their involvement with Non-government Organizations (NGOs) and reaction to unethical companies has forced companies to ensure sustainability in their supply chain. Reducing packaging waste, supplier assessment for sustainable practices, development of sustainable products, reducing carbon footprint, compliance with eco standards and specifications are some of the practices of SSCM.

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SSCM consists of the five basic elements of sustainability metrics, sustainable suppliers, responsible design, socially-responsible partners and sustainability leadership. Sustainability measurement metrics are essential in order to prove value creation from SSCM, create opportunities to analyze reduction in consumption of resources across the supply chain. Responsible design and sustainable supplier are crucial to sustainable management of products. The presence of socially responsible partners will help businesses in successful implementation of SSCM across the supply stream. Sustainability leadership is essential to plan, execute and monitor the SSCM practices across the supply chain by all the supply chain players.

A successful SSCM requires integration of its upstream and downstream processes and the life cycle management of its products. Life Cycle Management (LCM) aims to lessen the environmental, social and economic impacts of a product during its life cycle and value chain. It is a management system for dissemination of collected information on the social, economic and environmental aspects of the product across its life cycle. LCM involves product information from its stages of product design, manufacture, distribution, consumption/usage, and end-of life. This information is beneficial for the value chain of the product with reference to resource efficiency gains, reduction in production costs, better relationship management, company image, and reputation. Voluntary standards, labels, product announcements further help customers in identifying the sustainability of products based on its life cycle assessment.

The proactive integration of social and environmental issues into its operations prevents corporate vulnerability to the fluctuating market situations. This requires the monitoring of operations along upstream of their supply chain, since the blame for the unethical operational practices of suppliers and sub-contractors on labour practices, impact to environment, chemical content, often falls on the company pursuing their services. The current policies and environmental regulations further necessitate downstream players to take preventive steps to avoid such situations. Furthermore, companies have started realizing the relevance of traceability, transparency and accountability of their operations for SSCM.

A sustainable system of purchasing policies would help the company to reduce liability risks with greater operating efficiency and also increase the innovative product development. In order to ensure sustainability along with profitability for the upstream and downstream players, the integration of sustainability practices and its monitoring across the supply network is crucial. The first step to sustainability integration along the supply chain is to select companies and suppliers based on their ethical and social code of conduct. Selection of a sustainable upstream player will greatly help towards ensuring sustainability across the supply chain.

Secondly, the value chain should be examined to ensure suppliers are provided with sufficient resources to fulfil their responsibilities sustainably. The promotion of social responsibility and sustainability across supply chain networks would help in getting necessary support groups for SSCM integrity. A peer network support for development of best methods to sustainability and opportunities will fasten its adoption across the business networks.

Lastly, suppliers and customers need to be treated fairly to ensure their commitment to sustainability, cooperation and loyalty. Integration of SSCM is not an easy task, but good relationship management, committed team, good metrics for monitoring operations and a committed top management will go a long way to ensure sustainability and profitability to the business. SSCM is important not only due to its role in environment efficiency and supply chain effectiveness, but also due to its competitive advantage through product and service positioning by many companies.

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TRACEABILITY IN THE SUPPLY CHAIN

Traceability refers to the process of identification of the movement of a product across the supply chain. This is primarily conducted in order to identify cost centers throughout the chain, to identify the implementation of sustainability, and for consumer verification of product claims authenticity. United Nations Environmental Program (UNEP) described traceability as:

The ability to identify and trace the history, distribution, location, and application of products, parts and materials, to ensure the reliability of sustainability claims, in the areas of human rights, labour, the environment, and anti-corruption. - UNEP (2014, p. 6)

Traceability requires the establishment of a system for accounting the trail of products from the suppliers until it reaches the end consumers. Within the context of sustainability, traceability is the verification of sustainability claims of the product and operations of that firm. Many global firms have implemented their versions of traceability systems for competitive advantage through product positioning. However, complex supply chains require the stakeholders to work together to trace commodities successfully across the supply chain. Such traceability schemes are called multi-stakeholder schemes, wherein all the stakeholders involved in the value chain process work together to implement the system for traceability.

This scheme, however, requires careful governance for coordinated implementation. Integration of traceability systems across the supply chains not only helps in uniform tracking, but also aid in identifying the value creation activities for further enhancement. It is the ultimate test of a new supply chain design for its sustainability, responsiveness, flexibility, and agility. The nature of movement of the produce, time lag, resources expended will all explain the advantages and disadvantages of the existing supply chain design, and will help in the decision making process on supply chain strategies for value creation (UNEP, 2014). There are three models of traceability commonly used in agriculture, which is based on their individual approach to trace the products:

1. **Product Segregation:** Implies that the traceable products have been physically separated from non-traceable products. Thus, it is implied that the end product is actually from a certifiable source. This model is especially important for organic produce, wherein segregation is a step in organic certification process. Other examples include the Marine Stewardship Council (MSC), Responsible Jewelry Council (Chain-of-Custody Standard), and the Better Cotton Initiative. Product segregation consists of two models namely, Bulk commodity and identity preservation. In bulk commodity, certifiable products from different sources are allowed to inter-mix throughout the value chain, while in identity preservation inter-mixing is prevented. However, identity preservation model is often criticized for being costly and labor-technology intensive.
2. **Mass Balance:** In this model, the certifiable and non-certifiable products can be mixed. However the exact volume of certifiable material entering the value chain, and the exact volume exiting it has to be controlled. This is done in case of products like cocoa, cotton, and sugar wherein segregation is difficult. The Forest Stewardship Council (FSC) follows the mass balance model for their FSC volume based system.
3. **Book and Claim:** Traceability is not sought along every stage of the supply chain, and only the information on volume of certifiable material at the beginning and end of the supply chain is nec-

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essary. Sustainability certification is provided to firms based on the volume of certified materials entering the supply chain. The Roundtable on Sustainable Palm Oil (RSPO) group follows the book and claim model for their book and claim system.

The seven steps to efficient implementation of traceability in the supply chain include:

1. Identify the key commodities to trace
2. Gain a full understanding of all the sustainability issues raised for those commodities and reason whether traceability is the solution.
3. Develop a business model for traceability, incorporating new supply chain designs
4. Undertake actions to move forward with traceability
5. Involve the internal stakeholders in changes to accommodate traceability within the firm
6. Involve with upstream partners to adapt traceability into their part of the value chain
7. Continue evaluation and assessment of traceability after its implementation, for future revival.

LIMITATIONS TO TRACEABILITY AND SUSTIANABILITY INTEGRATION

Though SSCM and traceability have received much hype in the business world, its universal acceptance as a core operational strategy remains in its infancy. Considering the role that both concepts play as strategies in today's competitive markets, it is imperative to understand and remove these limitations. Some of the common business issues reported by companies are listed below. The limitation to full supply chain implementation of sustainability includes:

- Complexity in metrics for sustainability measurement
- Lack of motivation of internal resources
- Lack of better guidelines for better implementation
- Lack of long term commitment of top management towards environmental and social pillars of sustainability
- In-compatibility of SSCM practices with the current business format.

Certain limitations prevent the achievement of full supply chain traceability:

- **Supply Chain Complexity:** It is difficult to trace product movement at every stage along a long and complex supply chain.
- **Availability and Scale of Certified, Traceable Products:** Limited expansion of traceability due to complexity of the supply chain has resulted in limited number of traceable products.
- **High Costs:** Traceability requires high investment in technology development and implementation. This is not cost effective for smaller firms, particularly the upstream partners in the supply chain.
- **Lack of Technological Development:** Current technology is neither sufficient nor cheap enough to be implemented across entire supply chains which are complex in nature and large in structure.

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SOLUTIONS AND RECOMMENDATIONS

Globalization in trade has resulted in diminished distances across oceans, inter-continental supply networks, and heavy competition. Today's competitive marketplace requires supply chains to be flexible, responsive, traceable, and sustainable. However, before redesigning their supply chains, companies must evaluate the key issues in their supply chains. Generally, the issues in SCM revolves around distribution network configuration, inventory control, distribution strategies, strategic partnering and integration, product design, information technology and decision support systems, and customer value. Only by analyzing these issues will firms be able to understand the actual faults in their supply chains to take actions which make them competitive.

With competition increasing between supply chains instead of between companies themselves, it is essential to establish multi-stakeholder working groups, advanced technological developments, superior supply chain designs, trust, commitment and strategies for each supply chain. This further requires a complete understanding of the process of supply chain decision making, cycles of product development and integrations. Collaboration is the only solution to value creation along the supply chain. The firms must have sufficient knowledge on the parameters to successful collaboration between supply chain partners and the limitations to its success is essential before venturing into the process.

A combined utilization of the value chain model with the Triple Bottom Line (TBL) model of sustainability will help in giving each supply chain a unique positioning in the market. Also, an array of new models like the supply chain index, and the five game changing technology trends of MIC² (Mobility, Integration, Complexity, and Competition) are coming up for analyzing and developing supply chain strategies. Therefore, it is now up to the firms to return to the basics and understand the limitations before implementing any supply chain strategies for competitive advantage.

FUTURE RESEARCH

There is the need for a united framework incorporating the stakeholder theory, value chain model, and SCOR, into the UNEP Global Compact Management Model to study how firms with superior supply chains arrive at strategic decisions, implement them and evaluate them for future corrections. This will not only prevent any confusion regarding metric selection, but also help companies to accommodate three issues simultaneously. Such a study could thereafter be adapted for implementation in the small and medium enterprises (SME) firms, wherein sustainability and supply chain strategies have limited applicability.

CONCLUSION

Competitive advantage and value creation has gone beyond product differentiation into operational differentiation and operational strategies. With growing global trade networks, it is difficult yet important to design supply chains which are flexible and responsive to different market situations. Supply chains can no longer be ignored and must be at the forefront of any differentiation and diversification strategies

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by a firm. Today, the decision making process on such critical elements involves time, money, attitude, and an understanding of the goals to be achieved. In order to remain foremost in the marketplace, firms must increase their value creation through reduction of costs, or differentiation, and also position their products and services based on market opportunities. It is up to the operations manager of a firm to understand the changes in the market and equipment the supply chain accordingly.

REFERENCES

- Bratić, D. (2011). Achieving a competitive advantage by SCM. *IBIMA Business Review*, 2011, 1–13. doi:10.5171/2011.957583
- Canavari, M., Centonze, R., Hingley, M., & Spadoni, R. (2010). Traceability as part of competitive strategy in the fruit supply chain. *British Food Journal*, 112(2), 171–186. doi:10.1108/00070701011018851
- Carter, R. C., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38(5), 360–387. doi:10.1108/09600030810882816
- Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning and Operation*. Hoboken, NJ: Prentice Hall.
- Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *International Journal of Logistics Management*, 15(2), 1–13. doi:10.1108/09574090410700275
- Christopher, M. G. (1992). *Logistics and supply chain management*. London: Pitman Publishing.
- Clulow, V., Gerstman, J., & Barry, C. (2003). The resource-based view and sustainable competitive advantage: The case of a financial services firm. *Journal of European Industrial Training*, 27(5), 220–232. doi:10.1108/03090590310469605
- Du, L. (2007). Acquiring competitive advantage in industry through supply chain integration: A case study of Yue Yuen Industrial Holdings Ltd. *Journal of Enterprise Information Management*, 20(5), 527–543. doi:10.1108/17410390710823680
- Fan, J. P. H., Huang, J., Morck, R., & Yeung, B. (2014). Institutional determinants of vertical integration in China. *Journal of Corporate Finance*. doi:10.1016/j.jcorpfin.2014.05.013
- Gunasekaran, A., & Yusuf, Y. Y. (2002). Agile manufacturing: A taxonomy of strategic and technological imperatives. *International Journal of Production Research*, 40(6), 1357–1385. doi:10.1080/00207540110118370
- Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management: An International Journal*, 6(5), 205–207. doi:10.1108/EUM00000000006039
- Katie, J. (2013). *A Report on Horizontal and Vertical Business Integration*. California: GRIN Verlag.
- Kotler, P., Ang, S. H., Leong, S. M., & Tan, C. T. (2003). *Marketing Management: An Asian Perspective*. Singapore: Prentice Hall.

Strategic Value Creation in a Supply Chain

- Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *International Journal of Logistics Management*, 9(2), 1–20. doi:10.1108/09574099810805807
- Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Subba Rao, S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, 34(2), 107–133. doi:10.1016/j.omega.2004.08.002 PMID:17876965
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Nassar, S. H. (2011). *Supply chain visibility and sustainable competitive advantage: An integrated model* [Unpublished doctoral dissertation]. University of Bath, United Kingdom.
- Porter, M. E. (2004). *Competitive Advantage*. New York: Free Press.
- Sahay, B. S. (2003). Supply chain collaboration: The key to value creation. *Work Study*, 52(2), 76–83. doi:10.1108/00438020310462872
- Salam, M. A. (2005, October 29-30). Achieving competitive advantage through managing supply chain excellence: The case of Thai garment industry. *Proceedings of International Conference on Computer and Industrial Management (ICIM)*, Bangkok, Thailand.
- Stevens, J. (1989). Integrating the supply chain. *International Journal of Physical Distribution & Materials Management*, 19(8), 3–8. doi:10.1108/EUM00000000000329
- Svensson, G. (2002). The theoretical foundation of supply chain management: A functionalist theory of marketing. *International Journal of Physical Distribution & Logistics Management*, 32(9), 734–754. doi:10.1108/09600030210452422
- Towill, D., & Christopher, M. (2002). The supply chain strategy conundrum: To be lean or agile or to be lean and agile? *International Journal of Logistics: Research & Applications*, 5(3), 299–309. doi:10.1080/1367556021000026736
- UNEP. (2014). A guide to traceability: A practical approach to advance sustainability in global supply chains. *United Nations Environmental Report*, 1-45. Retrieved from <https://www.unglobalcompact.org/resources/791>
- Vastag, G., Kasarda, J. D., & Boone, T. (1994). Logistical support for manufacturing agility in global markets. *International Journal of Operations & Production Management*, 14(11), 73–85. doi:10.1108/01443579410068657
- Wittstruck, D., & Teuteberg, F. (2012). Understanding the success factors of sustainable supply chain management: Empirical evidence from the electrics and electronics industry. *Corporate Social Responsibility and Environmental Management*, 19(3), 141–158. doi:10.1002/csr.261
- Yusuf, Y. Y., Adeleye, E. O., & Sivayoganathan, K. (2003). Volume flexibility: The agile manufacturing conundrum. *Management Decision*, 41(7), 613–624. doi:10.1108/00251740310495540

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KEY TERMS AND DEFINITIONS

Competitive Advantage: A condition that puts a company in favorable position relative to its competitors.

Downstream: Consists of distributors, retailers, and consumers.

Flexibility: Ability to efficiently and effectively accommodate to market changes.

Horizontal Integration: Acquisitions, mergers, or hostile takeovers of competing firms to strengthen their position.

Responsiveness: Ability to adapt to current market features, within a limited time period.

Strategy: Plan of action to achieve long-term goal.

Supply Chain Management: Streamlining the business supply side with intention of competitive advantage.

Supply Chain Value: difference between the worth of final product to customer and the costs bore by the supply chain.

Sustainability: The maintenance of practices and factors supporting environment conservation.

Traceability: Process of identification of the movement of a product across the supply chain.

Upstream: Consists of suppliers and producers.

Vertical Integration: Control of suppliers or distributors/retailers to control the supply chain.

Chapter 12

International Supply Chain Case Study

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ABSTRACT

The chapter aims to explore how some successful global firms organize and manage their supply chain activities at a global level. Three interlink areas of international supply chains including global production, global sourcing, and global distribution within three separate case-studies; Samsung's global production, UK Airbus's global sourcing, and Tesco's global distribution are examined in the chapter. The overall results highlight the importance of a holistic approach to international supply chain management. Findings from Samsung's smart phone production network and Tesco's global distribution suggest that firms are able to be successful when they exploit specific opportunities wherever they are located in the world. Whilst Samsung have been successful with keeping in-house production, Airbus are doing well with outsourcing. The Airbus case highlights the importance of risk management in global supply chains. All three cases demonstrate examples of benefits and challenges posed by knowledge sharing with partners in the supply chain.

1. INTRODUCTION

Globalization and the development of information and communication technology lead to an increasing influx of new players into every market. Companies continue to join the global playground, selling their products or services to, and purchasing their inputs from, the international market. Supply chain processes and functions are increasingly implemented by node companies from different countries. Material, information, and financial flows in a supply chain run through different geographical, cultural, and legal environments. Thus, supply chain management evolves into a new stage of global supply chain management.

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Compared to traditional supply chain management, global supply chain management is much more complex because of the following reasons. Firstly, global supply chains cover a much wider area. Logistics is conducted over long distances by a variety of modes of transportation between different countries and regions, across oceans and continents. Secondly, global supply chains involve transnational transactions that involve different time zones, natural environments, and social and economic environments. Thirdly, global supply chains are implemented in different contexts, involving companies operating under different legal systems, cultures, customs and conventions, languages, management styles, technologies, and equipment.

These characteristics lead to a number of risks and challenges in managing a global supply chain. Therefore, to effectively manage a global supply chain, a firm may need to apply strategies and management methods which are different from those that it uses in managing a domestic supply chain. However, there is a lack of literature addressing the strategic issues in managing a firm's supply chain activities which are conducted on a global scope. The literature strand in the field of logistics and supply chain management focuses on how supply chain activities are planned, implemented, coordinated, and managed within a firm level but does not consider the locations where supply chain activities occur.

The literature strand in the field of international business addresses the issue of locations for expanding business activities internationally but does not deal with the issue of how business activities are systemically organized and coordinated within a firm operating globally. The literature strand in the field of inter-firm relationship management addresses the question of how transactions between different actors along the chain of activities in the production, processing and distribution of products are conducted and governed (Gereffi et al., 2005). None of these literature strands is adequate to answer the question of how a firm should manage its supply chain activities which are implemented globally.

The chapter aims to explore how some successful global firms organize and manage their supply chain activities at a global level by employing a case study research strategy. Case study research strategy is a relevant methodology for the research aiming at answering the question "how", especially when a researcher has little control over events, and when the focus is on a contemporary phenomenon within a real-life context (Yin, 2003).

Following Eisenhardt (1989), we began as close as possible to the ideal of no preconceived theories or hypotheses to test but determined the research question prior to the research commencing. We selected three firms operating globally from three different industries including electronics, aerospace, and retailing in order to explore how the firms use strategies and management methods to manage their global supply chain in three key areas of global production, global sourcing, and global distribution.

The electronics industry is one in which production is conducted at a global level. Electronics components and parts are produced in some countries and assembled in different countries into finished products. Samsung Electronics was selected to explore how the firm manages its global production network. Similarly, aerospace is an industry in which procurement and sourcing are conducted at a global scope. Airbus UK was chosen to explore how the firm manages its global sourcing network. Retailing is an industry in which distribution expands globally. Tesco was opted for in order to explore how the firm manages its global distribution network. Our three cases qualify for "extreme situations and polar types in which the process of interest is 'transparently observable'" (Eisenhardt, 1989, p. 537).

We collected data from both secondary and primary sources. For secondary data, we obtained news reported by worldwide known newspapers including *Business Insider*, *Bloomberg* and *Wall Street Journal*. For primary data, we archived the company's documents from their official websites and conducted semi-structured interviews with managers from the case firms. Regarding Samsung Electronics, our interview

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were conducted in October, 2014 with two managers at Samsung Electronics factories in Vietnam who are familiar with the company's plans but asked not to be identified because of privacy. For Airbus UK, we collected our primary data via conducting two semi-structured interviews with the department of Engineering of the UK Airbus. The Chief Engineer and an Engineer of Airbus-A380 who were aware of the global sourcing strategies of the company shared their perspectives on the Airbus global sourcing and its challenges. For Tesco, primary data was collected from the corporate website of the organization.

2. SAMSUNG'S SMART PHONES PRODUCTION NETWORK

Facing fierce competition and rapidly changing market demand, a manufacturing company must continuously seek improvement in the way that it makes products. Keys to success lie not only in technology improvement but how to organize and manage a production network. We will explore how Samsung Electronics organizes and manages its global production network from three key angles: (i) how production processes are organized within Samsung Electronics; (ii) where their factories are located; and (iii) how their global production network are coordinated and managed.

2.1. About Samsung Electronics

Founded in 1969 as a division of the Samsung Group, Samsung Electronics started as a TV producer.

In the early and mid-1990s, the company began producing memory and hard drives for personal computers. Today, Samsung Electronics is a global Information Technology (IT) leader which consists of three main divisions: Consumer Electronics, IT & Mobile Communication, and Device Solutions. Each division is responsible for its own factories and assembly plants and there is no outsourcing of assembly (Samsung, 2013).

IT & Mobile Communication is Samsung's best income generator accounting for a total of 54% of Samsung annual sales in 2013 (Samsung 2014a). This is largely due to Samsung's mobile phones in a new position as a global market share leader. Since launching its first Android smart phone in 2010, Samsung Electronics' annual sales and operating profit have increased significantly. The phone is now in its fifth generation and regarded as one of the best smart-phones in the global market. This enables Samsung to boost its share in global smart phone market from 8% in 2010, to 19.9% in 2011, 30.4% in 2012, and 32.3% in 2013 (Samsung, 2013; Samsung 2014a).

However, in 2014, Samsung's sales figure in its Business Report 2014 Quarter 1 signals a declining trend in its mobile business. Rising to dominate the global smartphone market in the past four years, Samsung faces a tough battle where its flagship Galaxy S5 handset is not selling as well as the previous year's model; Chinese and Indian low cost rivals are eroding its market share; and Apple is moving toward large-screen premium phones.

2.2. Samsung's Asia Production Network

The success of Samsung's smart phone arises from its successful production network in Asia. Although Asia was not Samsung's first attempt in off-shoring production, it soon became a major destination for Samsung's direct investment. Samsung's earliest overseas production efforts were a Portuguese joint venture set up in 1982 and a US subsidiary founded in 1984. But after unsatisfactory results with

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US production, Samsung focused on establishing low-cost manufacturing plants in Asia, and Eastern Europe. Among Samsung's total of 37 production sites around the world, a total of 21 factories are in Asia (Samsung, 2014f).

Samsung's production network in Asia spread rapidly since 1989 when it opened a TV assembly plant in Thailand. Samsung's production in Asia ranges from components to consumer products, and has spread from Southeast Asia to China and India. Southeast Asia and China are Samsung's important sub-production networks with the two central nodes located in Singapore and Beijing. Samsung's operations in Southeast Asia initially focused on assembling consumer goods for exports. Samsung's factories established in South East Asia aim to utilize the low-cost resources and also to pursue some of the major customers for its components as well as access some of the world's most dynamic markets. The experience of its network creation in Southeast Asia undoubtedly led to the subsequent creation of other Samsung production networks in China and in Europe. Samsung's production presence in China and India is increasingly connected to marketing objectives. The firm has established ties with local partners, typically as a pre-requisite for market entry, in addition to establishing its own distribution channels in these vast markets.

Interaction between Samsung's two Asian sub-networks occurs through a flow of components sent from Malaysia to an affiliate in China and then Chinese-made components sent to Thai and Vietnamese subsidiaries. The key intermediary is the Singapore-based purchasing office which purchases and distributes a large amount of components among the Samsung affiliates and those from their Korea based components suppliers. Having built on the company's past history of Original Equipment Manufacturer (OEM) relationships with Japanese companies, Samsung's Asian networks are now the most important part of the Samsung global production network, supplying a considerable number of components to Samsung affiliates in Europe and America. For example, Samsung Electronics Thailand has supplied parts to Samsung Electronics in Europe, Brazil, and Korea (Kim, 1997).

Samsung's locally-oriented operations have achieved local and regional linkages between production and marketing activities. For design and product development activities, although Samsung Electronics has set up a number of research regional centers in its strategic markets, the Korea-based plants still play a central role in Samsung's regional technology network.

2.3. Samsung's Smart Phone Production

Most of Samsung smart phones have been made by Samsung's Asian production network. As a part of Samsung's production network, the production of Samsung smart phones is facilitated by its existing supply network of components and parts. The heart of the Samsung production network is its plant in its home country, Samsung Electronics Gumi, a multimedia complex in Gumi, Gyeongsang Province in South Korea. The Galaxy Samsung smart phones have been designed, extensively tested, and produced in Samsung Electronics Gumi (Business Insider, 2014). Samsung retains most of the process of producing its smart phones in-house. Unlike some of its rivals, Samsung is in the unique position of being able to control all aspects of its smartphone production from chips and screens to software and assembly. Samsung uses its own hardware components to produce its handsets, rather than sourcing them from third parties. Manufacturing of all components for Samsung handsets is conducted in Samsung's factories in Korea, Malaysia, and China (Samsung2010).

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Samsung's component strategy is the operational efficiencies gained by placing manufacturing facilities and R&D offices in the same plant (Samsung, 2014e). Key components including processors, to screen of Samsung smartphones have been developed in Samsung's manufacturing plants and research centers in South Korea and mass produced in Samsung factories in China. In 2010 when the first Samsung smart phone was launched, the major locations for assembling Samsung mobile phones were Korea, China, and Vietnam. The assembly point would depend on the volume required and the ultimate customer.

For products for most of the world, the assembly point would be Korea or Vietnam. This might be Seoul Comtech, Samsung Mobile Media Division, or Samsung Electronics Vietnam. For Chinese customers, the assembly point would be China. This might be either assembled at Tianjin Samsung Telecom Technology or Shenzhen Samsung Kejian Mobile (Samsung 2011, 2013b). For India customers since 2011, smart phones have been assembled in India by Samsung's factory located in Noida although most of the devices built in India stay within the country rather than being sold elsewhere (Samsung 2014d). Recently, Samsung has tended to shift most of its smart phone production base in China to Vietnam. In 2013, Samsung expanded an existing mobile phone assembly plant and is building another huge plant in Vietnam.

According to a manager at Bacninh factory of Samsung Electronics Vietnam, by the time the Samsung's second handset factory in Vietnam reaches full production in 2015, Samsung factories in Vietnam will be making more than 40% of the phones and may eventually produce as many as 80% of Samsung handsets. Components are transported from Samsung factories in China to Vietnam for assembling. Logistics for components are arranged through three key centers: Tianjin, Shanghai, and Hong Kong. Samsung Electronics expects "Vietnam to play the central role of global mobile-phone production. The company chose to invest in Vietnam because it is politically stable, has a good labor environment, and supports the industry.

The government is very proactive", said HyukJoong Kwon, Samsung Electronics' managing director, in an interview with Bloomberg (2014). "Samsung and its units will pay no tax for the first four years and half the full rate the following nine years" said Mr. Duong Ngoc Long, chairman of the local People's Committee in an interview with in an interview with Bloomberg (2014). Does Vietnam's location close to Samsung production bases in China and South Korea provide an extra incentive which stops Samsung from shopping around for low cost production base where tax breaks and cheap workers are offered?

In 2014, Samsung Electronics is considering producing smartphones in Indonesia. "Samsung has been discussing with the Government of Indonesia to produce smartphones to meet domestic market demand, so that local consumer needs can be met in an effective manner," said a Samsung spokesman in an interview with Wall Street Journal (2014). Will Samsung leave Vietnam and chose Indonesia as its major assembly site for smart-phones?

Currently, Vietnam remains a good location for Samsung's smart phone assembling. Vietnam is in strategic location in the marine route connecting East Asia to South East Asia, close to China, Thailand, and Malaysia where almost of components and parts for Samsung's smartphones are produced. It offers skilled labor at competitive cost and attractive tax incentives. Indonesia is further away from Samsung's supply network and key markets. Producing in Indonesia to serve Samsung other major markets will result in higher logistics cost than producing in Vietnam to serve Samsung major markets. Therefore, Samsung's likely move to open cell-phones assembly lines in Jakarta is most probably to avoid the Indonesian government's policy of imposing a high sale tax on luxury imported goods like smartphones rather than to reconfigure its global production network.

*International Supply Chain Case Study***2.4. Discussions of the Research Findings**

The strategies and management approaches which Samsung applied to organize and manage its smart phone production network which lead to its huge achievements in the period from 2010-2014 provide good implications for both the academic and managerial communities. Key literature in strategic management in 1990s (Porter, 1990; Barney, 1991) suggests that to stay competitive a firm should focus on high value added activities or core competences and outsource low value added activities or non-core competences. In the 2000s, a large number of firms in apparel and electronics industries have focused on design and product development and outsourced production to Asia. Samsung's major rivals such as Apple outsource the production of components and assembly of finished products but Samsung has been doing things differently.

Samsung is involved in the whole production process, from design, manufacture of components and parts to final product assembly. Due to its involvement at all stages of the production process, Samsung was therefore able to produce the display for Apple. Learning by producing components for Apple's smart phones, Samsung soon caught up with Apple in smart phone production and has then outcompeted Apple in terms of market share. Manufacturing enables Samsung to develop capability in producing different product lines. This is an important capability in the high tech industry because in this industry market demand changes rapidly, so the capability of doing different things enables the firm to quickly create different product lines, and avoid the risk of overproduction in one product line. Samsung's achievements prove that making, rather than outsourcing, is still an effective business model in consumer products manufacturing sector.

Setting up subsidiaries in low labour cost countries to produce components and assemble finished products helps Samsung to save production costs and also to have good control over its whole production process and technology knowhow. With vertical integration or hierarchical governance, Samsung takes full control of its subsidiaries. The risk of creating future rivals due to sharing technology knowhow with suppliers is negligible for Samsung because almost of components and parts are produced by Samsung's subsidiaries.

The success of Samsung proves that in the technology industry, hierarchical governance is an effective approach to govern production networks. The key determinant for Samsung's choice of governance method is the return on investment and degree of control over production network, rather than the determinants suggested by the key literature in Global Value Chains. Gereffi et al (2005) proposes that three factors, including the complexity of transactions, the codifiability of transactions, and the capabilities of suppliers required to a specific transaction, determines a firm choice of governance of its production network.

Samsung's choice of hierarchical governance is different from the verdict of Gereffi et al (2005) that a firm invests to set up subsidiaries to produce a product because product specifications cannot be codified, products are complex and supplier capabilities are low. Smart phones' specifications are codifiable and the capability of the supply base in Samsung's key production sites like China, Thailand and Vietnam is not low. Clearly, return on investment and degree of control over production network are critical determinants of firm choice of production network governance but are omitted by key literature.

The decision on locating production sites needs to be taken in conjunction with market expansion strategy. Samsung's choice of location for production investment is closely related to Samsung's market entry strategy. Among two strategies to configure a firm's production network suggested by Harrison and Hoek (2011) are "focused market" and "focused factories"¹. The Samsung case suggests that "focused market" not "focused factory" is an efficient strategy for configuring production networks when a firm

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wishes to distribute its products in highly protected markets. A firm should consider “focused market” strategy, setting up a factory in a local market to serve that market if a local government imposes high import duty on the firm’s products.

Samsung’s choice of location for investment lends a support for the eclectic paradigm also known as OLI model², a key theory of firm’s internationalization developed by Dunning (1988). All the countries which Samsung invested in setting up factories have location advantages including low wages, geographical positions, and special tariffs. By engaging in foreign direct investment rather than exporting or licensing, Samsung successfully blend two different motives including efficiency seeking and marketing seeking and effectively exploit their ownership specific advantages in these markets.

To keep production cost low, a firm needs to be open to the possibility of relocating a factory to a new location which offers lower production cost. With rising labour costs, China is no longer a low cost production site. By relocating an assembly factory from China to Vietnam, Samsung obtained production costs lower than the expenditures which its rivals have to pay to have their product assembled in China. The case of Samsung has much to contribute to our understanding how in reality a firm organize and manage its global production network. Outsourcing in which a lot of firms are involved is not the only wining solution. Setting up factories in the countries with location advantages of low cost labour and geographic position enables the firm to achieve high efficiency in the supply chain, contributing to the firm’s competitive advantages and market share improvement.

However, it provides a useful illustration of some of the opportunities and challenges that internationalizing organizations may face with regards to their distribution strategies, and demonstrate the importance of strategic fit between such strategies and the local environment in which the organization operates.

3. GLOBAL SOURCING IN AEROSPACE INDUSTRY: A380 AIRBUS

The continuous internationalization of trade and the phenomenon of globalization have made global sourcing available and appealing to the global industries. With regards to the upstream part of the supply chain, the need for better suppliers and the research into specific competences and concerns related to international competition have forced companies to improve their ability to cope with suppliers located in different countries around the world (Golini & Kalchschmidt, 2011). This is ‘global sourcing’ which is defined as the purchasing of goods outside the geographical area to which the company belongs (Kotabe & Omura, 1989, Murray et al., 1995a; Murray et al., 1995b). During the last two decades, the number of companies outsourcing to external suppliers increased drastically which, in turn, contributed to economic development.

It is argued by Rossetti and Choi (2005) that strategic sourcing integrates the buying firm’s strategic decisions with those of its key suppliers, promoting trust and decreasing transaction costs. However, the failure in setting an appropriate strategic sourcing strategy can be very costly as the sourcing influences other activities as production and inventory because of longer and more uncertain lead times in an international supply chain (Golini & Kalchschmidt, 2011). Thus, strategic sourcing promises productive relationships and improved capabilities. Purchasing from a foreign source is not different in any fundamental way from purchasing from a domestic source; for example, the same value for money objectives are pursued (Baily, Farmer, Jessop, & James, 1998).

Outsourcing has an effect on financial ratios, in a way, to increase return on assets and investment (ROA, and ROI, respectively). However, according to researchers such as Rossetti and Choi (2005), this

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does not occur due to the misapplication of strategic sourcing by focusing on short term perspectives, and dishonesty at OEMs. This case study aims to explore outsourcing in the Aerospace industry, in particular, within Airbus UK, one of the leading and successful global aircraft manufacturers. Thus, the case study endeavors to contribute to a better understanding of the challenges in implementing a successful outsourcing strategy within Aerospace industry by reviewing: i) a background of the UK Aerospace industry and Airbus; ii) buy or outsourcing strategy; iii) supplier selection; iv) risk management; and v) findings and managerial implications.

3.1. A Background of United Kingdom Aerospace Industry and Airbus

Over the last 60 years, the United Kingdom (UK) has developed a world leading position in the manufacturing and design of aircraft and wings. The UK Aerospace industry is the largest in Europe; a direct employer of more than 100,000 people; and a powerhouse within the UK economy, with a turnover of more than £20 billion a year. The UK Secretary of State for Business (2014) stated that “the UK aerospace industry is a big success story and is the top aerospace industry in Europe and a lead supplier to the world aerospace market”. The UK aerospace industry currently holds 17% of global market share, earning it the number one position in Europe and the number two position in the world. On the other hand, fuelled by population rises, increasing urbanization, greater market access and economic growth, especially in emerging markets, as well as environmentally efficient technologies, the global civil aerospace market is entering a period of unparalleled demand which will see the number of passenger aircraft in service more than double over the next 20 years.

According to the ‘Reach for the Skies Report’ (2014), through to 2030, the forecast global demand for civil aerospace stands at 56,700 aircraft, valued at US\$4.14 billion, a total of 27,000 of which will be 100-plus seat passenger aircraft (themselves worth US\$3.2 trillion). Average sector annual growth by 2030 is forecast at 4.8%, with much of this growth forecast to occur in Asia-Pacific, where 33% of world traffic is expected to take place by 2030. It is also forecasted that by 2020 there will be a global market for around 9,500 civil helicopters (worth around US\$50 billion). This shows sourcing strategy in manufacturing aircrafts needs specific attention.

3.2. Buy or Outsource

The above evidences illustrate the increase in aircraft manufacturing to respond to the demand in the market place. In addition, the next generation of aircraft will be based on radically different technologies, requiring new manufacturing processes and placing new challenges on the UK supply chain if it is to remain globally competitive. Thus, the UK aerospace industry needs to identify upcoming opportunities to broaden its base across the global market, selling to a wider range of aircraft and equipment manufacturers. This raises a question of where the equipment and structures are sourced from. Does the UK need to globally outsource these capabilities?

Johnson, Leenders, and Flynn (2011) contend that companies decide whether to ‘buy or outsource’ to get access to superior supply chain management expertise, technical expertise, and because outsourcing may open up markets for the firm’s products or services. On the other hand, Chopra and Meindl (2013, p. 442) argue that the decision to outsource is based on the growth in supply chain surplus provided by

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the third party and the increase in risk incurred by using a third party. Outsourcing should be considered by a firm if the growth in surplus is large with a small increase in risk. Performing the function in-house is superior if the growth in surplus is small or the increase in risk is large.

Airbus UK, which is a wholly owned subsidiary of Airbus SAS, produces wings for the airbus aircraft family. Airbus is capitalizing on 30 years manufacturing experience, to build the world's largest ever civil aircraft to date: the A380. Building on their previous experience, the final assembly process in Toulouse, South West France, has been further consolidated to provide an enormously advanced and more integrated and efficient assembly process. On the other hand, Airbus has set up a production line in both China and the USA and locally sources from these areas. However, prior to production, the make versus buy decision is always a challenge. Most of Airbus materials come from a limited number of Tier 1 suppliers who are capable of supplying lead systems and structures. They will have 2nd and 3rd Tier suppliers that fit into them.

3.3. Supplier Selection Strategy

In selecting suppliers, a firm must decide whether to use single sourcing or multiple suppliers. Single sourcing, according to Chopra and Meindl (2013) can secure the supplier's sufficient business when the supplier has to make a significant buyer-specific investment. Choosing single sourcing depends on the industry. For example, outsourcing is also used in automobile industry for parts such as seats that must arrive in the sequence production. Coordinating such sequence would be impossible with multiple sources.

According to the UK Chief Engineer of A380, "*the outsourcing for the structure side of Airbus aircraft A380 tends to not travel from afar but equipment can come from over the world*". Airbus is cautious in choosing the supplier, as some of Airbus's suppliers are suppliers of its competitors. For the A380, the landing gear system and the nose are sourced from Canada; however, parts of the landing gear come from Poland to Canada. The control equipment are sourced from Massier-Bugatti-Dowty, an Anglo French Company; valves are made by the Zodiac group which is a French corporation; the brakes, and aviation control system are outsourced from the US; and a lot of pumps and equipment are sourced locally from an English company because the UK aerospace industry is strong from a technology, supply chain and manufacturing perspective. In particular, the key capabilities are: advanced wing design, integration and manufacturing; advanced aero-engines; advanced power trains; landing gear systems; aircraft and engine control systems; advanced propeller systems; wheels and brakes; electrical power system; and high-tech Research & Development (R&D).

The four biggest suppliers for A380 are the USA, Canada, France, and the UK. These are four areas which have the biggest history in aviation. Airbus uses single source supply for most of the equipment and structure part of aircraft, for example titanium is outsourced from Russia. This can generate real concerns when global instabilities such as the crisis in Ukraine in 2013 happened - what would be the alternative? Airbus also tends to multi-source some parts (e.g., brakes) which are consumables and they can be sourced from different suppliers. Chopra and Meindl (2013) state that having multiple sources ensures a degree of competition and also lower risk by providing a backup should a supplier fail to deliver.

The main US suppliers of A380 are Honeywell, Goodrich, and Hamilton. Honeywell who is supplying up to US\$2 billion worth of equipment for the aircraft was selected to provide the next-generation air data inertial reference unit, along with the precoolers for the bleed air system, provided by Liebherr. A Goodrich subsidiary, Hella of Germany, was selected in the first two rounds of tenders to provide the exterior lighting systems. This new award will create potential sales for A380 of up to US\$4 billion.

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Hamilton Sunderstrand has signed a strategic partnership agreement with the parent company of Airbus, EADS. One of the main concerns for Airbus in selecting its suppliers is whether the supplier has the necessary employees, skills, capability, financial performance, a good track record, manufacturing capability, and suppliers' supply network to make sure that the product works when it is needed to be available.

On top of that is the cost issue which is slightly complicated because it is not always the main driver due to the fact that Airbus does not always buy from the cheapest supplier. They buy from someone whose overall package is sensible and suppliers who will provide support throughout the product life. Airbus strategy in this case is in line with Chopra and Meindl's (2013) argument that no matter what mechanism is used in supplier selection, the decision should be based on the total cost of using a supplier and not just the purchase price.

3.4. Risk Management in Sourcing

Chopra and Meindl (2013) argue that sourcing risks may lead to an increase in procurement costs, delay in meeting demand on time, or the loss of intellectual property. In particular in high tech industries such as aerospace, it is important to develop strategies to mitigate a considerable part of the risk. A supply chain with a single sourcing strategy can be vulnerable in on time delivery in the case of natural disasters or political instability and protest which can lead to the risk of supply disruption, for example, the case of earthquake and tsunami in Japan in early 2011. This kind of risk can be mitigated by multiple sourcing strategies (Chopra & Meindl, 2013). Given the high cost of developing multiple sourcing, this approach seems to be more appropriate for products with relatively high demand.

Intellectual property risk can be mitigated by bringing and keeping sensitive production in-house. For Airbus, the main risk in global sourcing has been associated with the Intellectual Property Rights (IPRs) so far. The UK Chief Engineer for A380 believes that *'although IPRs is owned by the company who designed the structure, however, it is a real concern in recent years as new players from emerging economies such as China and Russia started to build their aircrafts'*. Scholars such as Chopra and Meindl (2013) stated that even when production is outsourced, firms can maintain ownership of part of the equipment if it is viewed as having significant intellectual property value. This is a reason that some companies in automobile industry such as Motorola own some testing equipment at its contract manufacturers.

3.5. Discussion of Research Findings

This case study discussed the significant role of outsourcing and in particular global sourcing in international supply chain management. The case of the UK Airbus global sourcing was examined and its contribution to knowledge is building on the 'global sourcing' literature (Chopra & Meindl, 2013; Rossetti & Choi, 2005; Golini & Kalchschmidt, 2011). In particular, the result of this case study highlighted three important part of global sourcing (i.e., buy or sourcing strategy, supplier selection, and risk management in sourcing).

This study revealed that UK Airbus apply outsourcing in their business. It is argued by Johnson, Leenders, and Flynn (2011) that companies decide whether to 'buy or outsource' to get access to superior supply chain management expertise, technical expertise, and because outsourcing may open up markets

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for the firm's products or services. The findings of this study show that most of Airbus materials come from a limited number of Tier 1 suppliers who are capable of supplying lead systems and structures. Thus, the purpose of outsourcing for UK Airbus is to get access to expertise that matches the company's standards and needs.

Indeed, the results support Chopra and Mindl's (2013) argument that low-cost suppliers should be given large, steady orders of mature, low-value products that do not require significant engineering and design support, such as brakes, thus multiple sourcing can be adopted. In contrast, responsive suppliers should be responsible for high-value, volatile products which are often early in their life cycle and need significant engineering/design support, therefore, single sourcing is recommended. The results also emphasize the risk management of sourcing. Intellectual property rights were identified as one of the main risks in global sourcing. IPR is very much respected among the main competitors (e.g., Airbus and Boeing). However, the presence of new players from emerging markets such as Chinese aircraft manufacturers remains a big concern to the main players.

3.6. Managerial Implications

To date, global sourcing, strong innovation in advanced manufacturing processes, and underpinning capability in key product areas have helped to sustain UK competitiveness in the global aerospace market. However, the next generation of single-aisle aircraft will feature much greater use of composites or advanced metal not currently available in today's market (Reach for the Skies Report, 2014). This would remain challenging to procurement managers when it comes to decide on the suppliers' selection strategy from the main and new players in Aerospace industry.

Given that IPR is one of the risks in global sourcing, another crucial area requiring special attention from a manager's point of view is how to ensure that the knowledge that suppliers are built up with Airbus is not being used to help new competitors/new players. What are the implications of disregarding IPR to Airbus? Will this issue encourage managers to adopt local sourcing than global sourcing in Aerospace industry? Thus, the aviation industry is slightly an unusual business. It makes a product which is sold in every country on the planet and having a global supply chain is not surprising but rather challenging.

The contribution to knowledge of this research-based case study builds on the growing literature on international supply chain management and in particular to 'global sourcing'. The managerial implication of this case study contributes to a better understanding of how global sourcing has been practiced successfully by a global company such as UK Airbus. This can be a lesson to learn for other high-tech manufacturing industries that requires expertise and specific engineering design.

4. TESCO'S DISTRIBUTION NETWORK

Global distribution is concerned with how firms who operate internationally get products to market, and the channels which they select through which goods or services will move until they reach the end user (Waters, 2009). Clearly, organizations that make these decisions on a global scale face a much more complex environment than those organizations which operate domestically, as different countries will typically use different channels. In this section, we will explore the global distribution network of Tesco in order to consider three key points:

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- I. The expansion path that Tesco have followed
- II. Entry methods that have been used in order to access local distribution networks
- III. Challenges that Tesco have encountered with a particular focus on cultural differences.

This case has been constructed using primary data from the corporate website of Tesco, and secondary data from a range of resources, including financial statements and reports, industry reports, and news articles. Tesco is one of the world's largest grocery retailers, currently employing around 500,000 people across twelve different countries (Tesco PLC, n.d.). The retail giant, which was founded in the UK in 1919, has operated internationally since 1979 when it acquired a 51% controlling stake in Albert Gubay's Three Guys business in the Republic of Ireland (Palmer, 2005), and now has retail stores not just in the UK and Ireland, but also in India, Malaysia, South Korea, Thailand, Czech Republic, Hungary, Poland, Slovakia, Turkey, and China, with 65% of its total retail space now located outside the UK (The Guardian, 2011).

Since this first incremental expansion into a market which is both culturally and geographically close to its home market of the UK, Tesco have since demonstrated a greater appetite for risk, venturing further afield to markets which have much less in common with its domestic market and in doing so, have used a variety of different market entry methods and distribution channels. This case study will examine some of the market entry decisions which Tesco have made over the past 35 years. Not all of the entry decisions that Tesco have made have been successful; for example, in 2013 the company announced that it was withdrawing from the US market after the disappointing results of its wholly owned subsidiary "Fresh & Easy," after operating in the market for just six years. The failure of Tesco in the US market came swiftly after the organization's decision to exit Japan in 2011, just nine years after its acquisition of the C2 chain of small food stores.

4.1. Initial International Expansion

After operating a successful business in the UK for 60 years, Tesco's first international venture was into the neighbouring market of Ireland in 1979 via acquisition. The UK and Ireland have long been important trading partners, and at first glance the 51% stake which Tesco acquired in the Irish chain "Three Guys" seemed a logical first step into international distribution for the grocery retailer. The UK and Ireland share a similar culture (Hofstede, 2001), and the geographic proximity of the market meant that it was relatively unproblematic for Tesco executives to visit their new acquisition which should have facilitated knowledge transfer.

However, while the location for the international expansion may have been appropriate, analysts questioned the timing of the move, believing that it would have been preferable for Tesco to continue to focus on its domestic business given the challenging competitive environment the company faced in the UK (Palmer, 2005). Ultimately, the exercise was viewed as a distraction, and in 1986, after seven years operating in the Irish market, Tesco divested itself of its stake in Three Guys, meaning that the company was once again operating solely in its domestic market. Since then, Tesco made the decision to re-enter the Irish market in 1997 via another acquisition. Having learnt from past experience, and other international experiences in the interim, the second time Tesco entered Ireland it has been successful, and now has 146 stores in the country, making it one of the leading retailers in the marketplace (Tesco PLC, n.d.)

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4.2. First Successes

Following the failure of its initial attempt at international expansion, Tesco waited until 1992 to attempt it again with another acquisition in a geographically proximate market – France. However, the company faced extreme competition in the face of local rivals such as Carrefour, and left the French market in 1997. Therefore, the first international expansion of Tesco which is still in operation today was their expansion into Hungary which occurred in 1995, again via acquisition of a controlling stake in an existing supermarket chain. Following the model which they had used in Ireland in 1979, Tesco acquired a 51% stake in Global, a Hungarian retail chain which gave Tesco access to 26 retail stores (Tesco PLC, n.d.).

With the break-up of the Soviet Union in 1991, the Central and Eastern European markets were an attractive option for retailers looking for access to a new pool of consumers eager for Western-style convenience. Although there are significant cultural differences between the UK and Hungary, Tesco showed itself ready to adapt to local consumer tastes, and now claims that 85% of its product offering in Hungary is locally sourced (Tesco PLC, n.d.). This has also provided an opportunity for the organization to offer an increased product range in its domestic market of the UK, as it now uses a significant number of Hungarian suppliers in order to support the UK retail business.

Success in Hungary was swiftly followed by acquisitions in two more former communist markets, the Czech Republic and Slovakia. Tesco is still present in these markets currently, and now operates a multichannel retail format, following the launch of its online retail service in the Czech Republic in 2012, and stand-alone stores for its fashion line, Florence and Fred, in an attempt to boost non-grocery sales in the market (Tesco PLC, n.d.).

4.3. Continued Expansion

Buoyed by success in Central and Eastern Europe, Tesco then broke then its trend of incremental, regional expansion, and turned its attention to the rapidly growing, but challenging, markets of East Asia. For their first expansion in this region in Thailand in 1998, Tesco followed its tried and tested method of acquisition when it purchased a 75% share of the retail chain Lotus. Food retailing in Thailand traditionally placed greater emphasis on smaller retailers, however Tesco sought to change this model with the introduction of hypermarkets. However, once having established hypermarkets, the company did then open a range of small convenience stores throughout the country as well.

Such moves caused criticism, and accusations of destroying the livelihoods of traditional retailers, criticisms which have been leveled at many other Western retailers operating in international markets, such as Wal-Mart. However, it appears that Tesco were merely providing the consumers with what they wanted, as their market share has now grown in Thailand so that Tesco Lotus now serves approximately 12 million customers per week, across 1,700 stores across the country (Tesco PLC, n.d.). On entering the South Korean market in 1999, Tesco deviated from its usual strategy of acquisition of existing retail chains, and instead established a joint venture with the giant South Korean conglomerate, Samsung, in which Tesco held an 81% stake.

The local knowledge that Tesco was to acquire as a result of these acquisitions was invaluable. Not only did it allow the organization to tap into local market knowledge, but it also allowed it to use a brand name which was already well established in the local market, instead of having to build up awareness of the Tesco brand. This strategy was so successful that Tesco would follow the same strategy when it entered the Turkish market by acquiring the Kipa chain and continued to operate as “Tesco

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Kipa.” Over time, however, Tesco continued to invest in the South Korean business until it eventually bought out Samsung so that its South Korean operations, which operate under the name “Homeplus”, are now the largest the company has outside of the UK.

Part of Tesco’s success in South Korea is due to their distribution format. While the company operates a number of large hypermarkets, it also has a significant number of smaller convenience stores, in addition to almost two hundred franchised stores. This enabled Tesco to integrate into traditional distribution channels outside of the major cities, with franchisees putting up 20% of the required capital to open the smaller stores, and Tesco supplying the rest. In this manner, Tesco were able to avoid some of the criticisms that the company faced in markets such as Thailand, and to further integrate into the local economy. As in Hungary, Korean suppliers have also become an important part of Tesco’s global supply chain for their other markets, particularly for non-food items.

4.4. Challenges in the USA

Tesco announced in 2013 that it planned to leave the US market after having been present since 2007 under the brand “Fresh & Easy”, and having failed to make a profit in any of the years in which it had been in operation in the market. Analysts estimated that the failed attempt at market penetration had cost Tesco approximately £2 billion (The Guardian, 2013). Among other things, it appeared that cultural differences between the UK and the US had been one of the contributing factors to the failure of the venture. Instead of opting for the hypermarket format which had proved successful in other areas of the world, Tesco opted for smaller store sizes which, though typical in many European cities, were unpopular in the USA where consumers tend to drive to supermarkets and make large bulk purchases.

Furthermore, Tesco had a large number of self-service checkouts which it uses widely in stores in the UK, but which did not prove popular with American consumers who felt that Fresh & Easy stores lacked a personal touch (Time, 2013). In this respect, it appears that Tesco failed to deal with cultural differences between Europe and the US, much in the same way that Wal-Mart did when the American retail giant unsuccessfully attempted to enter the German market in the late 1990s. Since then, Wal-Mart has entered the UK through the acquisition of Asda, an established British brand whose *modus operandi* it has left largely unchanged.

However, not only did Fresh & Easy face problems in the terms of the format of its stores but also with the distribution network that it had in place to support them. Tesco had built a sizeable distribution network in order to support their stores which were based in the states of California, Nevada, and Arizona, and established two large distribution centers which it ultimately envisaged would support some 400 stores across this region. However, given the lack of enthusiasm from American shoppers for Fresh & Easy, store openings did not proceed at the pace which had been envisaged, meaning that when Tesco announced its departure from the market in 2013, it still had only 200 stores after six years of operations (Telegraph, 2013).

This meant the company had a much larger and much more expensive and sophisticated distribution network than it actually needed to service the stores that it had, meaning that the company had to contend with extremely high overheads, making it more difficult for the US venture to break even. Ultimately, it became clear that the venture was going to continue losing money for the foreseeable future, leading Fresh & Easy to announce the sale of 150 stores to Yucaipa, a Californian private equity company, and the closure of the remaining stores (BBC, 2013).

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4.5. Looking to the Future

Despite the retreat from the US, Japanese, and Taiwanese markets, Tesco is still looking to continue to expand its international operations, and given the difficult conditions that the company faces in the UK market, the move to continue to diversify across different markets in order to reduce risk, would appear wise. In May, 2014, Tesco agreed to a joint venture with China Resources Enterprise (CRE), combining Tesco's existing 131 outlets which are mainly located in eastern China, following market entry in 2004, with the 3000 outlets of CRE stretching across the country. Although Tesco is the minority partner in this joint venture with a 20% stake, it is clear that having access to such a large existing distribution network will be of great benefit to them in their attempts to gain market share in one of the largest and fastest growing grocery markets in the world.

4.6. Managerial Implications

It can be seen that Tesco initially attempted to follow a model of incremental expansion (Johanson & Vahlne, 1977), seeking to gain access to distribution networks in markets which they felt were similar to the UK, by seeking to enter Ireland and France initially. However, the limited success of such an approach led them to seek out markets further afield, which were both geographically and culturally distant from the UK, and thus they could be said to be following the eclectic paradigm of Dunning (1988). Once operating in local markets, it seems that Tesco have given a high degree of autonomy to local operations to enable them to best access local distribution networks, thus following a multi-domestic strategy (Bartlett & Ghoshal, 1989) which is locally responsive as it gives each international operation a high degree of autonomy with control of their own sourcing and the distribution channels which they access, thus leading to a decentralized operation.

This strategy may be particularly effective in highly fragmented markets, which have long distribution channels, where local knowledge may be of importance in gaining appropriate information and accessing these distribution channels, and this is certainly the advantage that Tesco sought to gain in fragmented markets with traditional distribution structures, such as Thailand and South Korea. However, it appears that Tesco broke with this successful approach when they entered into the US market, and of adapting to local requirements, they tried to replicate what they had done in the UK, as the US was seen as being culturally very similar (Hofstede, 2001).

Here they appear to have fallen prey to the psychic distance paradox (O'Grady & Lane, 1996) which suggests that culturally close markets can, in fact, be extremely challenging for organizations to manage, as there can be a tendency to assume similarity where it in fact does not exist, which can then prevent managers from learning about important differences. We can therefore see that Tesco appear to have disregarded local information about preferred store format and distribution format, and instead were overly optimistic on the basis of culturally specific information gained from the UK, rather than the US market in which they were operating. Where Tesco have been successful in operating in international markets, they have tended to seek a collaborative strategy in order to enter initially, and this appears to be their new strategy with regards to China.

While collaborative entry methods are attractive given the lowered financial risks that they present to internationalizing organizations, and the access to local market knowledge that they provide, they are not without their risks, particularly with regards to the sharing of technology with local partners and thus the danger of creating a competitor (Cavusgil et al., 2012). It appears that Tesco have been aware

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of these risks throughout their international expansion, given that once established in markets, they have frequently sought to reduce the holdings of their partner, as exemplified in South Korea, where HomePlus is now solely owned by Tesco. Such an approach may be due to conflict in the distribution channel (Mehta et al., 2010) which is frequent in relationships of this nature.

Furthermore, a key part of Tesco's competitive advantage is the Clubcard, a system which gives them remarkable market intelligence on their consumers. The company does not tend to introduce such a system straight away when it enters a new market, and therefore risk sharing this key information with the local partner, as evidence by the fact that in 2010, Tesco operated Clubcard in just seven of the fourteen countries in which it operated at the time (Tesco, 2010). Therefore, from a managerial viewpoint Tesco could be seen to illustrate the benefits of collaboration in the distribution network, simultaneously being mindful of the risks of sharing technology, and thus in their approach, they seem to have achieved a successful balance between sharing information and working collaboratively, while guarding information and technology which could provide collaborators with a competitive advantage over Tesco in the future.

4.7. Discussion of Findings

The theoretical contribution of this case study is, therefore, the support that it lends to the approach of the eclectic paradigm model of international expansion (Dunning, 1988), as it can be seen that Tesco were initially unsuccessful when they attempted to follow a model of incremental expansion (Johanson & Vahlne, 1977) by pursuing distribution opportunities in proximate markets which was initially seen as a preferable option for internationalizing organizations (Johanson & Vahlne, 2009). The case study emphasizes the importance of collaborative market entry modes in order to gain access to local distribution networks. While the literature frequently emphasizes the dangers of collaborative market entry modes such as strategic alliances and joint ventures and their low success rate over an extended period of time (Inkpen & Beamish, 1997), the Tesco case demonstrates that although collaborative entry modes may be impermanent, as in the case of South Korea, this should not be a reason to consider them unsuccessful as it may be that this lack of permanence is not problematic for the parties involved. Indeed, it is not suggested that Samsung were unhappy with the fact that Tesco acquired them to make HomePlus a wholly-owned subsidiary.

In fact, in January, 2014, Tesco announced a sale and leaseback deal comprising of four Homeplus stores with Samsung SRA, a property fund management arm of the Korean conglomerate, which suggests continued good relations between the two organizations (Tesco, 2014). Clearly, collaborative entry methods are attractive to internationalizing organizations as they require fewer resources, and therefore should present a lesser financial risk to organizations as opposed to the operation of a wholly owned subsidiary. Furthermore, collaborative strategies provided other, less tangible benefits to Tesco, particularly regarding local awareness and market knowledge which they may have otherwise had difficulties in accessing, in part due to the liability of foreignness (Zaheer, 1995).

However, such methods present an increased risk to Tesco in terms of the sharing of technology and market information which could present opportunities for collaborators to later become competitors and, therefore, it is important to consider the trade-offs between resources and control, and control and technology risk as described by Osland et al (2001).

The case study shows that Tesco have attempted to mitigate these risks by limiting the amount of knowledge and technology that they shared in collaborative arrangements, at least initially until mutual

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trust had been developed, which is a vital component of any international collaboration (Das et al., 1998), and thus contributes to the extant literature on the internationalization of retail organizations, in which joint ventures have traditionally received little attention (Palmer et al., 2010).

Finally, the case also highlights the influential role of national culture in successful distribution strategies (Hofstede, 2001). Frequently, the supply chain literature is technicist and assumes a rational approach to decision-making by both organizations and consumers. However, the experience of Tesco with Fresh and Easy demonstrates that the construction of a distribution system which could be rationally justified based on forecast growth of the network, was in fact inappropriate because the organization had not considered cultural differences. Such findings should therefore alert practitioners to the dangers of using location models and formulas such as the gravitational location model (Chopra & Meindl, 2013), and indeed to etic models of culture such as those of Hofstede (2001) which may blind managers to deep cultural differences as they may superficially appear to be similar to the home country.

The experience of Tesco in the US suggests that a deep, emic understanding of consumer behavior is required in order to select appropriate distribution networks in unfamiliar locations, an approach which has not traditionally been taken by the field of operations and supply chain, where the small body of literature which does deal with cultural differences and the impact that they may have on the management of global supply chains, tend to an etic approach (e.g., Mehta et al., 2010; Mehta et al., 2011; Davis et al., 2014).

The Tesco case has much to contribute to the discussion regarding global distribution in international supply chains. It can be seen that the organization has used a variety of strategies in order to access local distribution networks, and has not always been successful in its attempts to internationalize. However, it provides a useful illustration of some of the opportunities and challenges that internationalizing organizations may face with regards to their distribution strategies, and demonstrates the importance of strategic fit between such strategies and the local environment in which the organization operates.

5. CONCLUSION

In this chapter, we have built on the growing literature on international supply chain management and specifically focused on three key areas of global production, global sourcing, and global distribution in supply chain management. We examined these areas of international supply chains, which we believe are interlinked, within three separate case-studies: Samsung's global production, UK Airbus's global sourcing, and Tesco's global distribution. The overall results show a link between the three areas, and highlight the importance of a holistic approach to international supply chain management.

The result of our research-based case studies revealed that in global production Samsung's choice of location for investment lends support for the eclectic paradigm, also known as the OLI model, a key theory of firm's internationalization developed by Dunning (1988). Samsung have tended to engage in foreign direct investment which have specific locational advantages, including low wages, favourable geographic positions and special tariffs. In this way, Samsung have combined two different motives for firm internationalization, efficiency seeking and market seeking which would not have been possible using forms of operation such as licensing.

The findings from Tesco also lend support to the eclectic paradigm suggesting that firms are able to be successful when they exploit specific opportunities wherever they are located in the world, and that it is not necessarily advantageous to seek to enter culturally or geographically proximate markets in the early stages of internationalization. However, a point which is raised here is the importance of custom-

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izing the product offering and use of distribution channels which appeal to local tastes, a factor which Samsung have not had to take into consideration in the configuration of their global production network.

While Samsung have tended to keep production in-house and to be involved with the manufacture of a variety of different components used in the production of smart phones, the case of Airbus demonstrates how outsourcing can be successfully used in order to build competitive advantage in the aerospace industry. However, it can be seen that Airbus outsource in order to focus on their core competences, and to ensure the supply of technologically advanced components meeting high specifications, and therefore prefer to use a limited number of Tier 1 suppliers in order to achieve this goal. Meanwhile, Airbus uses a multiple sourcing strategy for outsourcing spare parts of the aircraft which is not required specific engineering design.

Furthermore, the Airbus case highlights the importance of risk management in global supply chains, as the company is aware of concerns relating to intellectual property rights, and also working with suppliers which also supply competitors such as Boeing. Returning to the Samsung case, it can be seen how Samsung were able to exploit a similar scenario to their own advantage, as after supplying displays to Apple for the iPhone they were able to then use this knowledge to use these components in their own smartphones, suggesting that Airbus are wise to be wary of such a scenario. We can also observe that Tesco share concerns regarding the protection of intellectual property rights when working with local partner organizations, as exemplified by their seeming reluctance to launch Clubcard straight away when operating in a new market.

The fact that all three case organizations have demonstrated examples of benefits and challenges posed by knowledge sharing with partners in the supply chain suggests that the question of knowledge sharing and intellectual property rights is, indeed, a major challenge which organizations with international supply chains must face, regardless of the industry in which they are operating, and therefore highlight the necessity for mutual trust in international supply chains (Das et al, 1998). Despite this, the third case study which focused on Tesco demonstrated the importance of collaboration in global supply chains, in the case in order to access local market knowledge and appropriate distribution channels.

While both the literature (e.g., Inkpen & Beamish, 1997) and indeed the previous two cases highlight the dangers of collaborative working, the Tesco case demonstrates how such an approach can be used successfully in order to build competitive advantage. This approach is likely to be particularly relevant for multinationals who are using a multi-domestic strategy (Bartlett & Ghoshal, 1989) in order to overcome the liability of foreignness (Zaheer, 1995), which does not appear to be the case for Samsung or Airbus. Finally, the Tesco case highlights the influential role of national culture in international supply chain management, particularly in downstream relations. Although cultural challenges were not raised in the cases of Airbus and Samsung, this may be because for these organizations we have considered upstream activities, and therefore through the governance mechanisms used, these organizations have been able to mitigate some of the cultural challenges posed.

The experience of Tesco in the USA, however, demonstrates that regardless of a firm's previous international experience when looking to sell to consumers, not giving sufficient consideration to cultural differences, even in markets which are culturally close to the home market can be a serious flaw in downstream operations. Therefore, we suggest that not only should appropriate consideration of this topic be a key challenge for managers, but also requires greater empirical investigation within the supply chain literature, particularly following an emic approach to culture which has traditionally been overlooked in favour of eclectic models on the occasions that culture has been considered in the international supply chain management literature, (e.g., Mehta et al., 2010; Mehta et al., 2011; Davis et al., 2014).

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In conclusion, the three cases that we have selected have demonstrated a range of issues which are features of international, rather than purely domestic, supply chains. We have demonstrated how three leading international organizations cope with such challenges and the benefits and risks of the strategies that they have adopted in order to deal with them, and in doing so, have highlighted the importance of strategic fit between the global strategy of the organization, and the range of local environments in which international supply chains operate.

Our research reveals some limitations. The research aimed at theory building but the findings from case studies are only able to lend support or disapprove existing theories rather than to create a new theory. We conducted research of the three case firms on three different angles and three firms case were selected from three different industries. These prevented us from conducting comparative case analysis to provide more generalizations from research findings. Further research can be done on a sample of firms in the same industry. The primary data collected from interviews is limited and does not reflect a wide range of thought. We could not conduct interviews with a wider range of the companies' representatives. Due to business confidentiality, a number of managers to whom we approached for interview refused to participate. Further research should address this issue by creating better networking with international businessmen.

REFERENCES

- Baily, P., Farmer, D., Jessop, D., & Jones, D. (1998). *Purchasing Principles & Management* (8th ed.). Prentice Hall.
- Bartlett, C. A., & Ghoshal, S. (1989). *Managing Across Borders: The Transnational Solution*. Boston, MA: Harvard Business School Press.
- BBC. (2013). *Tesco offloads loss-making Fresh & Easy chain*. Retrieved on November 23, 2014, from: <http://www.bbc.co.uk/news/business-24040346>
- Bloomberg. (2014). *Samsung Vietnam Phone Leap Has Farmhand Living a Dream*. Retrieved from <http://www.bloomberg.com/news/2014-09-10/samsung-vietnam-phone-leap-has-farmhand-living-a-dream.html>
- Cavusgil, S. T., Knight, G., & Riesenberger, J. R. (2012). *International Business: The New Realities* (2nd ed.). New Jersey: Pearson.
- Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, 19(1), 1–31. doi:10.1057/palgrave.jibs.8490372
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, 12(1), 78–104. doi:10.1080/09692290500049805
- Golini, R., & Kalchschmidt, M. (2011). Moderating the impact of global sourcing on inventories through supply chain management. *International Journal of Production Economics*, 133(1), 86–94. doi:10.1016/j.ijpe.2010.06.011

International Supply Chain Case Study

- Harrison & Hoek. (2011). *Logistics Management & Strategy* (4th ed.). New York: Prentice Hall.
- Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviours, Institutions, and Organizations across Nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Insider, B. (2014). What It's Like Inside The Factory Where Samsung Builds Your Galaxy Phone. Retrieved from <http://www.businessinsider.com/samsung-gumi-factory-2014-5#ixzz3JWDncR1s>
- Johnson, P.F., Leenders, M., & Flynn, A. (2011). *Purchasing and Supply Management* (14th ed.). New York: McGraw Hill.
- Kim, Y. (1997). Technological Capabilities and Samsung Electronics' International Production Network in Asia (Working Paper 106). BRIE
- Kotabe, M., & Omura, G. S. (1989). Sourcing strategies of European and Japanese multinationals: A comparison. *Journal of International Business Studies*, 20(1), 113–130. doi:10.1057/palgrave.jibs.8490354
- Lee, J., & Folkmanis, J. (2013). *Samsung Shifts Plants from China to Protect Margins*. Retrieved from <http://www.bloomberg.com/news/2013-12-11/samsung-shifts-plants-from-china-to-protect-margins.html>
- Murray, J. Y., Kotabe, M., & Wildt, A. R. (1995a). Strategic and financial performance implications of global sourcing strategy: A contingency analysis. *Journal of International Business Studies*, 26(1), 181–202. doi:10.1057/palgrave.jibs.8490171
- Murray, J. Y., Wildt, A. R., & Kotabe, M. (1995b). Global sourcing strategies of US subsidiaries of foreign multinationals. *Management International Review*, 35(4), 307–324.
- Osland, G. E., Taylor, C. R., & Zou, S. (2001). Selecting international modes of entry and expansion. *Marketing Intelligence & Planning*, 19(3), 153–161. doi:10.1108/02634500110391690
- Palmer, M. (2005). Retailing multinational learning: A case study of Tesco. *International Journal of Retail & Distribution Management*, 33(1), 23–48. doi:10.1108/09590550510577110
- Reach for the Skies Report (2014). Industry and Government working together to secure the future for UK Aerospace: A Strategic Vision for UK Aerospace. *ADS, Aerospace Growth Partnership, and Department for Business Innovation & Skills*.
- Roh, J. J., Min, H., & Hong, P. (2011). A co-ordination theory approach to restructuring the supply chain: An empirical study from the focal company perspective. *International Journal of Production Research*, 49(15), 4517–4541. doi:10.1080/00207543.2010.497506
- Rossetti, C., & Choi, Y. T. (2005). *On the dark side of strategic sourcing: experiences from the Aerospace Industry* (Vol. 19). Academy of Management Executives.
- Samsung. (2010). Samsung's annual report 2010.
- Samsung. (2011). *Samsung Electronics' Business Report Q2 2011*. Retrieved from http://www.samsung.com/us/aboutsamsung/investor_relations/financial_information/business_report.html
- Samsung. (2013a). *Sustainability Report 2013*. Retrieved from http://www.samsung.com/common/aboutsamsung/download/companyreports/2013_Sustainability_Report.pdf

International Supply Chain Case Study

Samsung. (2013b). *Samsung Electronics Annual Report 2013*.

Samsung. (2014a) *Sustainability Report 2014*. Retrieved from <http://www.samsung.com/us/aboutsamsung/sustainability/sustainabilityreports/sustainabilityreports2014.pdf>

Samsung. (2014b). *Samsung Business Report 2014 Q1*. Retrieved from http://www.samsung.com/us/aboutsamsung/investor_relations/financial_information/business_report.html

Samsung. (2014c). *Business Overview*. Retrieved from <http://www.samsung.com/global/business/semiconductor/aboutus/business/factsheet>

Samsung. (2014d). *About Samsung India*. Retrieved from <http://www.samsung.com/in/aboutsamsung/samsungelectronics/india/manufacturing.html>

Samsung. (2014e). *Business Overview*. Retrieved from <http://www.samsung.com/global/business/semiconductor/aboutus/business/factsheet>

Samsung. (2014f). *About Samsung*. Retrieved from <http://www.samsung.com/us/aboutsamsung/corporateprofile/history04.html>

Telegraph (2013). *Tesco's Fresh & Easy: a timeline in pictures*. Retrieved from <http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/10299870/Tescos-Fresh-and-Easy-a-timeline-in-pictures.html?frame=2537629>

Tesco, P.L. C. (n.d.). *Tesco Czech Republic*. Retrieved from <http://www.tescopl.com/index.asp?pageid=332>

Tesco, P. L. C. (n.d.). *Tesco Hungary*. Retrieved from <http://www.tescopl.com/index.asp?pageid=340>

Tesco, P. L. C. (n.d.). *Tesco Ireland*. Retrieved from <http://www.tescopl.com/index.asp?pageid=348>

Tesco, P. L. C. (n.d.). *Tesco Lotus*. Retrieved from <http://www.tescopl.com/index.asp?pageid=324>

The Guardian. (2011). *Tesco admits defeat and pulls out of Japan*. Retrieved from <http://www.theguardian.com/business/2011/aug/31/tesco-japan-pull-out-philip-clarke>

The Guardian. (2013). *Tesco puts US chain Fresh n Easy into bankruptcy*. Retrieved from <http://www.theguardian.com/business/2013/oct/01/tesco-us-chain-fresh-easy-bankruptcy>

Tuttle, B. (2013). Tale of Two Supermarkets: Why Fresh & Easy Flopped and Fairway Flies High. *Time*. Retrieved from <http://business.time.com/2013/04/18/tale-of-two-supermarkets-why-fresh-easy-flopped-and-fairway-flies-high/>

Purnell, N. (2014). Samsung Considers Cellphone Production in Indonesia. *Wall Street Journal*. Retrieved from <http://online.wsj.com/articles/samsung-considers-cellphone-production-in-indonesia-1408364492>

Waters, D. (2009). *Supply Chain Management: An Introduction to Logistics* (2nd ed.). Basingstoke: Palgrave Macmillan.

Zaheer, S. (1995). Overcoming the Liability of Foreignness. *Academy of Management Journal*, 38(2), 341–363. doi:10.2307/256683

*International Supply Chain Case Study***ENDNOTES**

- ¹ “Focused market” is a strategy upon which each local market will be served by a factory set up in that local market. “Focused factories” is the strategy upon which a limited range of factories are set up to serve all markets.
- ² The OLI is an abbreviation for three categories of advantages, namely the ownership advantages, locational advantages and internalization advantages.

Chapter 13

Supply Chain Relationships: From Conflict to Collaboration

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ABSTRACT

The evolving field of supply chain management is rooted in the premise that traditionally independent firms need to work together in order to achieve supply chain success. This article outlines supply chain collaboration, which is a critical strategy for the field of supply chain management. While firms have traditionally operated in a manner that only considers their own well-being, a transition is occurring where open market relationships are diminishing and cooperation, coordination, and collaboration are becoming much more common. There are several key dimensions of collaboration that serve as drivers to its success, and firms that engage in these activities should experience closer relationships with channel partners and ultimately achieve higher levels of success. While this issue has been thoroughly covered in the logistics and supply chain management literature, its limited implementation and lack of widespread success provides evidence that the topic should continue to be a focal point in future research.

INTRODUCTION

The field of supply chain management has developed in recent decades from the convergence of different functions within the firm, such as procurement, production, and logistics. Numerous definitions exist for the term (Mentzer et al, 2001), and a common theme among these definitions is the premise that collaboration and close relationships are an integral facet of the field. For example, the Council of Supply Chain Management Professionals (CSCMP), a leading organization for the supply chain profession, defines supply chain management as:

The planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across

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companies. Supply Chain Management is an integrating function with primary responsibility for linking major business functions and business processes within and across companies into a cohesive and high-performing business model. It includes all of the logistics management activities noted above, as well as manufacturing operations, and it drives coordination of processes and activities with and across marketing, sales, product design, finance and information technology. (Supply Chain Management Terms and Glossary, 2013)

As seen in the CSCMP description, some of these definitions even require collaboration. In other words, they posit that supply chain management may not truly exist without firms participating in close, boundary spanning relationships. The primary objective of this chapter is to clearly explain the criticality of supply chain management and collaboration. Supply chain management represents a way of managing the business and relationships with other members of the supply chain (Lambert et al., 1998). All firms participate in the supply chain from the raw materials suppliers to the end customer (Lambert & Cooper, 2000). These firms working together are analogous to teammates competing against other supply chains on a worldwide scale. Since close relationships are so critical to the field of supply chain management, this article seeks to present a thorough and clear explanation of collaboration and its different characteristics.

BACKGROUND

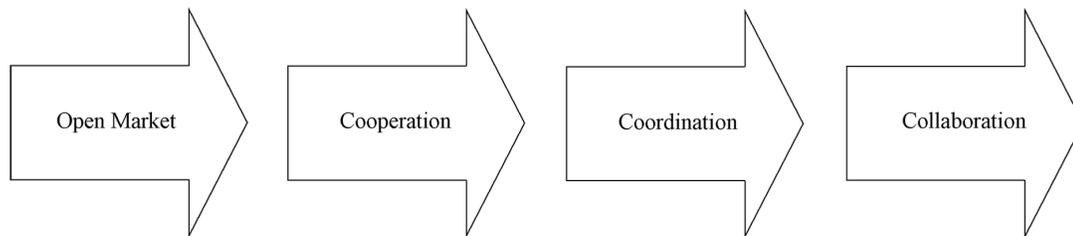
In the global marketplace, companies do not compete – supply chains do (Christopher, 1997; Lambert et al., 1998; Burgess, 1998; Lummus & Vokurka, 1999; Lambert & Cooper, 2000; Christopher & Juttner, 2000; Duclos et al., 2003; Myers & Cheung, 2008). As a result, firms can no longer compete in isolation of their suppliers or other entities in the supply chain so they must seek understandings with other firms (Lummus & Vokurka, 1999; Leeuw & Fransoo, 2009). This is taken further by Christopher and Towill (2001) when they point out that to be truly competitive requires not just an appropriate manufacturing strategy, but an appropriate supply chain strategy. Thus, firms must focus on optimizing all aspects of their supply chains in order to create the greatest opportunity to gain a competitive advantage over time.

Every company sources globally, sells globally, or competes with someone who does (Mentzer et al., 2006). With higher standards of performance being demanded in the current business environment, companies are looking to their suppliers to help them achieve success (McHugh et al., 2003), since two or more companies working together may be able to achieve greater success than can be attained in isolation (Daugherty et al., 2006). Therefore, collaboration with supply chain partners is critical since this is the driving force of effective supply chain management (Sahay, 2003; Sheu et al., 2006). An important step is to recognize that supply chain management can be used as a competitive weapon to secure and maintain customer loyalty (Burgess, 1998). In addition, channel members have much to gain by working together in an environment of mutual trust and cooperation (Sheu et al., 2006). Not only does this allow firms to share resources, but it helps to reduce a burden since risk and costs can be spread out among the participating firms (Soosay et al., 2008).

Although the previously mentioned CSCMP definition of supply chain management is now widely accepted, this description has significantly evolved over recent decades as numerous authors have proposed varying definitions as the field has developed (Mentzer et al., 2001). Figure 1 shows the continuum

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Figure 1. The Supply Chain Management Continuum (Adapted from Spekman et al., 1998)



that represents the transition from an open market to collaboration (Spekman et al., 1998). In its infancy, supply chain management involved firms that focused solely on open market negotiations, where each firm in a supply chain operated on its own and sought to increase its own profits with little attention being devoted to channel counterparts (Lancioni, 2000). This situation often resulted in conflict-laden relationships where firms operated in a combative manner. While many firms have progressed to more advanced stages of collaborative activities, it is not unrealistic to think that some firms still operate in this manner.

When a firm engages in open market negotiations, it seeks to leverage the supply chain to achieve the lowest possible prices while assuring supply (Spekman et al., 1998). Lancioni (2000) notes that in this situation minimal importance is placed on relationships and little emphasis is given to the customer or other channel members, so relationships tend to be more adversarial in nature. Since competition is fierce and firms possess a silo mentality, information is not shared since that could potentially give a competitor an advantage or put a firm at a disadvantage in a price war.

The second stage in the continuum is one in which firms cooperate with one another and begin working together for the good of all involved parties rather than individual firms. This stage of supply chain management became more common in the 1980s as intense global competition led manufacturers to realize the benefits of strategic and cooperative relationships between buyers and suppliers. This cooperative stage involves rationalizing the supplier base by utilizing fewer suppliers and engaging in longer-term contracts. While information is shared with channel partners as needed, a culture of openness and complete trust and commitment still does not exist at this level of supply chain management.

The third stage involves the coordination of information and activities between firms in a supply chain. This involves specific and planned information linkages, such as electronic data interchange (EDI), that inherently imply that information is shared in a systematic and continual manner. Also present are work-in-process linkages that, when paired with information linkages, allow for the use of tools like a just-in-time (JIT) inventory system. These types of linkages can expose a firm to much risk, so trust and commitment become key attributes to these types of relationships.

Lastly, the most advanced stage in the supply chain management continuum involves true collaboration that can be viewed as the exact opposite of open market negotiations. While the latter sees firms utilizing a self-centered mentality, collaboration indicates that firms are completely committed to the supply chain and its well-being is the ultimate focus. In this stage, firms in a supply chain may be integrated and practices like joint decision-making, technology sharing, and joint planning are common. Thus, while in previous stages the infrastructure exists to enable firms to work together in certain areas, the collaboration stage sees firms operate and make decisions as if they were one entity.

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Dimensions of Collaboration

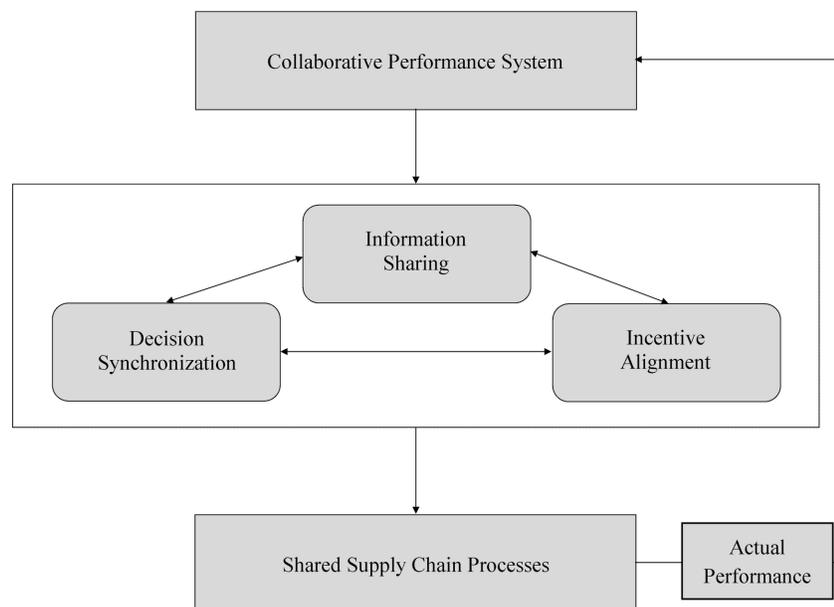
There are several key dimensions of close relationships and collaboration that play a crucial role in the success of firms working together. These include information sharing (Simaputang & Sridharan, 2004), resource sharing (Sheu et al., 2006), decision synchronization (Stank et al., 2001; Simaputang & Sridharan, 2004), incentive alignment (Manthou et al., 2004; Simaputang & Sridharan, 2004), goal congruence (Angeles & Nath, 2001), and collaborative communication (Cao & Zhang, 2011). While each of these dimensions is crucial to supply chain management, there exists a significant level of overlap between them. Therefore, for the purposes of this chapter many of them will be considered in tandem. The collaborative activities that result from these dimensions will ideally result in joint knowledge creation (Malhotra et al., 2005) that benefits the group of firms as a whole. Figure 2 outlines the interactions between these dimensions of collaboration (Simaputang & Sridharan, 2004).

It must be mentioned that while there are other issues that are critical aspects of supply chain collaboration, most notably referring to trust and commitment, these types of themes are encompassed within and a significant aspect of these dimensions.

Information Sharing, Resource Sharing, and Collaborative Communication

Information sharing is arguably the most commonly referenced dimension of supply chain collaboration in the extant literature since shared information forms the backbone of interfirm relationships. It facilitates the exchange of data regarding sales, customer needs, market structures, and demand levels (Myers

Figure 2. Conceptual Model for Supply Chain Collaboration (Adapted from Simaputang & Sridharan, 2004)



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& Cheung, 2008). Similar concepts include resource sharing and collaborative communication since all three involve channel partners utilizing various methods to maintain open lines of communication. Since many authors merge resource sharing and information sharing together into one theme (Fawcett et al., 2008), this writing will be no different.

Potential benefits of these tools include early problem detection, faster response, and trust building (Lee & Whang, 2001). This is a key aspect of collaboration because shared information facilitates firms' ability to meet end user needs (Spekman et al., 1998) and free exchanges of information have been found to be very effective in reducing the risks of supplier failure (Lee, 2004). This criticality has not been overlooked in the literature since it has been called the starting point (Simatupang & Sridharan, 2004) or foundation (Lee & Whang, 2001) of collaboration, while Min et al. (2005) claim it is an essential ingredient. Much like a relationship between people, Myers and Cheung (2008) posit that information sharing can make or break a supply chain relationship.

Not only is this dimension critical to collaboration on its own, but it can also enable other dimensions. Decision synchronization is improved by having timely and accurate information from channel partners (Simatupang & Sridharan, 2005) that facilitates visibility in the supply chain (Simatupang & Sridharan, 2004). In addition, incentive alignment is supported by helping to ensure fair compensation (Simatupang & Sridharan, 2004).

Although this is clearly a crucial practice for supply chain management as a whole, information sharing is not without risk. A common fear is that sensitive knowledge which is shared may end up in the hands of competitors. However, despite the fear of information being accessed by unauthorized parties, partners must realize that unless knowledge is shared between parties, the well-being of the entire supply chain may be put at risk since other competing supply chains will potentially be exploiting the benefits of shared knowledge. Many of the most common causes of supply chain failures can be addressed by increasing knowledge flows between partners and Sahay (2003) notes that partners may even feel more secure in their relationship when they can openly share sensitive information.

While it has a strong connection with the internet and electronic communication and information sharing in general, resource sharing may also involve physical goods. Harland et al. (2004) note that physical assets like plant equipment and facilities may also be shared between independent firms. This can allow firms to hedge against the risk of purchasing or leasing physical goods like equipment or facilities on their own since the risk can be shared between the firms. Companies that allow partners to leverage their resources require high levels of trust and commitment since each party is counting on the other to follow through on its promises of covering its share of issues like leasing or equipment maintenance costs.

While information sharing relates to the interfirm sharing of tactical and strategic data, such as forecasts or inventory information, collaborative communication relates to "the contact and message transmission process among supply chain partners in terms of frequency, direction, mode, and influence strategy" (Cao & Zhang, 2011). It relates to the everyday, informal communications firms are involved with that can include transmission media like e-mail or phone calls. These frequent communications can be convenient and effective methods to solve problems that may arise between channel partners. Collaborative communication is generally a sign that a close relationship exists and may include balanced and open communications that occur in both directions between the firms (Tuten & Urban, 2001; Goffin et al., 2006).

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Decision Synchronization

Decision synchronization is an issue that can greatly reduce a source of conflict inherent in many supply chain relationships. For example, while a supplier will prefer large order quantities so that it can better take advantage of scale economies in production, a retailer will prefer smaller order quantities in order to keep inventory costs low. This dimension of supply chain collaboration is defined by Simaputang and Sridharan (2002) as the degree to which channel partners are able to coordinate critical decisions in planning and operations that benefit the supply chain as a whole. It can relate to issues like forecasting, inventory management, or replenishment. If utilized appropriately, decision synchronization can improve information sharing by specifying information needs and incentive alignment by providing a justification for aligning incentives (Simatupang & Sridharan, 2004).

If this dimension of collaboration is practiced appropriately, buyers and suppliers will need to gain an understanding that they need to work together for the good of the supply chain. Holweg et al. (2005) provide an example of a supplier controlling the stock levels of its own products in a retailer location, which is commonly referred to as vendor managed inventory. In this case, the decision between the partners has been merged and responsibility given to the supplier. In these situations, the supplier has a degree of risk that prevents it from simply overloading a retailer with its products, such as generous return terms or actual ownership until a customer makes a purchase from a retailer. Therefore, this dimension provides justification to appropriately devise incentives based on the level of responsibility a party owns.

Incentive Alignment and Goal Congruence

Incentive alignment is a crucial dimension of collaboration since an underlying necessity of the strategy is to have common goals and agreed upon rules. This dimension aims to reduce the incidence of a supply chain member from making decisions that are limited to its own benefit. Simaputang and Sridharan (2002) define this dimension as a way to share costs, benefits, and risks across all supply chain partners. They note that this is a good way to improve commitment from supply chain partners, and it can also aid in trust building since firms are working to help each other rather than themselves. Gains and risk should be shared equitably so that they are fair in regards to the level of investment and risk a firm is accountable for (Lee & Whang, 2001; Manthou et al., 2004).

In other words, they note that a firm with minimal investment should not reap comparable gains as a firm that has a significant investment. These types of agreements, which determine how each channel partner will contribute and gain benefits from the relationship, must be established early in the process of a collaborative relationship so that unnecessary disagreements can be avoided. This dimension of collaboration impacts decision synchronization by creating a motivation to engage in joint decision making, as well as information sharing by creating a motivation to share truthful and accurate information (Simatupang & Sridharan, 2004).

Having risks and rewards aligned makes it much easier for firms to have congruent goals. Goal congruence is defined as “the extent to which firms perceive the possibility of common goal accomplishment” (Eliashberg & Michie, 1984). It refers to the degree to which supply chain partners agree on goals (Angeles & Nath, 2001) and the extent that an individual channel member perceives its own objectives being satisfied by focusing on the supply chain objectives. True goal congruence indicates partners have goals that fully match those of the supply chain or they believe that their individual goals can be

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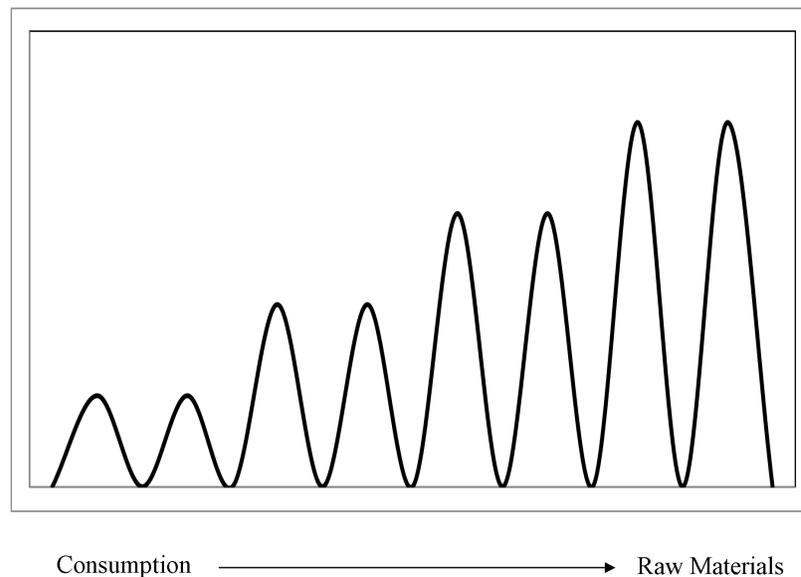
achieved by working towards those of the supply chain (Lejeune & Yakova, 2005). This is an area where commitment and trust are at the forefront since it is a key component of the relationship between channel partners and having common goals can help reduce the incidence of opportunistic behaviors (Jap, 2001).

Integrated Supply Chains

The end result of collaborative efforts between supply chain partners should be an integrated supply chain. A well-integrated supply chain involves organizing the flow of information and materials between all partners (Tan, 2001). A key tool a supply chain can emphasize to more effectively compete against opposing supply chains is integrated supply chain management (ISCM), which is the process of integrating the business processes of the partners in a supply chain (Mentzer et al., 2006). An integrated supply chain strategy should use the supply chain as a tool that cannot easily be copied by competitors (Tan, 2001). This integration is usually achieved via a greater transparency of customer requirements through effectively executing the dimensions of collaboration, such as the sharing of information (Christopher & Juttner, 2000).

Firms have observed that distortions in demand information can occur as one proceeds away from the customer up the supply chain (Mettters, 1997). This is known as the “bullwhip effect” and can be caused by several culprits, including – but not limited to – variance in demand or seasonality effects. Studies have found that collaboration between supply chain partners can reduce this effect (Sheu et al., 2006) and that failure to collaborate could lead to the bullwhip effect as information moves through the supply chain (Sahay, 2003). A way to counter the bullwhip effect is to have transparency of demand information throughout the supply chain (Lee & Whang, 2001). Having demand information visible throughout the supply chain will allow upstream members to update forecasts and ensure continuous replenishment of products (Simatupang et al., 2002). Thus, an integrated supply chain that involves knowledge sharing will help to reduce the bullwhip effect and the resulting stock miscalculations (Myers & Cheung, 2008) that result from poor forecasting. See Figure 3 for a graphical depiction of the bullwhip effect.

Figure 3. The bullwhip effect



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Tight knit partnerships are an integral part of an integrated supply chain and can help to smooth uncertainty and enhance control of supply and distribution channels (Maloni & Benton, 1997). As a result of these partnerships, higher levels of profitability can result for the firms involved. Metters (1997) found a 10-30% increase in product profitability through elimination of the bullwhip effect. This indicates coordination through the supply chain will benefit each of the individual firms involved in a coordinated effort (Maloni & Benton, 1997). Therefore, sharing of demand information and tight coordination with channel partners are crucial for supply chain efficiency if a disruption occurs (Lee, 2004).

Integrated supply chains have benefited dramatically from advances in technology. This is due in large part to the premise that technology has helped to support the interorganizational sharing of resources and competencies that help to maintain network structure, communication, and coordination (Gunasekaran & Ngai, 2004). An excellent example of a technological advancement that has significantly aided supply chain management is the internet. The internet has provided firms with an excellent resource to collaborate and share information in an instantaneous manner. E-business, which is the use of the internet to execute various business processes, has risen to be a key facilitator for channel partners to execute business processes (Lee & Whang, 2001).

This allows firms to unite to share information, technology, and planning efforts, as well as to reduce uncertainty and increase control in the process (Maloni & Benton, 1997). The internet has been such a powerful tool partly due to the fact that web-based methods of information sharing are able to provide a holistic service that combines all activities and resources along the supply chain from the raw material purchases to customer service (Simatupang & Sridharan, 2002). The result is a faster, more cost-effective, more reliable, and less error-prone supply chain (Lee & Whang, 2001).

FUTURE RESEARCH DIRECTIONS

Future research on collaboration should continue to evaluate how the field of supply chain management has evolved in embracing close relationships. Previous research has shown that true collaboration does not yet truly exist (Spekman et al, 1998; Fawcett & Magnan, 2002), and a body of work that confirms the prevalence of collaboration has not yet been developed. Therefore, continually evaluating the status of this key strategy will be critical to ensure academics and practitioners alike are able to ensure efforts are maintained to take advantage of the benefits associated with close relationships. It may also be advisable to investigate how specific functions of supply chain management, such as purchasing or manufacturing, or specific industries are utilizing the strategy. In addition, investigating collaboration as it applies to vertical, horizontal, or lateral integration might lead to fruitful results.

The dimensions of collaboration are also in need of additional investigation. Can firms truly operate without boundaries in order to effectively utilize these dimensions? A key aspect of this involves trust. Collaboration requires firms to abandon the traditional practice of operating with a silo mentality, and significant trust is required in order to have confidence that other firms will not abuse sensitive information. This risk of opportunistic behaviors may be a key factor that has limited the development of collaborative relationships in the present business environment.

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CONCLUSION

The foundations of the field of supply chain management are built on the premise that relationships between firms will be strong and mutually beneficial. This has evolved from a time when firms were at odds and more often than not working in the interest of their own gains. This evolution has led to the premise that firms no longer work alone, but as teams that make up supply chains. This development sees supply chains competing against one another to become more efficient and better serve customers for the good of all firms involved. However, this is not without conflict since some firms may benefit more than others and this can lead to conflicts within a supply chain.

Since organizations must work together for the good of all involved, relationships are critical components of any supply chain. While this should not be interpreted as a zero conflict situation, it does mean that situations in which obstacles arise must be handled appropriately. Of vital importance to relationships is knowledge sharing between parties. Knowing the intricacies of other firms within its supply chain will give a firm the ability to be more adaptable and better suited to serve the end customer. What must be avoided in this situation are opportunistic behaviors where a firm can benefit by sabotaging a channel partner whose sensitive information is at its disposal. Therefore, trust and commitment are important factors of supply chain relationships. The end result will be a well-integrated supply chain that can more effectively compete against rival supply chains.

REFERENCES

- Angeles, R., & Nath, R. (2001). Partner congruence in electronic data interchange (EDI) relationships. *Journal of Business Logistics*, 22(2), 109–127. doi:10.1002/j.2158-1592.2001.tb00006.x
- Ballou, R. H. (2007). The evolution and future of logistics and supply chain management. *European Business Review*, 19(4), 332–348. doi:10.1108/09555340710760152
- Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of Management Information Systems*, 22(2), 253–277.
- Burgess, R. (1998). Avoiding supply chain management failure: Lessons from business process re-engineering. *International Journal of Logistics Management*, 9(1), 15–23. doi:10.1108/09574099810805717
- Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management*, 29(3), 163–180. doi:10.1016/j.jom.2010.12.008
- Christopher, M. (1997). *Marketing Logistics*. Oxford: Butterworth-Heinemann.
- Christopher, M., & Juttner, U. (2000). Developing strategic partnerships in the supply chain: A practitioner perspective. *European Journal of Purchasing and Supply Chain Management*, 6(2), 117–127. doi:10.1016/S0969-7012(99)00038-6
- Christopher, M., & Towill, D. (2001). An integrated model for the design of agile supply chains. *International Journal of Physical Distribution & Logistics Management*, 31(4), 235–246. doi:10.1108/09600030110394914

Supply Chain Relationships

- Daugherty, P. J., Richey, R. G., Roath, A. S., Min, S., Chen, H., Arndt, A. D., & Genchev, S. E. (2006). Is collaboration paying off for firms? *Business Horizons*, *49*(1), 61–70. doi:10.1016/j.bushor.2005.06.002
- Duclos, L. K., Vokurka, R. J., & Lummus, R. R. (2003). A conceptual model of supply chain flexibility. *Industrial Management & Data Systems*, *103*(6), 446–456. doi:10.1108/02635570310480015
- Eliashberg, J., & Michie, D. A. (1984). Interorganizational competitive advantage. *Academy of Management Review*, *23*(4).
- Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*, *32*(5), 339–361. doi:10.1108/09600030210436222
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, *13*(1), 35–48. doi:10.1108/13598540810850300
- Goffin, K., Lemke, F., & Szejczewski, M. (2006). An exploratory study of ‘close’ supplier-manufacturer relationships. *Journal of Operations Management*, *24*(2), 189–209. doi:10.1016/j.jom.2005.05.003
- Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, *159*(2), 269–295. doi:10.1016/j.ejor.2003.08.016
- Harland, C., Zheng, J., Johnsen, T., & Lamming, R. (2004). A conceptual model for researching the creation and operation of supply networks. *British Journal of Management*, *15*(1), 1–21. doi:10.1111/j.1467-8551.2004.t01-1-00397.x
- Holweg, M., Disney, S., Holmstrom, J., & Smaros, J. (2005). Supply chain collaboration: Making sense of the strategy continuum. *European Management Journal*, *23*(2), 170–181. doi:10.1016/j.emj.2005.02.008
- Jap, S. D. (2001). Perspectives on joint competitive advantages in buyer-supplier relationships. *International Journal of Research in Marketing*, *18*(2), 19–35. doi:10.1016/S0167-8116(01)00028-3
- Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, *29*(1), 65–83. doi:10.1016/S0019-8501(99)00113-3
- Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *International Journal of Logistics Management*, *9*(2), 1–20. doi:10.1108/09574099810805807
- Lancioni, R. A. (2000). New developments in supply chain management for the millennium. *Industrial Marketing Management*, *29*(1), 1–6. doi:10.1016/S0019-8501(99)00106-6
- Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review*, *82*(10), 102–112. PMID:15559579
- Lee, H. L., & Whang, S. (2001). E-business and supply chain integration. *SGSCMF-W2-2001*.
- Leeuw, S., & Fransoo, J. (2009). Drivers of close supply chain collaboration: One size fits all? *International Journal of Production and Operations Management*, *29*(7), 720–739. doi:10.1108/01443570910971397

Supply Chain Relationships

- Lejeune, M. A., & Yakova, N. (2005). On characterizing the 4 C's in supply chain management. *Journal of Operations Management*, 23(1), 81–100. doi:10.1016/j.jom.2004.09.004
- Lummus, R. R., & Vokurka, R. J. (1999). Defining supply chain management: A historical perspective and practical guidelines. *Industrial Management & Data Systems*, 99(1), 11–17. doi:10.1108/02635579910243851
- Malhotra, A., Gosain, S., & El Sawy, O. A. (2005). Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *Management Information Systems Quarterly*, 29(1), 145–187.
- Maloni, M. J., & Benton, W. C. (1997). Supply chain partnerships: Opportunities for operations research. *European Journal of Operational Research*, 101(3), 419–429. doi:10.1016/S0377-2217(97)00118-5
- Manthou, V., Vlachopoulou, M., & Folinas, D. (2004). Virtual e-chain (VeC) model for supply chain collaboration. *International Journal of Production Economics*, 87(3), 241–250. doi:10.1016/S0925-5273(03)00218-4
- McHugh, M., Humphreys, P., & Mclvor, R. (2003). Buyer-supplier relationships and organizational health. *The Journal of Supply Chain Management*, 39(2), 15–25. doi:10.1111/j.1745-493X.2003.tb00151.x
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Mentzer, J. T., Stank, T. P., & Myers, M. B. (2006). *Why Global Supply Chain Management? Handbook of Global Supply Chain Management*. Thousand Oaks, CA: Sage Publications.
- Metters, R. (1997). Quantifying the bullwhip effect in supply chains. *Journal of Operations Management*, 15(2), 89–100. doi:10.1016/S0272-6963(96)00098-8
- Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Glenn Richey, R. (2005). Supply chain collaboration: What's happening? *International Journal of Logistics Management*, 16(2), 237–256. doi:10.1108/09574090510634539
- Myers, M. B., & Cheung, M. S. (2008). Sharing Global Supply Chain Knowledge. *Sloan Management Review*, 49(Summer), 67–73.
- Sahay, B. S. (2003). Supply chain collaboration: The key to value creation. *Work Study*, 52(2), 76–83. doi:10.1108/00438020310462872
- Sheu, C., Rebecca Yen, H. J., & Chae, B. (2006). Determinants of supplier-retailer collaboration: Evidence from an international study. *International Journal of Operations & Production Management*, 26(1), 24–49. doi:10.1108/01443570610637003
- Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *International Journal of Logistics Management*, 13(1), 15–30. doi:10.1108/09574090210806333
- Simatupang, T. M., & Sridharan, R. (2004). Benchmarking supply chain collaboration: An empirical study. *Benchmarking: An International Journal*, 11(5), 484–503. doi:10.1108/14635770410557717

Supply Chain Relationships

- Simatupang, T. M., & Sridharan, R. (2005). An integrative framework for supply chain collaboration. *International Journal of Logistics Management*, *16*(2), 257–274. doi:10.1108/09574090510634548
- Soosay, C. A., Hyland, P. W., & Ferrer, M. (2008). Supply chain collaboration: Capabilities for continuous innovation. *Supply Chain Management: An International Journal*, *13*(2), 160–169. doi:10.1108/13598540810860994
- Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics*, *22*(1), 29–48. doi:10.1002/j.2158-1592.2001.tb00158.x
- Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing and Supply Management*, *7*(1), 39–48. doi:10.1016/S0969-7012(00)00020-4
- Tuten, T. L., & Urban, D. J. (2001). An expanded model of business-to-business partnership foundation and success. *Industrial Marketing Management*, *30*(2), 149–164. doi:10.1016/S0019-8501(00)00140-1
- Vitasek, K. (2013). *Supply Chain Management Terms and Glossary*. Retrieved from http://cscmp.org/sites/default/files/user_uploads/resources/downloads/glossary-2013.pdf

ADDITIONAL READING

- Ireland, R.K., & Crum, C. (2005). *Supply Chain Collaboration: How to Implement CPFR and Other Best Collaboration Practices*. Boca Raton, Florida: J. Ross Publishing, Inc.

KEY TERMS AND DEFINITIONS

Bullwhip Effect: Common in supply chains that rely on forecasts, this occurs when variability continually increases as one progress upstream in a supply chain from the customer to the raw materials suppliers due to orders that are exaggerated in order to provide buffer stock.

Decision Synchronization: The ability for channel partners to engage in decision making that considers the interests of the supply chain rather than any individual firm.

Incentive Alignment: When channel partners share costs and benefits in supply chain relationships in a manner that all parties feel is equitable.

Information Sharing: The process in which supply chain partners share critical and often sensitive knowledge in order to create a more harmonized supply chain.

Just-in-Time (JIT) Inventory System: When a downstream customer takes delivery of materials required for production when they are needed rather than carrying inventory.

Logistics: The planning and managing of all activities related to the storage and movement of physical goods between origin and consumption.

Supply Chain Collaboration: Occurs when boundary spanning relationships exist between mutually dependent firms who work together for joint success. The primary focus for these firms is the overall well-being and success of the supply chain.

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Supply Chain Management: The process of managing all activities, ranging from the raw materials source to the customer, including sourcing, procurement, production, transportation, and logistics management.

Vendor Managed Inventory: When an upstream supplier manages the inventory of its product at a downstream customer location.

Chapter 14

Green Supply Chain Initiatives: The India Perspective

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ABSTRACT

Emergence of 'sustainability' as the new paradigm of conducting business has led to increased focus on operations of firms in emerging economies such as India. With growing concerns on the environmental impact of products and processes of firms in emerging economies, it becomes imperative to understand the factors steering green initiatives in India. This chapter aims to answer the question regarding what drives firms in India towards greening? Through research and discussions with managers, we observe certain common underlying factors determining firms' greening initiatives. The chapter aims to outline these common factors and takes a look at various approaches of firms in India in line with those factors. The current work aims to provide a better understanding of environmental friendly practices in India to both practitioners and researchers alike and establishes a platform for green supply chain research.

INTRODUCTION

The increasing environmental concerns of nations world over have led organisations to reconsider their existing supply chain designs and operations from a sustainability standpoint (Porter & Kramer, 2006; Wu & Pagell, 2011). Globally spread supply chains have led firms operating in emerging economies like India to notice the need for environmentally- friendly products and processes. While India's standing in environmental rankings globally has been below par (rank 155 out of 178 countries in the Environmental Performance Index by Yale University), firms in India are gradually undertaking pioneering efforts in greening their supply chains, products and processes (Yale University, 2014). While the Information

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Technology and services sector is at the forefront of this change, several traditional sectors like automotive and industrial good manufacturing firms are taking giant steps towards green initiatives. There is a growing need to understand such initiatives being undertaken in emerging economies (Khanna & Palepu, 2006; Cheung, Tan, Ahn, & Zhang, 2010).

An in-depth understanding of green initiatives of firms in countries like India would provide an innovative approach to new firms looking to conduct business in emerging markets (Khanna et al., 2005). Further, for existing firms, this serves as an opportunity to review their supply chain strategies. Several observations can be outlined for green initiatives in India. Increased awareness, focussed government regulations and pressure from non-governmental organisations are forcing companies to go 'green'. Giant beverage manufacturer Coca-Cola, for example, has often faced accusations about ground water depletion and contamination due to its operations in the state of Kerala (a state located in the southern half of India). It has faced similar accusations elsewhere in India, leading to several litigations and focussed sustainability efforts from the leading soft drink maker.

In another example, while Indian emission standards are at least a few years behind European emission standards, the central pollution control board under the ministry of environment and forests is making strides in implementing the *Bharat stage IV* (equivalent to Euro 4) standards for all automobiles in major cities in India. In a different view, the changing preferences of consumers in India hold potential for companies to take advantage of the growing 'green' consumer base while simultaneously managing the costs of doing so. Firms like Hindustan Unilever (HUL), for example, have chalked out innovative product strategies to not only reduce wastage and natural resource consumption during product usage, but have also increased market penetration several folds through the introduction of such products in the Indian consumer market.

In-home water purifier, *Pureit*, is one such example, which does not require electricity or continuous tap water supply. Giant consumer goods company, P&G, has also entered into the manufacturing and marketing of several environmentally conscious products in India. To cite examples, products like *Ariel Excel Gel*, *Pampers*, and *Gillette Fusion* have been innovatively designed such that they not only consume less water and energy during usage, but also during their manufacturing.

Question then arises as to what drives firms in India towards greening. Through research and discussions with managers, we observe certain common underlying factors determining firms' greening initiatives. We believe outlining these common factors will work towards a better understanding of environmental friendly practices in India to both practitioners and researchers alike. The change as we observe is being initiated on four fronts: regulatory enactment, consumer driven demand, price premium potential, and cost reduction prospects.

ENVIRONMENTAL REGULATIONS DRIVEN GREENING

Increased government regulations and environmental standards are mandating organisations to go green. While the European Community created the WEEE (Waste Electrical and Electronic Equipment Directive) and RoHS (Restriction of Hazardous Substances), directives around 2003 with effective enforcement over the years and the USA-enacted several amendments to its laws through its Environmental Protection Agency (Corporate Average Fuel Economy (CAFE) regulations for automobiles being one such example). India had been slow to catch up with such initiatives. Recent changes by the Indian Legislation are gradually directing firms to undertake sustainable initiatives. For example, the National Manufacturing Policy,

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2012, issued by the Department of Commerce outlines regulatory and market based incentives to drive firms towards green initiatives. This includes setting emission and discharge standards, suggesting a choice of technologies for cleaner and greener operations, incentivising the indigenous development of green technology through tax concessions and subsidies and setting up a Technology Acquisition and Development Fund (TADF) for the acquisition of appropriate technologies.

In another example, the Security and Exchange Board of India (SEBI) mandated the Top 100 listed entities (based on market capitalisation) at Bombay Stock Exchange (BSE) and National Stock Exchange (NSE) to disclose what is called the Business Responsibility Report covering Environmental, Social, and Governance perspectives. Furthermore, in 2011, the Ministry of Environment and Forests drafted the E-waste (Management and Handling) Rules which made producers of electrical and electronic equipment manufacturers responsible for the life-cycle of products and for take-back, recycling and disposal. It came into complete effect only in May, 2012.

India generated around 0.8 million tonnes of e-waste in 2012 and by 2018, e-waste generated from India is expected to exceed two million tonnes (Central Pollution Control Board, 2011). To cope up with such legislations, a few firms have developed their own research and development capabilities to change processes and bring environmentally friendly products into the market, while several others have formed joint ventures or invested in third party research organisations to develop cleaner technologies. For example, PC and laptop manufacturers like Toshiba and Hewlett Packard (HP) have developed products which conform to RoHS (Restriction of Hazardous substances) requirement across the world and also comply with the “India E-waste Rule 2011” by limiting the use of lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers to the minimum levels prescribed by the rules (Toshiba India, 2012). Toshiba is also committed to the cause of proper disposal and recovery of e-waste in India.

In another example, the project ULCOS (Ultra Low Carbon Emissions) is a joint venture of several EU steel companies and TATA steel (Indian multinational steel making company) for developing technologies for reduction of carbon emissions by at least 50 percent. With Government restrictions on discharge of effluents in water bodies, Asian paints (Indian Chemicals company) has achieved zero industrial discharge capability in all its paint plants through the deployment of effluent treatment facilities and reverse osmosis techniques. In addition, the firm has reduced water usage per litre of paint manufactured by 54% and energy consumption by 17% (IHS, 2011). Soft drink and bottled water manufacturers such as Coca Cola and Bisleri (Indian bottled water manufacturer) are collaborating with third party recyclers for processing and recycling PET bottle wastes. The firms are innovatively leveraging the network of rag pickers in metro cities for collection of waste bottles while incentivising them through monetary payouts.

CONSUMER DEMAND DRIVEN GREEN INITIATIVES

Increasingly changing preferences of consumers in India towards green products provide opportunities for firms to capture the ‘green’ consumer segment (DuPont, 2014). Manufacturers today face a changed demand against polluting, carbon intensive products and increased purchasing of greener products. For example, consumers often look for the energy rating in electrical products like ACs, refrigerators, and tube lights or conduct fuel efficiency checks for automobiles. Firms in India realize the brand value that green products carry and for many industrial sectors greening is turning into an important value proposition for competition. To cite a few examples, the automotive sector, which is often considered to

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be at the forefront of technological innovation, has displayed new product lines of hybrid cars, fuel cell based vehicles, less energy intensive engines, and more fuel efficient vehicles. Auto makers in the Indian market are increasingly under pressure to design and deliver highly fuel efficient cars to consumers who are sensitive about their increasing fuel expenses.

While auto maker Maruti (Indian automobile manufacturer) came up with *Alto* and *Swift* models and Hyundai with *i10* with mileage north of 20 kmpl¹, General Motors in India introduced *Chevrolet Beat* in both diesel and petrol versions with an average mileage of 24 kmpl. Needless to say, auto makers often go an extra mile through their advertisements to pitch innovative fuel-efficient vehicles to Indian consumers in a very competitive market. To achieve results, this not only entails a change in their existing products and processes, but also of their partners in the supply chain. Manufacturers realize that green supply chain initiatives must extend beyond the boundaries of their organizations and involve players upstream and downstream of the supply chain. This further affects the relationships and contracts with both retailers and suppliers. ITC (a multi-business conglomerate in India) is one of the quintessential examples of a sustainable venture. ITC's agribusiness division launched what is called the 'e-choupal' ('choupal' means a village gathering place). E-choupal is a successful Information and Communication Technology (ICT) initiative by ITC, which helps farmers garner information about the weather forecasts, better farming practices, market prices (on a real time basis) and take an informed decision on selling their farm produce. Through this initiative, ITC strengthens the supply chain of farm produce by not only empowering the farmers with better information, but also by reducing the marginalization by cutting out many middlemen. Furthermore, through direct sourcing ITC has improved product quality several folds. *Aarshirvaad atta* produced by ITC is one such example, which has increasingly penetrated the Indian households because of its superior quality. The overall increase in brand reputation through such initiatives, in a highly competitive CPG Industry is worth much more to the firm.

In another example, Consumer Packaged Goods (CPG) company HUL, as a part of its *Sustainable Living Plan*, has introduced innovative products which consume less water and electricity during their usage. *Comfort One Rinse Fabric Conditioner* introduced by the company targets to save water consumption during post wash activities. Similarly, after wash laundry product *Magic* intends to reduce water usage during the rinsing of clothes.

In addition, shampoo and hair conditioners which reduce water consumption during usage are also being worked on by the firm. HUL's strategy of introducing environmentally friendly products in the Indian market while leveraging its widespread distribution network, emerges from the core principle that a change in Indian consumer behaviour towards more innovative and environmentally friendly products will lead to widespread market penetration and serve as a definite source of competitive advantage for this CPG giant.

PRICE PREMIUM POTENTIAL THROUGH GREENING

Contrary to common understanding of Indian consumers being price sensitive, firms realize there are consumer pockets in India which are increasingly focused on products built through ethical and sustainable sourcing, clean manufacturing practices, and health friendly. Secondary research also suggests that several consumers are often ready to pay a premium for these products (Nielsen, 2013). Such products range from organic food and apparels to paints, furniture and electronic gadgets. The organic foods market in India for example, is currently valued at US\$10 billion and reported to grow at a staggering

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20% (Business Standard, 2012). Several initiatives have been taken by firms focussed on such niche markets. Ecofarms (India) Ltd. for example, started with a group of farmers in the 1990's practising organic farming in the Yavatmal district of Maharashtra (a state located in the western part of India).

Today, its practices have spread to several other districts of Maharashtra and states in the country. Among its product categories are organic cotton clothing, organic cereals, pulses, oil seeds, spices, fruits and vegetables, processed foods like soybeans, sugar, flakes, medicinal plants and herbs. From humble beginnings, the company today has joined major retail chains such as Reliance, Big Bazaar, Metro Cash and Carry and Aditya Birla (*More Retail Chain*) to market its products under the brand name of 'Ecofarms'.

In another example, initiatives by Fab India (an Indian craft based retail chain) to collaborate with Indian artisans to build a profitable business and a well-known brand; have been documented and researched over time. Through an innovative strategy of consolidation of upstream supply chain activities, Fab India focuses on an organic, khadi loving consumer market and garners good margins for its products. Fab India's innovative upstream supply chain consolidation includes setting up of "supplier region companies (SRCs)" involving community of artisans, handloom workers and craftsmen who are responsible from sourcing to producing most of Fab India's product categories.

Owing to the success of the retail chain, Future Group (an Indian retail conglomerate) has also invested in another similar retail chain-*Mother Earth* which leverages workmanship of rural communities to create sustainable livelihoods while targeting urban Indian consumers.

COST REDUCTION THROUGH GREENING

Several firms in India view greening as an opportunity to eliminate waste and reduce costs. The top management of these organisations have consciously moved beyond the current set of products and processes, to plan actions for an environmentally conscious establishment. Cost reduction is primarily targeted through reduction in consumption of fuels, energy savings, reduction in total waste generated (which has to be either separately treated or safely disposed). For example, Xerox, the world's largest distributor of cut sheet paper, intended to reduce greenhouse gas (GHG) emissions by 25% by 2012-13 from its 2002 levels and beat this goal with over 42% reduction in GHG emissions (Xerox, 2013). This not only enhances Xerox's reputation, it also realizes savings for its end users through reduced wastage of papers and toner cartridges.

Mahindra Rise (an Indian multinational conglomerate) undertook several green initiatives across several of its divisions over the years leading to cost savings and enhanced reputation. Mahindra Rise undertook "Reduce, Reuse and Recycle" program across its auto and farm sectors and the initiatives led to savings of US\$5,792 for the period 2012-13. The same program was initiated at its paint shop in AD, Nashik (a city in Western India in the state of Maharashtra) which led to a saving of US\$0.45 million in 2012-13 (Mahindra, 2013).

To cite another example, Tata Chemicals (an Indian chemicals, crop nutrition, and consumer products company) has targeted innovative solutions to realise potential savings in their logistics function. Tata chemicals bought *Lupa bulkers* (large size transportation equipment) to transport the soda ash produced, thus cutting out on usage of plastic bags and material handling equipment. The firm found that this option is not only environmentally friendly because of the reduced carbon dioxide emissions, but also realises savings (Tata chemicals, 2012).

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PepsiCo India has invested in a renewable energy initiative in their Kolkata plant (Kolkata is the capital of West Bengal, a state located in the eastern part of India), replacing LPG² with rice husk for their energy consumption and thus saved around 1,000 metric tons of LPG per year and at the same time reduced GHG emissions by 2,700 metric tons (PepsiCo India, 2011). In another example, Pfizer India has invested in green chemistry solutions for their products as a part of their global initiatives which has reaped benefits amounting to US\$110 million in cost savings over the past five years alone (Ramesh, 2009). Indian pharma firms like DSM Pharmaceutical products and Dishman Pharma have been in the forefront of innovations in reduction of waste through their green initiatives. These savings are a result of efficient operational practices combined with a positive reinforcement of their drive for environmental protection.

CONCLUSION

Initiatives by firms in India are burgeoning. A combination of the factors outlined here are driving firms in India to undertake green initiatives. However, the challenges of implementing greening plans in India remain. Economic benefits of greening are often not realized immediately. Several of the product and process changes entail significant investments which may only yield returns in the long run. The low hanging fruits of greening initiatives can often be assimilated by firms, but with the increasing convex nature of costs, firms in India find it difficult to take such decisions in the short run.

Research has revealed that the economics of certain green initiatives like re-manufacturing, reverse logistics are positive for firms (Guide & Wassenhove, 2009). However, this often requires a well-integrated supply chain with firms working in close collaboration with each other. Disparate supply networks, lack of infrastructure facilities and trust deficit between supply chain partners add to the challenges in India (Shah & Ghosh, 2011). While firms fret over solving day to day supply chain issues, greening initiatives are often ignored.

Under these circumstances, firms in India which innovate to bring in greener products in the market while impacting consumer demand and reducing costs will stand to benefit significantly. Firms which are able to create and serve niche markets in green products will win in comparison to firms operating in highly competitive markets with razor thin margins.

Through innovative consumer product designs which look to change consumption patterns in a resource constrained economy like India, CPG companies in particular in India; aim to target the large potential Bottom of Pyramid consumers (Shah & Ghosh, 2010). With intensive distribution networks and gradual change in consumer behavior, this strategy of CPG companies in India can be a source of long term advantage (Shah, 2009). Additionally, strict enforcement of environmental legislations will bring forth a significant competitive advantage to greener, sustainable firms while improving their brand image manifolds.

As global players continue to enter the Indian market and as Indian firms play a larger role in global trade, scrutiny of sourcing, production and distribution practices along with environmental and labour standards will get tougher. Under such circumstances, firms in India which are surging ahead with greener practices will stand to benefit.

Green Supply Chain Initiatives**REFERENCES**

- Business Standard. (2012). Retrieved from http://www.business-standard.com/article/companies/india-s-organic-foods-market-growing-at-over-20-112082300157_1.html
- Central Pollution Control Board. (2011). Implementation of E-Waste Rules 2011: Guidelines. Retrieved from http://cpcb.nic.in/upload/Latest/Latest_71_ImplementationOfE-WasteRules.pdf
- Cheung, Y. L., Tan, W., Ahn, H. J., & Zhang, Z. (2010). Does corporate social responsibility matter in Asian emerging markets? *Journal of Business Ethics*, 92(3), 401–413. doi:10.1007/s10551-009-0164-3
- DuPont. (2014). DuPont Green Living Survey: India 2014; Consumer Awareness and Adoption of Biobased Products. Retrieved from <http://www.dupont.co.in/corporate-functions/media/press-releases/Green-living-india-press-release.html>
- Guide, V. Jr, & Van Wassenhove, L. N. (2009). The Evolution of Closed-Loop Supply Chain Research. *Operations Research*, 57(1), 10–18. doi:10.1287/opre.1080.0628
- IHS. (2011). Asian Paints Minimizes Environmental Impact and Maximizes New Operational Efficiencies. Retrieved from http://www.ihs.com/pdfs/Asian_Paints-2011_Excellence_Award-2.pdf
- Khanna, T., & Palepu, K. (2006). Emerging giants. *Harvard Business Review*, October, 60–69.
- Khanna, T., Palepu, K., & Sinha, J. (2005). Strategies that fit emerging markets. *Harvard Business Review*, 83, 6–15. PMID:15938439
- Mahindra. (2013). Retrieved from <http://www.mahindra.com/How-We-Help/Environment/Sustainability-Reports>
- Nielsen. (2013). Retrieved from <http://www.nielsen.com/us/en/press-room/2013/nielsen-50-percent-of-global-consumers-surveyed-willing-to-pay-more-fo.html>
- PepsiCo India. (2011). Retrieved from <http://pepsicoindia.co.in/Download/environment%20Sustainability.pdf>
- Porter, M. K., & Kramer, M. R. (2006). Strategy & Society—The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review*, 84(6), 78–92. PMID:17183795
- Ramesh, D. (2009). Cost Cutting Becomes the Pharma Industry's Mantra. *Chemical Week*, October, 24–28.
- Shah, J. (2009). *Supply Chain Management: Text and Cases*. Delhi, India: Pearson Education.
- Shah, J., & Ghosh, D. (2010). Business strategy drives supply chains. *Economic Times*, 1-2.
- Shah, J., & Ghosh, D. (2011). *Decoding Supply Chain Leadership in India in Managing Supply Chains on the Silk Road: Strategy, Performance, and Risk*. London: Taylor and Francis.
- Tata Chemicals. (2012). Tata Chemicals takes another step towards a green supply chain strategy for soda ash. Retrieved from http://tatachemicals.com/media/releases/201207july/20120731_soda_ash.html#.VEOAGPmSyNg

Green Supply Chain Initiatives

Toshiba India. (2012). Environmental Position. Retrieved from <http://www.toshiba-india.com/environment.html>

Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, 29(6), 577–590. doi:10.1016/j.jom.2010.10.001

Xerox. (2013). Retrieved from http://www.xerox.com/downloads/usa/en/e/Environment_Sustainability_Commitment.pdf

Yale University. (2014). Environmental Performance Index. Retrieved from www.epi.yale.edu/epi

ENDNOTES

¹ Kilometer per litre

² Liquefied petroleum gas

Chapter 15

Sustainability: A Comprehensive Literature

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ABSTRACT

Sustainability has become vital aspects for today's world and the future to come. Various definition of sustainability have added to the confusion with respect to sustainability in people's mind and in the organizations. A collection of different sustainability frameworks, indicators and tools have provided important insights about the outcomes of the sustainability process and in providing analytical and logical designs for sustainability. However, implementing sustainable practices has been overlooked by the majority of the organizations. Identifying the challenges and integrating with the tools in the form of indicators, assessment, and strategies will be a good start for an organization to be sustainable. The organizations that develop and implement sustainable practices are recognized as a success in sustainability. This chapter aims to provide an outline for sustainability with strategies, assessment, indicators, and application for better products and create and maintain business and customer value.

INTRODUCTION

Well-being has always been correlated with real asset value. The important aspects that must be emphasized are to articulate the concerns about sustainability or sustainable development. With the Brundtland Report (1987), there was little doubt about the relevance of the term "sustainable development" within the contemporary debates on development policy and more specifically the environment and resources policy (Atkinson, 2008). However, the term sustainability and sustainable development have conveyed different meanings to a different sector of people about current decision that affect the well-being of the people of the future (Atkinson, 2008). Still, many scholars still cite the famous definition from the Brundtland Report for sustainable development as:

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Sustainability

Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. (WCED, 1987, p. 43)

The predominant approach is to bring the concept of sustainability and sustainable development from the literature to practical aspects and redefine within a particular context. Many factors make the implementation of sustainability difficult and draw conclusions from current literature. Rather, many concepts of sustainability have been proposed to reflect the major issues. Different approaches have different implications for the way in which the issues are handled and draw some conclusions. The triple bottom line approach is well known in terms of identifying the different indicators of economic, social, and environmental concerns presented as heterogeneous units. This will provide a link for empirical and policy framework on the basis of the principles of accounting and sustainability concepts as the Global Reporting Initiative (GRI) in 1999.

Companies, governments, and non-government organizations (NGOs) usually use the triple bottom line model for sustainability issues. The three pillars, namely social, economic, and environmental are the backbone of the triple bottom line used for sustainability aspects. Sustainability will influence with, related to context, innovation by itself, process and capacity to sustain (Wiltsey Stirman *et al.*, 2012). Sustainability should be adopted as a goal for the organization. The comprehensive activities of the organization must be sustainable. It is the governing body that plays different characters in creating sustainability, instead than in adopting sustainability as a societal goal (Jennings & Zandbergen, 1995). According to the US National Academy of Science, people are related to the social system, profit with economic systems and finally planet in the environmental system.

Thus, the three pillars are known as triple bottom line (TBL) or 3Ps (People, Planet, and Profit) and its solution can be achieved by balancing the 3Ps. Priorities must be set to achieve the 3Ps so that one P can gain profit with the expenses of another in which each P is important and crucial. It shows that the sustainability has multi-actor characteristics in nature. Thus, according to Achman (2011), sustainability is not a top down solution to balance the 3Ps, but rather it is a consensus solution where stakeholders are involved in the decision-making process. Mulder (2006) defines the 3Ps as follows:

- **Planet:** Reaching a balance between the environmental burden and the capacity of the earth to carry environmental burdens.
- **People:** Deals with the communities and workers who have a stake in organization activities.
- **Profit:** All economic activities must create prosperity for the organization as well as well-being for the employers. It is necessary to distinguish between short-term and long-term perspectives.

Gradually, sustainability or sustainable development has evolved further and influenced many activities from policy, technology, and the economy on a daily basis. This has created an environment and involvement of different stakeholders in developing and managing the 3Ps, which became important and played a crucial role in the successful planning and implementation of sustainability activities in the organization. Mulder (2006) states the basic principles that describe sustainable activity areas as:

1. Consumption of resources should be optimum
2. Consumption of non-renewable materials should be closed
3. Renewable materials and energy sources should be given preferences

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4. Development of human potentials like communication, creativity, cooperation should be encouraged; and
5. The contribution should be made not to get personal profit rather work for the common goal

As the demand profile changes, there becomes a need for the companies to operate in a less secure and more complex environment, making their business plan their strategies to cater for a wide range of requirements. According to Pham & Thomas (2012), low cost, high responsive, and flexible product is required in order to capture the new markets by the company and also become economically sustainable. However, due to this the organization should be able to support the operations and integrate the traditional strategic requirements of agility with business process strategies in order to achieve a sustainable environment and to be sustainable. Sustainability is defined as “ability to solve some of the world’s most complex sustainability challenges with rapidly evolving business innovations, applications, methods, products and processes, adapted to changing situations” (Dixon & Gorecki, 2010:8).

Hence, sustainability has become a core part of business strategy and simultaneously it delivers value to shareholders in a more responsible way by making sustainable long-term decisions to build an organization. Thus, both keeping sustainability and agility will provide potentially to grow rather than achieve the actual growth and expansion. Hence, sustainability is about making the right decision for our people, communities, and shareholders and most importantly, for the plant.

DEFINITION OF SUSTAINABILITY AND SUSTAINABLE DEVELOPMENT AND ITS TAXONOMY

Sustainability is defined as “interconnections for understanding the concept and for better communication in the process of developing and moving the society in sustainable development” (Glavič & Lukman, 2007, p. 1884). The term sustainable development has become important in understanding the long-term impact of activities and with an increase in awareness of the importance of sustainability. Sustainable development is used for the development of human society with environmental and economic aspects. To have a clear vision and its connections between three pillars, sustainability and sustainable development Doods and Venables (2005) have shown the integration among all the three terminologies in Figure 1. Thus, to reach in implementing the three pillars, 3Ps or triple bottom line and to achieve sustainability are to manage by significant shifts in behaviour and consumption patterns with technological change. There are many definitions of sustainability and sustainable development offered by different scholars, researchers, and industry practitioners in the past years and has gained popularity. Table 1 and 2 shows some selected definitions of sustainability and sustainable development.

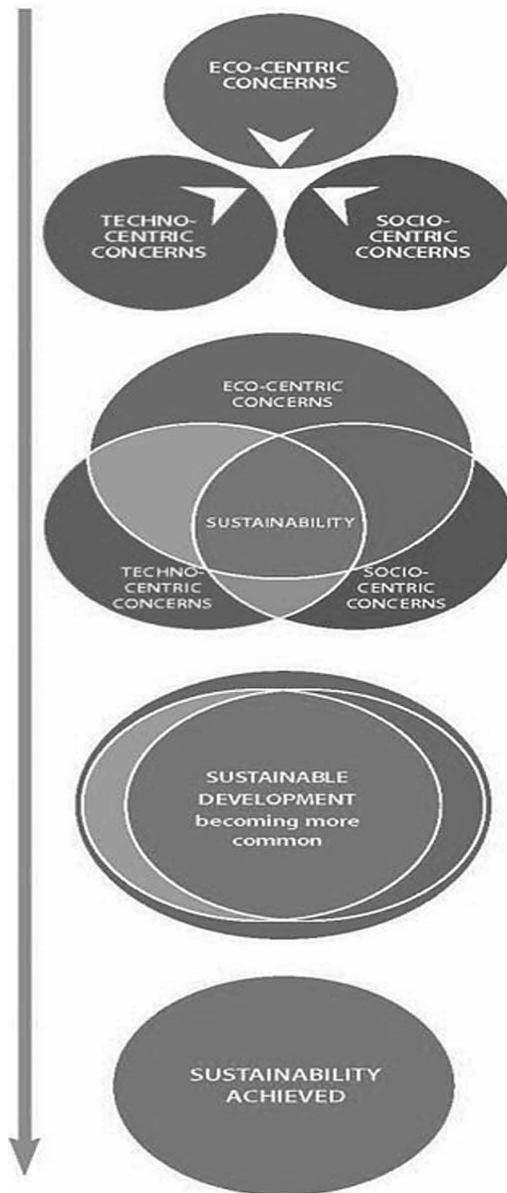
CONCEPT OF TRIPLE BOTTOM LINE (TBL)

The triple bottom line was coined by John Elkington in 1995 (Vanclay, 2004) and was not popular until his book, *Cannibals with Forks: The Triple Bottom Line of 21st Century Business*, in 1997. Elkington's consultancy company, SustainAbility, has given the bigger picture in 1987 about TBL and also the accounting concept.

Sustainability

Figure 1. Moving towards sustainable development

Source: Dodds & Venables, 2005



The triple bottom line (TBL) focuses corporations, not just on the economic value they add, but also on the environmental and social value they add and destroy. At its narrowest, the term ‘triple bottom line’ is used as a framework for measuring and reporting, corporate performance against economic, social, and environmental parameters.

At its broadest, the term is used to capture the whole set of values, issues and processes that companies must address in order to minimize any harm resulting from their activities and to create economic, so-

Sustainability*Table 1. Partial list of definition of sustainability*

| Author (Year) | Sustainability Definition |
|--|---|
| Watson et al.(2010) | Seeking sustainability does not mean abandoning economic thinking |
| Enkvist et al.(2007) | Fundamental impact on key issues of business strategy, such as production economics, cost competitiveness, investment decisions, and the value of different types of assets |
| Russo (2003) | Acquired [...] many overlapping definitions |
| World Commission on Environment and Development (1987) | Development that meets the needs of the present without compromising the ability of future generations to meet their own needs |

Table 2. Partial list of definition of sustainable development

| Author (Year) | Sustainable Development Definition |
|-------------------------------------|---|
| Monet (2001) | Sustainable development means ensuring dignified living conditions with regard to human rights by creating and maintaining the widest possible range of options for freely defining life plans. The principle of fairness among and between present and future generations should be taken into account in the use of environmental, economic, and social resources. Putting these needs into practice entails comprehensive protection of biodiversity in terms of ecosystem, species and genetic diversity, all of which are the vital foundations of life. |
| The World Conservation Union (1991) | To improve the quality of life while living within the carrying capacity of ecosystems. |

cial and environmental value. This involves being clear about the company's purpose and taking into consideration the needs of all the company's stakeholders' shareholders, customers, employees, business partners, governments, local communities, and the public. (Vanclay, 2004:28)

The TBL is a conceptual framework that has encouraged the institution to implement sustainability. Earlier, it was a philosophy or way of thinking to implement sustainability. It is not fundamentally different from the well-established field of impact assessment. The impact assessment and in particular the field of social impact assessment has much more to offer in terms of understanding of professional and theoretical base. TBL line has become a mechanism for simpler accounting and reporting. Vanclay (2004, p. 27) describes TBL as:

- Social, environmental, and economic performance
- Sustainable development, sustainable environment, sustainable communities
- Impact on society, the environment, and economic sustainability
- Economic, environmental, and social sustainability
- Economic prosperity, environmental quality, and social justice
- Economic growth, ecological balance, and social progress
- Economic growth, social progress, and environmental health
- Economy, environment, equity
- Profit, people, planet (or planet, people, profit)

Sustainability

TBL approaches have developed measurement systems that incorporate financial, ecological, and social outcomes for business. It has expanded the baseline for measuring performance, adding social and environmental dimensions to traditional monetary benchmark (Wikström, 2010).

Taxonomy on Studies on Triple Bottom Line (TBL)

Table 3 represents the taxonomy on studies conducted on TBL.

SUSTAINABLE DEVELOPMENT MODELS

Sustainable development has tremendous challenges to remain sustainable and includes many models which aid in understanding the concept of sustainability better. Thus, to achieve sustainable development requires being more effective and productive. Sustainable development models help to share and analyze information, coordinate work, and educate and train policymakers, professionals, and the public. Some of the sustainable development models include the following (Joshi, Ravindranath, Jain, & Nazareth, 2007):

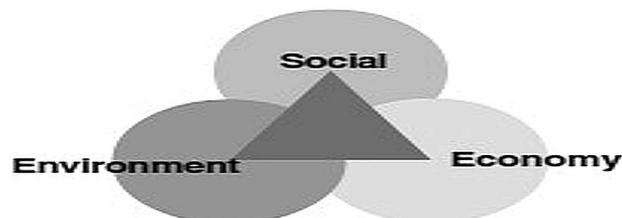
Three Pillar Model

This is one of the common models created using three dimensions known as triple bottom line, namely the economy, environment, and society. The interlocking circles with the triangle are the three dimensions of sustainable development (see Figure 2).

Egg of Sustainability Model

In 1994, the International Unions of Conservation of Nature designed the Egg of Sustainability Model (Gujit & Moiseev, 2001). The relationship between ecosystems and people are put together in an egg shape circle. This shows that people are within the ecosystems and are dependent upon each other. It will be good if both the ecosystems and people are good. Hence, the ecosystem is considered the coordinate system to other dimensions of the triangle. Therefore, according to this model sustainable development = human well-being + ecosystem well-being (IDRC, 1997). See Figure 3.

Figure 2. Three pillar basic model
Source: Joshi et al., 2007



Sustainability*Table 3. Taxonomy on studies on TBL*

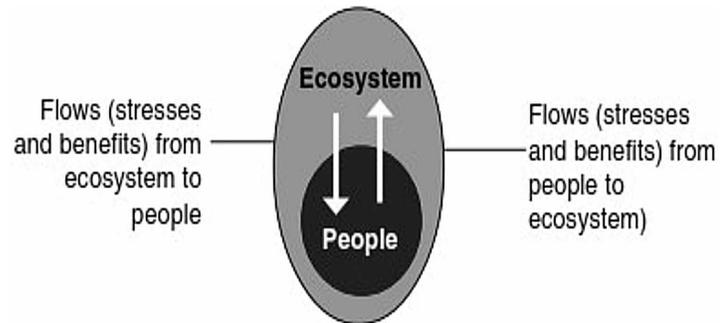
| Author (Year) | Objective | Methodologies and Tools |
|---|--|--|
| Parachini et al. (2011) | Integrate economic, environmental, and social issues across a variety of sectors | The operational multi-scale framework, which comprises the assessment in the three dimensions of sustainability |
| Gormez-liman & sanchez-fernandez (2010) | Evaluate the three dimensions sustainability of farms by means of composite indicators | 16 indicators that cover the three components of the sustainability concepts |
| Zahm et al. (2008) | Designed as a self-assessment tool based on the IDEA method to support sustainable agriculture | 41 sustainability indicators covering the three dimensions of sustainability |
| Van Cauwenbergh et al. (2007) | Proposed a framework for sustainability assessment of agricultural systems, encompassed the three dimensions of sustainability | The framework is composed of principle criteria, indicators and reference values in a structured way |
| Abildtrup et al. (2006) | Presented an approach to the Construction of socioeconomic scenarios required for the analysis of climate change impacts | Scenarios that ensured internal consistency between the evolution of socio-economics and climate change |
| Halberg et al. (2005) | Selected ten input-output IOA systems as effective tools for agri-environmental improvement | Environmental indicators based on good agricultural practices (GAP) |
| Rasul & Thapa (2004) | Examined the sustainability in terms of environmental soundness, economic viability, and social acceptability | 12 indicators covering the three dimensions |
| Glaser & Diele (2004) | Presented some central aspects for the three dimensions of sustainability | Criteria from biology, economics and sociology |
| Lundin & Morrison (2002) | Presented a procedure which measures environmental sustainability of urban water systems, based on Life Cycle Assessment (LCA) methodology | Indicators, which best reflect environmental sustainability |
| Girardin et al. (2000) | Adopted an interaction matrix to evaluate the effects of farmer production practices on the agro ecosystem | Agro-Ecological Indicators (AEI) and Indicators of Environmental Impact (IEI) |
| Onate et al. (2000) | Tried to evaluate the potential effects of Agri-environmental Regulation | Agri-environmental indicators (AEIs) |
| Haas et al. (2000) | Adapted the Life Cycle Assessment (LCA) method, for assessing the environmental impact of production Processes | The whole farm level, efficiently and feasibly assessing all relevant environmental impacts |
| Pannell & Glenn (2000) | Presented a conceptual framework for the economic valuation and prioritization of sustainability indicators | The framework was based on Bayesian decision theory calculate the value of information under conditions of uncertainty |
| Rossing et al. (1997) | Designed a framework for environmentally friendly flower bulb production systems | Economic, environmental objectives, and various socioeconomic constraints |
| Biewinga & Van der Bijl (1996) | Tried to assess ecological and economic sustainability of growing and conversion of crops to energy | Environmental and additional economic indicators specifically for agricultural production systems. |
| Taylor et al. (1993) | Tried to measure ecological sustainability, taking into account recent changes in practices on the farm | Farmer Sustainability Index (FSI), a single value reflecting ecological sustainability. |

Source: Chatzinikolaou & Manos, 2012

Sustainability

Figure 3. Egg of sustainability model

Source: Gujit and Moiseev, 2001



Atkisson's Pyramid Model

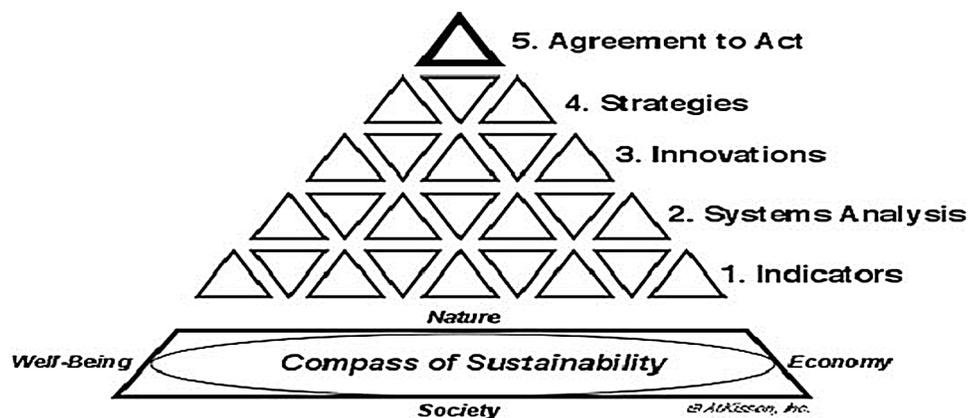
The Atkisson's Pyramid Model supports and accelerates the progress of identifying the vision of sustainability through a plan of action, analysis, and brainstorming. The model guides the process of building the firm based on understanding through searching and collecting relevant information and narrowing down ideas which can be agreed upon by all concerned. The Model (Figure 4) consists of five levels and is a blueprint for the sustainable development process.

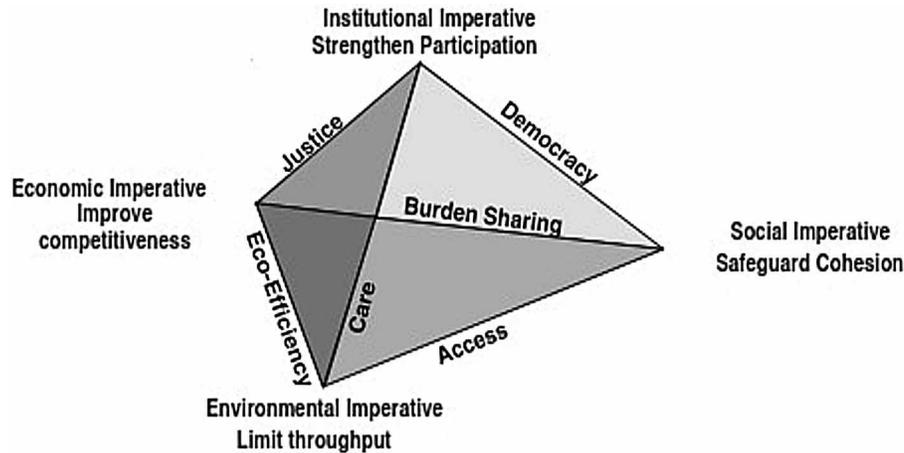
Prism of Sustainability

The model was developed by the German Wuppertal Institute and has four dimensions for sustainable development including the economy, environment, society, and institutions. The inter-linkages show the relations between the dimensions which will transform and influence the policy makers. The prism of sustainability is shown in Figure 5.

Figure 4. Atkisson's pyramid model

Source: Atkisson, Hatcher, Green, & Lovins, 2004



Sustainability*Figure 5. Prism of sustainability**Source: Joshi et al., 2007; Spangenberg, 2003***SUSTAINABILITY INDICATORS**

Sustainability indicators cover all dimensions of sustainability from the sustainable development indicators. The indicators proceed from broad categories through definite aspects to specific indicators and are created on a sector or case basis. They are used at different levels for building national economics to business areas and to product development or services. Sustainability indicators identify which aspects of performance must be improved and to give direction for change rather than to measure incremental improvements. Warhurst (2002) states the sustainable development measurement has a two-step approach: (i) The progress made in a number of selected individual fields is measured; and (ii) the overall progress made towards sustainable development is being assessed by a combination of the individuals to interlink within the fields. Hence, sustainable development indicators have given two approaches that can be distinguished as (Lundin, 2003; Singh et. al., 2009):

- **Top-Down Approach:** In this case, the experts and researchers define the framework and set the sustainable developed indicators.
- **Bottom-Up Approach:** In this case, all the stakeholders participate in designing the framework and in the selection process for sustainable development indicators.

Classification and Taxonomy of Indicators

The classification and taxonomy of indicators is presented in Table 4.

SUSTAINABILITY ASSESSMENT

An evaluation and optimization process that aimed to strengthen and integrate the sustainable development activities in the decision-making process across the areas. The assessment takes place across 3Ps

Sustainability*Table 4. Classification and taxonomy of indicators*

| Authors (Year) | Indicators | | | Institution |
|---|---|---|--|-------------|
| | Economic | Environmental | Social | |
| Paracchini <i>et al.</i> (2011) | Residential Indicators Services; Land based Production; Infrastructure | Abiotic Resources; Provision Habitat; Ecosystem Processes | Work; Health & Recreation; Culture | |
| Gomez-Limon & Sanchez Fernandez (2010) | Income of agricultural Producers; Contribution of agriculture to GDP; Insured area | Economic dependence on agricultural activity; Specialization; Mean area per plot; Soil cover; Nitrogen balance; Phosphorus balance; Pesticide risk; Use of irrigation; water; Energy balance; Agro- environmental subsidy areas | Agricultural employment; Stability of the workforce; Risk of abandonment of agricultural activity | |
| Zahm <i>et al.</i> (2008) | Available income per worker compared with the national legal minimum wage; Economic specialization rate; Financial autonomy; Reliance on direct subsidies from CAP and indirect economic impact of milk and sugar quotas; Total assets minus land's value by non-salaried worker unit; Operating expenses as a proportion of total production value | Diversity of annual or temporary crops; Diversity of perennial crops; Diversity of associated vegetation; Animal diversity; Enhancement and conservation of genetic heritage; Cropping patterns; Dimension of fields; Organic matter management; Ecological buffer zones; Measures to protect the natural heritage; Stocking rate; Fodder area management; Fertilization; Effluent processing; Pesticides and veterinary products; Animal well-being; Soil resource protection; Water resource protection; Energy dependence | Quality of foodstuffs Produced; Enhancement of buildings and landscape heritage; Processing of non-organic waste; Accessibility of space; Social involvement Short trade; Services, multi- activities; Contribution to employment; Collective work; Organization of space; Probable farm sustainability Contribution to world food balance; Training; Labour intensity; Quality of life; Isolation; Reception, hygiene and safety | |
| Van Cauwenbergh <i>et. al.</i> (2007) | Farm income; Dependency on direct and indirect subsidies; Dependency on external Finance; Agricultural activities; Market activities; Farmer's professional training; Inter-generational continuation of farming activity; Land tenure arrangements; Adaptability of the farm | Supply (flow) of quality air function; Supply (stock) of soil function; Supply (flow) of water function; Water flow buffering function; Supply (flow) of energy function; Supply (stock) of biotic resources; Supply (stock) of habitat function; Biotic resource flow buffering function | Food security and safety; Physical well-being of the farming community function; Psychological well-being of the farming; community function; Well- being of the society | |
| Rasul & Thapa (2004) | Land productivity; yield stability and profitability | Land-use pattern; cropping pattern; soil fertility management; pest and disease; management; soil fertility status | Input self-sufficiency; equity; food security; risks and uncertainties involved in crop cultivation | |

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Sustainability

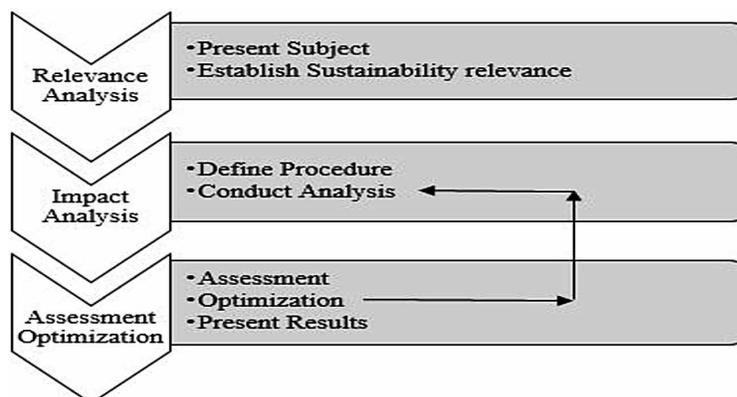
Table 4. Continued

| Authors (Year) | Indicators | | | Institution |
|--|--|--|---|---|
| | Economic | Environmental | Social | |
| Global Reporting Initiative (2002) | Direct Economic Impact | Environmental | Labour practices and decent work Human rights Society Product Responsibility | |
| Institution of Chemical Engineers – IChemE (2002) | Profit, value and tax Investments Additional items | Resources usage Emission, waste and effluents Additional items | Workplace Society Additional items | |
| United national Commission on Sustainable Development – UNCSO (2001) | Economic structure Consumption and production patterns | Atmosphere Land Ocean, Seas, and Coasts Fresh water Biodiversity | Equity Health Education Housing Security Population | Institutional framework Institutional capacity |
| Spangenberg & Bonniot (1988) | Gross National Product Growth rate Innovation Competition | Resources use State indicators | Healthcare Housing Social Security Unemployment | Participation Justice Gender Balance |

or TBL to discover the impacts of projects, political issues, and conflicting goals which promote the optimization at the earliest possible stage. The assessment occurs prior to project realization. The sustainability assessment is focused on the strategic, planning, and programmatic levels and is involved in the evaluation of projects and undertakes the broad range of policy sectors (Federal Office for Spatial Development ARE, 2004). Sustainability assessment evaluates the projects based on the criteria set by sustainable development strategy division. Sustainability assessments are identified by three phases: (i) relevance analysis; (ii) impact analysis; and (iii) assessment/optimization. These can be displayed as a flowchart in Figure 6.

Figure 6. Sustainability assessment procedure

Source: Berger, 2007



Sustainability

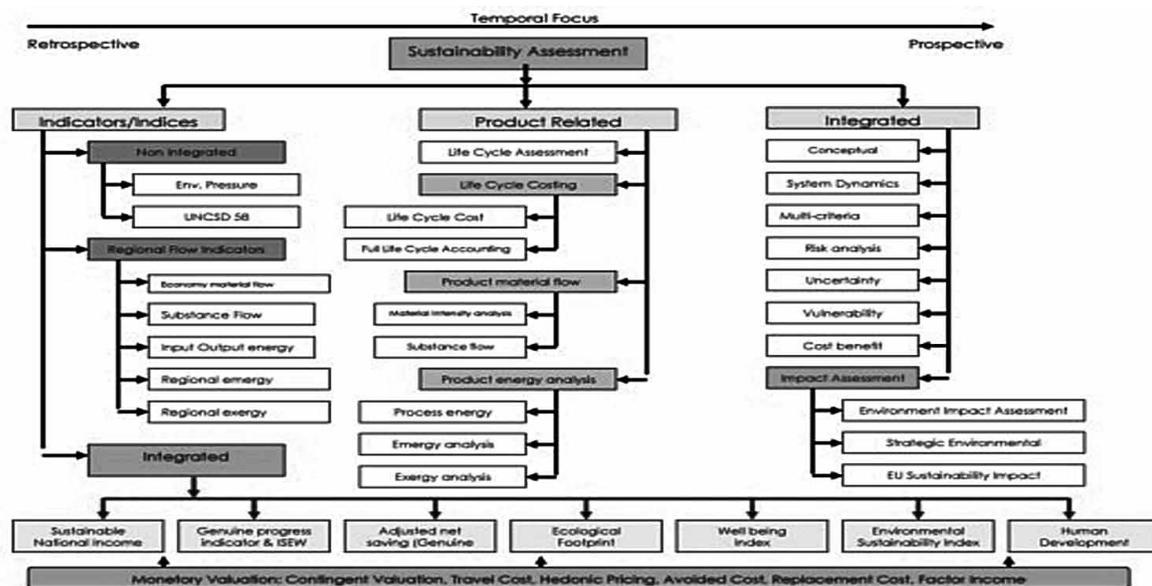
However, to have basic insights for the sustainability assessment, Gibson (2006) has established eight points as follows:

1. Sustainability is comprehensive which includes socio-economics and has interrelation and interdependency over the long term as well as short term strategies.
2. Precaution measurement is required to address the human and ecological factors in open, dynamic, and multi-scale systems.
3. Sustainability assessment must encourage positive steps towards greater community and ecological towards a future that is more viable, pleasant and secure; thus, minimization of negative effects is not enough.
4. Corrective actions must be merged together to serve multiple objectives and to have positive feedback in complex systems.
5. Sustainability requires recognition based on creative innovation.
6. Sustainability is not about balancing that presumes a focus on compromises and trade-offs.
7. Sustainability is universal and context dependent.
8. The means and ends intertwined and the process is open-ended.

According to Singh, Murty, Gupta, & Dikshit (2009), the sustainability assessment provides decision makers with an evaluation of global to local integrated nature society systems in short and long term perspectives to assist them in determining actions taken to make the society sustainable. Ness, Urbel-Piirsalu, Anderberg, and Olsson (2007) have developed the comprehensive structure for sustainability assessments are shown in Figure 7.

Figure 7. Sustainability assessment

Source: Ness, Urbel-Piirsalu, Anderberg, and Olsson, 2007; Singh, Murty, Gupta, & Dikshit, 2009



Classification and Taxonomy Evaluation of Sustainability Assessment Methodology

The classification and taxonomy on the evaluation of sustainability assessment methodology is presented in Table 5.

SUSTAINABILITY STRATEGIES

A sustainability strategy is an effort to improve the environment and simultaneously increase efficiency and economic development efforts. It will help with the return on investment with limited risks with cost savings. Simple strategies with clear objectives help in its success. To implement the sustainability strategies it should be flexible and should work across different communities. The development of sustainability strategies enables the organization to identify the requirements for lean and agile which emerge from analyzing the existing product mix, new product development, economic, and environmental factors (Pham & Thomas, 2012). The interlinking between sustainability and agility elements within the framework will indicate the organization that integration will obtain better business performance.

Thus, it is clear that the best sustainability strategies with agility will provide the organization with the key direction to implement sustainability, agility, or both. Table 6 shows the different sustainability strategies and technologies (National Association of Countries, 2014).

Phase of Business Response to Sustainability

In recent years, the organization has become a major player to drive, to handle carbon emission, and to have greater transparency in performing for future development. Table 7 represents the phase of business response to sustainability.

Table 5. Major assessment methods

| Assessment Method | Description | Application |
|----------------------------------|--|--|
| Comparative Value Analysis (CVA) | Impacts are scored. Indicators are expressed in terms of common denominations, but not weighted and aggregated between themselves | Comparability of partial impacts is possible. Especially in complex cases where unquantifiable or difficult to quantify values are of importance. |
| Utility Analysis (UA) | Indicator values (impacts) are rated on a uniform scale, impacts are weighted, point totals and weightings are combined into a single utility value. | In complex decision-making situations, where unquantifiable or difficult to quantify values are of importance and weighting is useful. |
| Cost-impact Analysis (CIA) | Impacts are related to costs. No aggregations, weighting or monetization. | All impacts can be measured. No indication of efficiency. Applied where monetization of utility components is not possible/desirable. |
| Cost Benefit Analysis (CBA) | Monetary values for target measures fulfil the weighting function different impacts can be compared directly. | Not suitable as sole method for complex, multidimensional assessment process such as sustainability assessments. The information value of monetized values may be limited. |

Sustainability

Table 6. Sustainability strategies and technologies

| |
|--|
| Sustainability Strategies and Technologies |
| Electric Vehicle Infrastructure Development |
| Community-wide Energy Management |
| Community-scale (Distributed) Wind Power Generation |
| Purchase of Bio-based Products |
| Conversion Technologies |
| Environmental Media Buying |
| Bicycle Sharing Programs |
| Power Purchase Agreements |
| Smart and Connected County Facilities |
| Energy and Water Conservation in County Corrections Facilities |
| Energy Efficiency and Renewable Energy in County Water Facilities |
| Implementation of the International Green Construction Code (IgCC) |
| Commercial Property Assessed Clean Energy (PACE) Programs |
| Going Green through Information Technology Improvements |
| Building Energy Performance Disclosure |
| Community Choice Aggregation |
| Plastic Bag Regulations and Fees |

Source: Adopted from National Association of Counties, 2014

Table 7. Three phase of business response to sustainability

| Phase | Time Frame | Context | Driver | Solution | Type of Strategy |
|-------|---------------------------------------|--|---|---|--|
| I | Early 1970's to Mid 1980's | Improved environmental performance | Government regulations and legislation | End-of-pipe and cleanup approach | Reactive |
| II | From mid-1980's to early 1990's | Environmental and economic | Above solution too cost intensive; pressure from legislative systems; legal fines and penalties; potential cost saving and increase profit | Eco-efficiency; pollution and cleaner production through reduction of waste at source and efficient use of resources | Gradual shift from reactive to proactive |
| III | Starting from mid-1990's till present | Improved environmental, economic, and social performance | Above solution too cost intensive; Pressure from legislative systems; legal fines and penalties; Potential cost saving and increase profit; Increasing stakeholder awareness. | Eco-efficiency + eco-effectiveness + socio-efficiency + socio-effectiveness + ecological equity + sufficiency + Performance reports = corporate social responsibility | Proactive |

Sustainability Issues

Sustainability issues include environmental, social and economic aspects. It may be of relevance to individuals, communities and organizations and it varies between different communities' localities, and organizations. Table 8 represents sustainability issues.

Sustainability*Table 8. Sustainability issues*

| Sustainability Dimensions | Theme | Specific Issue |
|----------------------------------|---------------------|--|
| Economic | Competitiveness | Efficiency, productivity, profitability, investment, employment, innovation/R&D |
| | Value for money | Whole life costs, life cycle assessment, risk assessment, value management, lean construction, affordability, budget constraint, road users cost during maintenance work |
| Environmental | Energy | Energy efficiency, use of renewable vs non-renewable |
| | Materials | Efficiency of use, use of renewable vs non-renewable, embodied energy, transport, energy, use of local outsource |
| | Water | Efficient use, pollution of surface and groundwater |
| | Land | Ethical use of land, use of brown-field vs greenfield site, degradation/pollution |
| | Waste | Elimination, source reduction, re-use, recycle, treatment & disposal |
| | Air | Local air pollution, noise pollution |
| | Nature conservation | Protection of wildlife habitats |
| Social | Build environment | Quality of build environment, equality of access, disruption to road users |
| | Employees | Working environment, health and safety, training and development, equal employment policy |
| | Community | Construction impacts, contribution to viable, safe and cohesive communities, community involvement |
| | Wider society | Industry accountability |

APPLICATION OF SUSTAINABILITY**Supply Chain Sustainability**

Supply chain sustainability is considered a key component of corporate responsibility. It helps the organization to manage TBL impacts in supply chains and corruption, and also helps to provide the business with an ethical sense regarding the right thing to do. Supply chain sustainability encourages good governance practices through the life cycle for good and services, ensures implementation of the law, obtains recognition at the international level, and supports international principles for sustainable business. Thus, supply chain sustainability is defined as “the management for social, economic, and environmental impacts and encourage them to have good governance practices” (Sisco, Chorn, & Pruzan-Jorgensen, 2011, p. 7).

Many organizations have increased the scope of sustainability to incorporate a complete supply chain. The organization should be aware of their full product life cycle, ranging from upstream suppliers to downstream including the end user. Sustainability is recognized as a key generator of business value and is an important element of strong corporate sustainability performance. Hence, supply chain sustainability impacts value creation levers such as pricing power, cost savings, and market share to have total business value in Figure 8 (Chorn, Sisco, & Pruzan-Jorgensen, 2010).

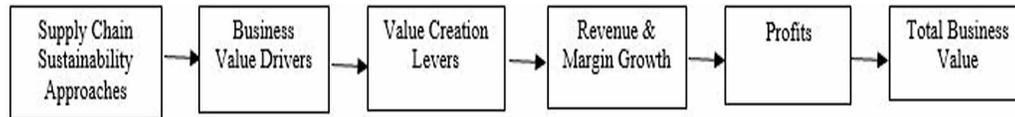
Corporate Sustainability

Sustainability purchasing has shown a trend in growing business. Many organizations have changed their purchasing policies to be sustainable purchasing policy over the years and more are planning to do so in

Sustainability

Figure 8. Supply chain sustainability leads to total business value

Source: Chorn et al., 2010



the future. Organizations implement sustainable purchasing policies for corporate sustainability. During 2005-2007, the implementation of general sustainability or implementing with environmental policy increased by 7%, whereas the organizations which implemented green purchasing policy or corporate sustainability rose by 26% (Robinson & Strandberg, 2008). This shows there will be an increase of organizations likely to implement sustainable purchasing policy as to fulfill their corporate sustainability commitments (see Table 9).

The table above shows that the AT Kearny study of US Fortune 100 companies have found that 60% have corporate sustainability policies and around 38% have sustainable purchasing policies. There are five levels of sustainability that incorporate corporate sustainability; namely, Sustainability for Regulatory Compliance, Profit-Driven Sustainability, Innovative Sustainability, Organizational Sustainability and Societal Sustainability (Rankina, Gray, Boehlje, & Alexander, 2011).

The first level of corporate sustainable development is characterized as compliance driven sustainability as these companies pursue only environmental and social actions that conform to established laws and industry standards. The second level of sustainability is considered to be profit driven as these focus on economic goals and consider it only for environmental and social aspects if they found any profits which will improve its brand image and preserve the company's license to operate. The third level of the sustainability is considered as innovative companies that understand that environmental, social, and economic concerns are equally important. Company involvement increases efficiency and innovation, formalizes sustainability criteria and metrics, and increases communication with stakeholders.

The fourth level is to have an entire system which integrates firms with their business processes, optimizes organizational designs, and provides business models for long-term survival. The fifth level of sustainability is to transform firms which have sustainability as a core business function. These companies are motivated to serve society and able to redefine and change the nature of business and be competitive in merging sustainability activities as per their business agendas.

Table 9. Organization with corporate sustainability programs adopt sustainable purchasing policies

| Study | Respondents | Corporate Sustainability | Green Purchasing Policy |
|--|--|--------------------------|-------------------------|
| EcoMarkets Report 2005 Green Purchasing | 367 Purchasers in Canada | 63% | 34% |
| EcoMarkets Report 2007 Green Purchasing | 700 Purchasers in Canada, US and Mexico | 71% | 60% |
| SPN Survey 2007 Sustainability Purchasing | 58 Purchasers in British Columbia (Mostly Greater Vancouver) | 72% | 41% |
| AT Kearny Study 2007 Sustainability Purchasing | 25 Fortune 100 Companies in the US | 60% | 38% |

CHALLENGES TO SUSTAINABILITY

Challenges to sustainability include: (i) global coordination; (ii) relevance to decision makers; and (iii) control (Reid *et al.*, 2010). Sartori *et al.* (2014) state there are several challenges which have been identified regarding the implementation of sustainability:

1. Implementing environmental protection standards
2. Capturing the external impacts of activities beyond the local level
3. Recognizing social sustainability
4. Human development
5. Eradication of poverty
6. Balanced production and consumption
7. Promotion of education
8. Development and maintenance of environmental resources
9. Efficiency in resource allocation
10. Cooperation among stakeholders, governments and the civil society
11. Publicly available sustainability methodologies and indicators
12. Use of complementary indicators on assessments
13. Use holistic approaches
14. Indicators for measuring the consumption of resources
15. Population awareness
16. Using a standard benchmark between countries
17. Reconciling local objectives with the overall objectives
18. Applied research that brings practical results
19. Balance between the pillars of sustainability
20. Dynamic sustainability indicators
21. Pointers directed toward business and local systems
22. Public participation in planning
23. Participation in science and technology

SOLUTIONS AND RECOMMENDATIONS

Fundamentally everyone talks about sustainability, but few are committed to deliver and take actions and also to be passionate about sustainability practice. One basic model should be considered to make people and the organizations engage in sustainability practice. The TBL approach will help to produce results stakeholders desire and to maximize the operational efficiency and environmental management through better process technologies.

Today, organizations are facing immense pressure to be sustainable in all three basic pillars of sustainability (environmental, economical, and social). It would be better if stakeholders collaborate for better TBL implementation as this would help everyone concerned to achieve optimal solutions for sustainability. The TBL will also help the organization to have lower risk, to raise productivity, to have benchmarks, and to optimize capital returns, all of which indirectly reduce costs and boost the economy of the organization and gross domestic product.

Sustainability

FUTURE RESEARCH

A comprehensive model is required to address the increasing population, global environmental change and sustainable development, which are interlinked in a very effective and efficient manner. The initiative should be to bring natural scientists, social scientists, engineers, policy makers, organization, and governments together and to develop a comprehensive innovative model or solution that would lead to sustainable development. The aforementioned initiative will represent an interdisciplinary approach to provide best practices and early warning signals for environmental change and risk so that the model can inspire and support organizations towards attaining sustainability.

CONCLUSION

Sustainability is defined from a long historical process with an awareness of environmental problems, economic crises, and social inequalities. Since it is an ongoing concept and complex in nature, different approaches have been identified to understand and explain the concept of sustainability as a whole. In this respect, a comprehensive approach is undertaken to understand about sustainability its assessment, indicators, and models along with identifying the different challenges of implementing sustainability. The term sustainability and sustainable development have conveyed different meanings to make people understand the concept and have supported divergence views on how the sustainable development will be able to attain sustainability and well-being. Thus, sustainability indicators, assessment, strategies, and models will help the organization and individuals to enhance the knowledge of sustainability issues and to achieve sustainability.

REFERENCES

- Achman, R. (2011). *Stakeholders' Perspectives on Sustainability in Project Management Case studies of 4 different projects in the Netherlands*. Delft University of Technology.
- Atkinson, G. (2008). Sustainability, the capital approach and the built environment. *Building Research and Information*, 36(3), 241–247. doi:10.1080/09613210801900734
- AtKisson, A., Hatcher, R. L., Green, S., & Lovins, H. (2004, Fall). Introducing pyramid: A versatile process and planning tool for accelerating sustainable development. Draft paper for publication in *The Natural Advantage of Nations*. Australia: EA Books.
- Berger, G. (2007). *Sustainability Impact Assessment: Approaches and applications in Europe*. ESDN Quarterly Report.
- Chatzinikolaou, P., & Manos, B. (2012). *Review of existing methodologies and tools for measuring sustainability in rural areas*. Retrieved from http://www.feem-project.net/belpasso_2012/files/studpapers/Paper_Chatzinikolaou.pdf

Sustainability

- Chorn, B., Sisco, C., & Pruzan-Jorgensen, P. M. (2010). *The Business Case for Supply Chain Sustainability: A Brief for Business leaders* (pp. 1–10). Retrieved from <http://www.bsr.org/en/our-insights/report-view/the-business-case-for-supply-chain-sustainability-a-brief-for-business-lead>
- Dixon, P., & Gorecki, J. (2010). *Sustainability: How Smart Innovation and Agile Companies will Help Protect our Future*. London: Kogan Page.
- Dodds, R., & Venables, R. (2005). *Engineering for Sustainable Development: Guiding Principles*. London: The Royal Academy of Engineering.
- Enkvist, P., Naucler, T., & Rosander, J. (2007). A Cost Curve for Greenhouse Gas Reduction. *The McKinsey Quarterly*, (1): 34–45.
- Federal Office for Spatial Development ARE. (2004). *Sustainability assessment Conceptual framework and basic methodology* (pp. 1–67). Retrieved from <http://www.are.ch>
- Gibson, R. B. (2006). Sustainability assessment: Basic components of a practical approach. *Impact Assessment and Project Appraisal*, 24(3), 170–182. doi:10.3152/147154606781765147
- Glavič, P., & Lukman, R. (2007). Review of sustainability terms and their definitions. *Journal of Cleaner Production*, 15(18), 1875–1885. doi:10.1016/j.jclepro.2006.12.006
- Global Reporting Initiative. (2002). *Sustainability reporting guidelines*. Boston, MA: Global Reporting Initiative.
- ICChemE. (2002). *The sustainability metrics: sustainable development progress metrics recommended for use in the process industries*. Warwickshire, UK: Institution of Chemical Engineers.
- International Development Research Center (IDRC). (1997). *Assessment Tools*. Ottawa, Canada.
- Jennings, P., & Zandbergen, P. (1995). Ecologically sustainable organizations: An institutional approach. *Academy of Management Review*, 20(4), 1015–1052. Retrieved from <http://amr.aom.org/content/20/4/1015.short>
- Joshi, M., Ravindranath, S., Jain, G. K., & Nazareth, K. (2007). *Sustainable Development: An Introduction*. Centre for Environment Education. Retrieved from <http://www.sayen.org/Volume-I.pdf>
- Lundin, M. (2003). *Indicators for Measuring the Sustainability of Urban Water Systems—a Life Cycle Approach* [Doctoral Thesis]. Department of Environmental Systems Analysis, Chalmers University of Technology, Göteborg, Sweden.
- Mulder, K. (2006). *Sustainable development for engineers: A handbook and resource guide*. London: Greenleaf Publishing Limited.
- National Association of Counties. (2014). *2012 Emerging Sustainability Strategies in America's Counties*. Retrieved from http://www.naco.org/newsroom/pubs/Documents/2012_Emerging_Sustainability_Strategies_Publication.pdf
- Ness, B., Urbel-Piirsalu, E., Anderberg, S., & Olsson, L. (2007). Categorising tools for sustainability assessment. *Ecological Economics*, 60(3), 498–508. doi:10.1016/j.ecolecon.2006.07.023

Sustainability

- Pham, D. T., & Thomas, A. J. (2012). Fit manufacturing: A framework for sustainability. *Journal of Manufacturing Technology Management*, 23(1), 103–123. doi:10.1108/17410381211196311
- Rankina, A., Gray, A. W., Boehlje, M. D., & Alexander, C. (2011). Sustainability Strategies in US Agribusiness: Understanding Key Drivers, Objectives, and Actions. *International Food and Agribusiness Management Review*, 14(4), 1–20. Retrieved from <http://www.ifama.org/files/14i4.pdf#page=7>
- Reid, W. V., Chen, D., Goldfarb, L., Hackmann, H., Lee, Y. T., Mokhele, K., & Whyte, A. (2010). Earth system science for global sustainability: Grand challenges. *Science*, 330(6006), 916–917. doi:10.1126/science.1196263 PMID:21071651
- Sartori, S., Latrônico, F., & Campos, L. M. S. (2014). Sustainability and sustainable development: a taxonomy in the field of literature. *Ambiente & Sociedade*, 17(1), 01-22. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-753X2014000100002&lng=en&tlng=en
- Singh, R. K., Murty, H. R., Gupta, S. K., & Dikshit, K. (2009). An overview of sustainability assessment methodologies. *Ecological Indicators*, 9(2), 189–212. doi:10.1016/j.ecolind.2008.05.011
- Spangenberg, J. H. (2003). Sustainability Science: Science must go public for Sustainable Development. In *Frontiers 2 Conference* (pp. 12-15).
- Spangenberg, J.H., Bonniot, O. (1988). *Sustainability indicators—a compass on the road towards sustainability*. Wuppertal Paper No 81.
- United Nations Commission on Sustainable Development. (2001). Indicators of sustainable development: guidelines and methodologies. Retrieved from <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf>
- Vanclay, F. (2004). Impact assessment and the Triple Bottom Line: Competing pathways to sustainability? *Sustainability and Social Science Round Table Proceedings* (pp. 27-39).
- Warhurst, A. (2002). Sustainability Indicators and Sustainability Performance Management. Report to the Project: *Mining, Minerals and Sustainable Development* (MMSD). Warwick, England: International Institute for Environment and Development (IIED). Retrieved from http://www.iied.org/mmsd/mmsd_pdfs/sustainability_indicators.pdf
- Watson, R. T., Boudreau, M. C., & Chen, A. J. (2010). Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community. *Management Information Systems Quarterly*, 34(1), 23–38.
- Wikström, P. (2010). Sustainability and organizational activities—three approaches. *Sustainable Development*, 18(2), 99–107. doi:10.1002/sd.449
- Wiltsey Stirman, S., Kimberly, J., Cook, N., Calloway, A., Castro, F., & Charns, M. (2012). The sustainability of new programs and innovations: A review of the empirical literature and recommendations for future research. *Implementation Science; IS*, 7(17), 1–19. doi:10.1186/1748-5908-7-17 PMID:22417162
- World Commission on Environment and Development. (1987). *Our common future – The Brundtland Report*. Oxford: Oxford University Press.

Sustainability**KEY TERMS AND DEFINITIONS**

Sustainability: The persistence of the systems and process with basic three pillars.

Sustainability Challenges: It is an ability to attain sustainability with great effort and determination.

Sustainability Indicators: A measurement scale for sustainable development.

Sustainability Model: A representative form for sustainable development.

Sustainability Strategies: A plan of action or method for achieving sustainability.

Sustainable Development: It is ability to improve by refining, expanding and enlarging the area to achieve sustainability.

Sustainagility: An ability to solve complex issues, be sustainable and is ready to adapt the change quickly.

Triple Bottom Line (TBL): A combination of people, planet, and profit.

Chapter 16

Supply Chain System and Barriers of Exporting: Evidence from Ghana in Sub Saharan Africa

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ABSTRACT

This research applies interviews to investigate export barriers pertaining in the supply chain system of the agricultural industry of Ghana, as a representative country of Sub Saharan Africa. Evidence is provided from an unexplored area which is likely to bring new insights into export barrier literature primarily focused on lower emerging economies in Sub-Saharan Africa. The study identified four main export barriers; which are logistics, functional, marketing and financial barriers. The study concluded that management of firms have to be proactive in disassembling export barriers to enable a commanding role in pursuit for strong economic and industrial development in African and beyond.

INTRODUCTION

This research presents the results of a qualitative research using case studies to investigate export practices and barriers exporters in the agricultural industry of Ghana encountered in the supply chain system in relation to the distributors of their products. A multiple case study approach was applied to interview seven managers in the agricultural sector outsourcing farm produce from out growers in the supply chain system.

Supply chain management (SCM) has been a key contributory factor to many firms' success in exporting rather than applying the same old traditional intra-enterprises' focus on internal processes which are sometimes expensive and identified as a major challenge in operations (Matopoulos, Vlachopoulou, Manthou, & Manos, 2007).

Many scholars have highlighted the increased need for collaboration, emphasizing the establishment of closer and long-term working relations to create effective partnerships with suppliers at various stages in the supply chain system to develop efficient and responsive partnerships with suppliers in order to

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deliver exceptional value to customers (Gunasekaran, Patel, & Tirtiroglou, 2001). In most cases, collaboration in the supply chain is not always easy to achieve when past supply targets are not met regarding inefficient communication within the supply chain system (Christopher, 1998). A number of factors related to the business environment, the industry structure, and firm characteristics may still influence the series of dyadic business relationships which comprise the supply chain, enabling or deteriorating the collaborative opportunities (Gunasekaran et al., 2001).

A supply chain is a set of organisations or entities that pass materials forward, in the process, several independent firms or functions are involved in manufacturing a product and placing it in the hands of the end user in a supply chain (Matopoulos et al., 2007). Raw material and component producers, wholesalers, retailer merchant's and transportation companies are all members of a supply chain (La & Masters, 1994). Stock, Greis, and Kasarda (2000) define supply chain as the alignment of firms that brings products or services to the market. SCM has also been defined as a network of organisations that are involved through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer (Christopher, 1998).

All these concepts of supply chain include the final consumer as part of the supply chain (Stadtler, 2005). Therefore, a supply chain consists of multiple firms supplying and distributing products or services to the ultimate consumer. The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of materials from suppliers in order to affect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost (Bala, 2014). The operational supply chain refers to the series of primary and support supply chains that have to be constructed to provide the inputs and outputs that deliver products and services of any company (Cox, 1999). All companies have operational supply chain and these supply chains are normally unique to the firms creating the linkage.

Benefits of Supply Chain Management (SCM)

SCM has become popular in recent times (Stadtler, 2005) as specific drivers may be traced to trends in outsourcing, an emphasis quality-based competition, time and various contributions to environmental uncertainties in operations (Ramanathan & Gunasekaran, 2014). Many firms and organisations have increasingly turned to outsourcing for their supplies and depended on reflective means to coordinate the flow of materials into and out of the firm (Puertas, Martí, & García, 2014).

Paramount to this phenomenon is ways of coordination towards a closer relationship with suppliers in terms of delivery based on time quality and defect-free products (Bala, 2014). Customers in recent times are demanding products consistently, reliable fast delivery with no damages which necessitates closer collaboration with suppliers and distributors. The intense competition combined with rapidly changing economic conditions contributes to market place uncertainty which requires great understanding and flexibility on individual firms in the supply chain to foster stronger relationships (Bala, 2014). The benefits firms can expect from supply chain management are lowered inventory risks and costs, along with reductions in warehousing, distribution and transportation cost (Horvath, 2001).

Other benefits include sustainable cost savings through increased productivity and streamlined business processes in procurement and purchasing (Horvath, 2001). Accelerated product delivery times, more efficient product development efforts and lower manufacturing costs could be beneficial to the firm (Horvath, 2001). In the long term, the most significant benefits to businesses with advanced supply

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chain management capabilities will gradually improve customer responsiveness, increased flexibility for changing market conditions, improved customer service satisfaction and effective marketing (Mentzer et al., 2001).

The driving force behind effective supply chain management is the collaboration in the relationship. Strategic SCM demands collaboration among all participants in the value chain, irrespective of their size, function or relative position (Horvath, 2001; Matopoulos et al., 2007). One cannot enhance their own operations until it is clearly understandable on the real-time demands of your customers' customers as well as the current constraints of one's suppliers' supplier (Horvath, 2001). It is the ability to apprehend and respond to the changing needs of customers far down the demand chain that produces such strategic benefits as improved delivery and effective marketing (Horvath, 2001). Furthermore, collaboration is about organisations and firms working together and can be viewed as a concept going beyond normal commercial relationships (Bessant & Tsekouras, 2000).

Against this background, this study explores the practices and barriers exporters in the agricultural industry of Ghana experience in terms of outsourcing raw material supplies from out growers in the domestic market. A qualitative method to explore this phenomenon will add in-depth insights into the international business literature to clarify challenges exporters encounter in the supply chain system using a case study approach. Among qualitative methods, case studies play an important role as they are characterised as one of the most adopted methods in organisational studies (Yin, 2009). Case studies have been acknowledged as a method of generating and testing theory (Eisenhardt, 1989).

Johanson and Mattsson (1998) argued that the field of internationalisation theories requires further theoretical development; therefore, as research is still evolving in the Sub-Saharan African (SSA) region, greater explorations is necessary to reveal the key characteristics thwarting the success of exporters relying on distributors in supply chain system.

The research question developed for investigation is "Does internal constraints in the supply chain system affect domestic operations and negatively impact export performance of firms in agricultural industry of Ghana? If that is the case? How and why? If not, why not?"

Additionally, investigating this phenomenon in relation to operational constraints in exporting due to distractions in the supply chain system is paramount to the development of agricultural exports in Ghana and SSA. This chapter makes contribution to theory development and practice in emerging economies in Africa to bridge the gap in studies on export barriers emanating from the supply chain system to enrich export barrier literature in general.

To address this phenomenon, first, the development of the agricultural sector of Ghana is discussed; we present the theoretical foundation and review literature to identify the capabilities required to operate a successful supply chain system in export operations. These views are used to develop the qualitative set of semi-structured interview questions for investigation, as this study is exploratory in nature; a multiple case study methodology is applied and justified for collecting data. The next section evaluates the findings from the research and highlights the various barriers encountered in the supply system of the agricultural industry. Finally, we conclude the study with managerial implications and limitations.

Economic Overview of Ghana

Ghana's economy is divided into three main sectors namely agricultural, industry and services. Kolavalli et al. (2012) posits that agriculture continues to be an important sector in Ghana's economy, contributing more than one-third of Gross Domestic Product (GDP) in 2010 (Kolavalli et al., 2012). There is strong

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evidence to indicate that the Ghanaian economy continues to revolve around subsistence agriculture (Mmieh, Frimpong-Owusu, & Mordi, 2012), which accounted for nearly 39% of GDP and employs around 50% of the workforce (WTO, 2009). The agricultural sector contributed 24.6%, 22.3% and 21.3% in 2011, 2012 and 2013 respectively to Ghana's GDP (GSS, 2014). Recently agriculture is transforming slowly, led primarily by development of value added exports in Ghana, however productivity has changed only marginally in the sector (Budget, 2012).

Ghana is losing competitiveness in the domestic market for many agricultural products the country traditionally produced as the agricultural sector continues to decline in performance (Kolavalli et al., 2012). Agriculture was the backbone of Ghana's economy throughout the post-independence period (1958) until recently when the service sector began to dominate the economy. Agriculture is dominated by crop production in Ghana, accounting for nearly two-thirds of the agricultural GDP in 2011. Agricultural exports, comprising cocoa butter, oil palm, cotton, rubber, and fruits, accounted for around 20% of agricultural GDP (Budget, 2010). Kolavalli et al. (2012) contend that agriculture can play an important role in a country's transformation to a modern economy if the expansion of agricultural produce and modernization of traditional agriculture provide significant sources of productivity gains.

Against this background, diversification into production of higher-unit-value products, often with the potential for exports is an indication of both agricultural and economic transformation (Kolavalli et al., 2012). Experiences of successfully transformed developing countries show that rapid diversification to processed agricultural exports has accelerated growth in agriculture and general economic transformation (Kolavalli et al., 2012). Therefore, this study is particularly interested in the development of the agriculture sector of Ghana to boost value added exports.

Theoretical Background

This research draws insights from the contingency theory and resource based view (RBV) (Barney, 1991; Lages & Montgomery, 2004). The RBV posits that the management of firms gains sustained competitive advantage by implementing strategies that exploit their internal resource based strengths through responding to environmental opportunities, while neutralizing external threats and avoiding internal weaknesses (Barney, 1991). Lages and Montgomery (2004) attribute the roots of the contingency theory to Boulding (1956) and the behavioural theory of the firm to (Cyert & March, 1963). The contingency paradigm considers that variables such as industry and market conditions are expected to mediate the influence of the various firms' characteristics, strategies and competences with regard to the performance of the firm (Cavusgil & Zou, 1994; Lado, Martinez-Ros, & Valenzuela, 2004). Again, firms react to a number of potentially unforeseen contingencies and internalization can take place through planned and unplanned strategies depending on how they exploit the opportunities (Crick & Spence, 2005).

LITERATURE REVIEW

Export commitment improves the efficiency and effectiveness of resource allocation, providing vital motivation to boost both export sales and managers' satisfaction with the firm's performance (Navarro, Losada, Ruzo, & Díez, 2010). Committed managers separate export department and regulate visits to the export market to enhance performance (Stoian, Rialp, & Rialp, 2011). Export executives committed to exporting search for business opportunities worldwide, notably in countries which have different

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culture and are farther away from the home country than the firm's current export markets (Gençtürk & Kotabe, 2001). As upsurging levels of resources are committed to the firm, the firm is able to plan and implement more export marketing mix strategies as adaptation demands greater resources (Lages, Jap, & Griffith, 2008).

International experience refers to the degree to which the firm's management has overseas experience, having lived or worked abroad, as well as the accumulated skills and abilities that sustain the achievement of the export market goals (Lages & Jap, 2002). Managers with international experience will better learn the specific characteristics of each export market combined with the complexity of marketing strategies of different markets, making it easier for their operations (Douglas & Craig, 1989; Stoian et al., 2011). The firm can better achieve its exporting goals if management's experience in international markets increases, promoting learning by assisting to identify and take advantage of opportunities thus avoiding international threats (Lages et al., 2008).

Experience at the combined firm level has been identified to be valuable when making decisions to enter particular export markets, evaluating of resource commitments to country markets, reacting to the actions of competitors and influencing the relationship between marketing strategy adaptation and performance (Hultman, Katsikeas, & Robson, 2011). International experience enables managers to react to the actions of competitors and influence the relationship between export marketing mix strategy and performance (Hultman et al., 2011). This enables them to improve the depth of planning procedures in terms of market analyses needed to implement marketing strategies that are suitable to the needs of different export markets (Stoian et al., 2011). Management commitment to exporting has emerged as one of the key determinants of export performance, irrespective of performance dimensions (Lado et al., 2004; Lages et al., 2008; Sousa, Martínez-López, & Coelho, 2008).

Export Barriers

The study of export barriers is of uttermost relevance for many reasons. It provides insights into the different types and nature of challenges that forbid domestic firms from doing international business and secondly, it develops a platform for understanding the setbacks that prevent current exporters from sustaining successful export operation outside their national borders (Leonidou, 2000). A barrier in exporting is a constraint that hinders the ability of a firm to initiate, develop or to withstand business in foreign markets (Leonidou, 2004). Understanding export barriers can assist to establish why some exporting firms are unable to exploit the full capacity of their business and why firms fail to achieve positive performance outcomes in their operations (Julian & Ahmed, 2005).

Small and Medium Enterprises (SMEs) are especially more prone to problems such as resource constraints, organisational deficiencies, and managerial limitations than are larger firms (Leonidou, 2004). Export barriers have been categorised differently by many scholars in the field. Generally, export barriers can be classified as internal and external (Gençtürk & Kotabe, 2001). Internal barriers are related with organisational resources/ capabilities and the firm's approach to export business. External barriers usually emanate from the home and host environment within which the firm operates (Julian & Ahmed, 2005; Leonidou, 1995). Procedure barriers which fall within internal barriers refer to those factors that are critical to the efficient operation of the firm. They originate from logistics and distribution aspects as well as the need for outsourcing raw materials, which is the focus of this study (Julian & Ahmed, 2005).

Though procedure barriers are external to the firm, they are not controlled by the firm (Julian & Ahmed, 2005; Leonidou, 2000). Shortage of working capital to finance has been identified as an export

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barrier. To operate a successful export business often than not require extensive expenditure in researching overseas markets, customer pretences and adapting the product to suit the idiosyncrasies of the export market (Leonidou, 2004). This can clearly generate excessive financial constraints and inhibit the firm's progress in exporting. Other important factors are necessary to make these dormant barriers functional, which can be attributed to the characteristics of the manager, the firm and the environment within which the firm operates (Fillis, 2001; Leonidou, 2004).

Managerial factors are paramount in operationalising the type, content and effect of export barriers. Managers who are incompetent, risk adverse and inexperienced are very likely to perceive export obstacles in a more strong and grave manner than managers who are capable, risk-taking and foreign oriented (Leonidou, 2004). Dissimilarity in export-barrier impact can be attributed to the outcomes of differences in the managerial attitudes toward cost, profit growth and other aspects of exporting (Leonidou, Katsikeas, & Piercy, 1998). Organisation factors can have a determining effect on export-barrier perceptions. There is evidence to illustrate that young firms are generally more susceptible to export barriers, compared to those that have more experience in the export business (Leonidou, 2000).

Small firms are usually vulnerable to barriers related to resource constraints, operating difficulties and trade restrictions (Tefom, Lutz, & Ghauri, 2006). Moreover firms belonging to different industries appear to perceive export barriers differently depending on their operations (Leonidou, 2004). Environmental factors can also affect export-barrier perceptions in two ways (Leonidou, 2004). First, they can be the source of barriers in the home market, such as those connected with local government, infrastructure like roads/transport and logistics systems. Second, they shape the obstacles derived from foreign market conditions including economic, political and sociocultural within which the firm has to operate.

METHODOLOGY

Multiple Case Study Methodology

Multiple case studies, using non-probability benchmarks, were considered appropriate for this study. The use of multiple case studies gives a holistic viewpoint of an exploratory study of the firm, thus creating a theoretical podium where no particular standards are in place (Gummesson, 2000). In-depth (45 minutes to 1 hour) case interviews were conducted with exporters comprising of Owner/Managers and Managing Directors from the agricultural industry of Ghana. These firms are actively involved in exporting agricultural products to different countries.

Based on theory an interview protocol was developed to guide the interviews. A significant part of the process included questions about how long the firm has been involved in exporting and direct questions about their international experience, export commitment and ownership of the firm was inquired. Further probing questions about the common problems they encounter in their business in relation to their distributors in the supply chain system was inquired, and finally questions about how they would measure export performance was inquired to explore the operations of the firm.

Level of Analysis

The objective of this research is to investigate and explore the export behaviour and barriers influencing the export performance of the firm in terms of outsourcing raw materials from out growers in the local

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market and how this affects the operations of the firm. For the enquiry, seven companies were selected from which seven cases were constructed based on in-depth interviews with seven managers. This study adopted the level of analysis presented by Loane and Bell (2006) who conducted interviews with key respondents of SMEs, which in most cases included the management executives for firm-level analysis of the export behaviour of the firm.

Loane (2006) argued that research papers in international business involving the international entrepreneur can be seen as the single representation of the firm in relation to internal decision making processes within the firm. Thus, the interviews were conducted with the exporter (Owner/Managers/Managing Directors) which will have research implications for the operation of the firm.

Unit of Data Collection

With the case study method, a very essential decision is the selection of cases. Cases are selected because they are particularly suitable to illustrate a phenomenon and for extending relationship and logic among variables (Eisenhardt, 1989). The unit of data collection in this research is the individual exporter who is the Owner/Manager/Managing Director of the firm. Data was collected via interviews, which was deemed appropriate to investigate the characteristics of exporters at that individual level rather than a collective, as decision-making power within the firms are generally dependent on one or few people (Reid, 1981). In most cases owner/managers are the principal force behind the initiation, development and existence and success of firm internationalisation (Chetty & Hamilton, 1993).

Additionally, the decision of a firm to pursue international markets is dependent on the international orientation and characteristics of firm executives (Glavas & Mathews, 2014). Research has highlighted that applying cognitive perspectives, such as understanding of the characteristics of individual international entrepreneurs as managers may lead to an increasing comprehension of how many firms are recognising and exploiting new international markets opportunities (Mostafa, Wheeler, & Jones, 2006; Zahra, Korri, & Yu, 2001). Therefore, it is important to reiterate that the findings from this study are significant for both the firm and the manager as a whole.

Selection of Cases

In the selection benchmarks in this study, all seven exporters are firm executives and all seven cases come from the agricultural industry. Case studies analysis is the difficult aspect of the research (Yin, 1981), yet data analysis is the core of theory building in case studies. The approach to data analysis was adopted by (Miles & Huberman, 1984; Yin, 1981). The analysis of qualitative data is a “continuous iterative process” (Miles & Huberman, 1984). After data collection and transcription of the interviews, three steps were utilised to manage the information, including; data reduction, data display and data analysis.

The first step involved the simplifying and transforming the raw data. Data display is the process where the information is displayed and organised to allow constructive themes to be extracted at the third and final stage of the analysis (Miles & Huberman, 1984). Case study methodology has an exclusive strong point to deal with a full variety of evidence, such as documents, websites, observations and interviews (Eisenhardt, 1989). In this research, company websites and interview transcripts were used to triangulate the results. Their firms were selected from the list of award winners and active exporters’ directory from

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the Ghana Export Promotion Authority, the main public policy maker in Ghana. It is important to note that all the managers included in this study include the owner/manager or and managing director of the firm. Thus decision-making power is aligned with the key respondent in the firm.

Within Case Analysis

The general information relevant for the firm and the exporters are displayed in Table 1. At an individual level in Table 1 the information includes; job role, gender, type of ownership, and level of education, experience, country of origin, industry and destination of products.

Table 1. Case analysis matrix of the agricultural exporters in Ghana

| Participant Case Number | Job Role and Position of the Manager/Ownership | Gender of the Manager | Industry | Level of Education | International Experience of the Manager | Number of Year of Exporting | Firms Number of Employees | Destination of Product |
|-------------------------|---|-----------------------|--------------|--------------------|---|-----------------------------|---------------------------|--|
| CASE A | Managing Director –Ghanaian owned | Female | Agricultural | Diploma | Yes | 14 | 50(M) | Britain, Germany and Italy |
| CASE B | Foundation Manager - Foreign owned | Male | Agricultural | University Degree | Yes | 14 | 1800(L) | France, Italy, Britain, Switzerland and Holland |
| CASE C | Owner/ Manager - Ghanaian owned | Male | Agricultural | Secondary Level | No | 23 | 25 (S) | Lebanon and Dubai Egypt, Algeria and Libya |
| CASE D | General Manager Ghanaian/Foreign owned | Male | Agricultural | University Degree | Yes | 18 | 650(L) | United Kingdom, Germany, Britain, France and Switzerland |
| CASE E | Foundation Manager– Foreign owner | Male | Agricultural | University Degree | Yes | 15 | 500(L) | Italy, Germany and Switzerland. |
| CASE F | President Farming Co-operative - Ghanaian owned | Male | Agricultural | Diploma | No | 9 | 150(L) | Holland, Germany, and Lebanon. |
| CASE G | General Manager Ghanaian owned | Male | Agricultural | University Degree | Yes | 15 | 29 (S) | USA, United Kingdom and Germany |

Definition of small and medium-sized firms in Ghana

Micro- Those employing less than 5 workers

Small- Those employing 6 to 29 workers

Medium- Those employing 30 to 99 workers

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Case A

Vegetable exporter: CASE A is one of the leading vegetable exporters in Ghana and has exported extensively over 10 years. As a woman and founder of her firm, CASE A became interested in exporting by word of mouth when she was a resident abroad. CASE A migrated to Ghana and started the business export. Living abroad had a positive impact on the commencement of the business. CASE A depends mainly on out growers in the supply chain system for her produce for exports. CASE A was personally satisfied with the export performance outcomes of the firm.

Case B

Processed fruits exporter: CASE B commenced business in Ghana, mainly processing fresh fruits including pineapple, mango, banana and sugarcane to major supermarkets in Europe. The company is one of the largest foreign companies in Ghana exporting fresh processed fruits to overseas markets. CASE B started as an export company in Ghana. CASE B relies on out growers and farming co-operatives for their fresh produce for processing. CASE B measured export performance with financial and strategic measures as the company has expanded in recent years.

Case C

Fruit exporter: CASE C capitalises on growing mangoes and pineapples for the export markets in the Middle East. Established in 1991, the firm would have already been out of existence if the manager had not sought overseas markets. The manager had no international experience before the inception of the business, and also depends partly on out growers for agricultural produce for export. The company plugs back the profit acquired in exporting for expansion and quality of the produce. As founder and owner, personal satisfaction is the firm's measurement of export performance.

Case D

Fresh/dry fruit exporter: CASE D is one of the top exporters in the agricultural industry of Ghana. The firm migrated from sole proprietorship to a limited liability company with a foreign investor. The company exports fresh and dry pineapples and mangoes to Europe. CASE D depends on their farms and out growers for the produce for the export market. CASE D believes in producing quality fruits for the international market and signed up for the Fair-trade logo to access certain supermarkets in foreign markets. CASE D measures export performance with financial outcomes of the firm.

Case E

Dry fruit exporter: CASE E is a foreign company established in Ghana for processing dry fruits including coconut, pineapple and mango for the European market. CASE E diverted from exporting fresh fruits to dry fruits when they identified a niche on the European market and diversified their business because of the credit crunch in Europe. The company buys their produce from out growers and farming co-operatives for processing for the international market and plays an active role in the supply chain system. CASE E measures export performance with personal satisfaction and strategic measurements.

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Case F

Fresh fruit exporter: CASE F is an association of farmers who came together to form a farming co-operative in 2005. They grow pineapples and mangoes for exporting companies in Ghana. CASE F is one of the main out growers in Ghana supplying fresh fruits to companies for export. CASE F produces quality products for exports and plays a key role in the supply chain system in the agricultural industry. As farming co-operative, CASE F believes producing quality fresh fruits retain them in business. CASE F believes financial measurement of export performance is most important to the business.

Case G

Fresh Yam exporter: CASE G was into supplies of office equipment and supplies of garments to certain agencies in Ghana and diverted the entire business into exporting foods to the international market. The company exports fresh foods to markets in Europe and the USA. CASE G depends mainly on out growers in the supply chain system for the products for the export market. CASE G measures export performance with financial and strategic outcomes and believe both most important to the firm.

Cross: Case Analysis

Key Factors Initiating Exporting of Entrepreneurs in Ghana

We begin by focusing on how the firms became involved in exporting and follow this with a discussion on how the different theoretical perspectives, deducted from four identified approaches are connected to exporting. The key factors are presented in order of their emphasis and importance across the seven cases, and we begin with most strongly emphasised through to the less strongly emphasized factors. The most strongly emphasized factor was the potential in exporting, unavailability of market and exporting considered as a sustainable business.

Potential in Exporting

The company actually started as an exporting company, we were processing fresh fruits, and we realised the potential in this area in the country for our raw material. We were processing and exporting from day one. CASE B

Originally, the firm was into supplies of office equipment and supplies of garments to certain agencies in Ghana, but then we saw the export potential in the yam business and started diverting the firm's activities. So after some time, we closed down the import company and became an export company. CASE G

Experience and Links from Abroad

We were mainly processing for processors and exporters; we decided to take our time before going on the international market. So by the time we decided to go on our own we had enough experience and on top of that one of our shareholders is a Swiss, he had links with a marketing agency in Switzerland so that was the first platform we used to export fruits to international markets. CASE D

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Unavailability of Market

Actually, in 1991, there was hardly any local market available for our products, so we were forced to look for other markets outside of Ghana and that was why. CASE C

When we started the marketing of the product became a big issue. Luckily, we got involved with a company, who were a processing factory. They promised us they could buy our products and that encouraged us but soon as production was going up, we found out that they cannot buy all and so we started looking around for market and a few people came and they were buying from us and exporting. CASE F

Diversification of Business

Our company has been buying fresh fruits from Ghana for about 15 years now. During the credit crunch in Europe, we realised that the fresh fruits business in Ghana might not go well with us. Therefore, we decided to go into a different type of business that is how come we went into exporting dry fruits. CASE E

Living Abroad and Word of Mouth has a Contributing Factor to Exporting

One of my children living in Britain came with a friend who was talking about vegetable exports, so I got interested and I went to the airport and I saw many people exporting these vegetables so then I decided to get involved. CASE A

The findings from this research indicate that two out of seven cases (CASES B and F) started their export business because of the potential in exporting agricultural products. CASE D's firm started exporting after gaining experience from processing fruits for other exporters and links from abroad. CASE C and CASE F started exporting due to unavailability of market for their produce in the local market. Finally, CASE E's company diverted their business into export of dry fruits due to the effects of the credit crunch in Europe.

Internal Competence of the Manager

Two key characteristics – international experience and export commitment associated to international capabilities of the manager – were analysed in relation to export performance within the firms. International experience in this study was defined as living or working abroad.

Living or Working Abroad Before Commencement of the Export Business

I lived in England for about 13 years by profession I am a nurse midwife. CASE A

Our CEO himself is an international person and management generally. CASE B

No international experience at all before starting this business, but I have had the opportunity to travel around. CASE C

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All the top management was schooled in Ghana, but one of the shareholders is a banker in Switzerland, so he linked us with the marketing agency that had enough knowledge on the market abroad. CASE D

Yes, they have. The mother company is Swiss and it is a marketing company so they are quite interested in marketing in Europe. CASE E

The management of the firm have a lot of international experience. The Managing Director spends six months every year in the USA and he visits our buyers in the UK at least once a year. CASE G

No international experience before, but I have travelled myself and some of our members too have been participating in trade shows, which have influenced our exporting. CASE F

Out of the seven cases, five (CASES A, B, D, E and F) indicated the management of their firms have international experience as some of the firms were either foreign owned or had foreign shareholders. This indicates that foreign affiliation plays a role in the initiation of exporting in Sub Sahara Africa – Ghana. The remaining two cases, (CASE C and F) did not have international experience before the commencement of their export business, although they have had the opportunity to travel around because of their business.

The interview inquired to what extent the firms committed financial and human resources to develop their export business since its inception?

It is quite difficult to commit financial resources because the business is capital intensive and you don't get paid immediately, maybe after a few shipments then they will send you something. CASE A

We are very committed; I think our company is responsible for one percent of Ghana's total exports. Consider the oil, the cocoa and the gold. We do about averagely 19 tonnes of fruits very year. CASE B

As and when it is needed and necessary, but to say this year I invested US\$10,000 for marketing, I do not do that but when it is needed I do it. CASE C

In fact, it has been the policy of the company to always commit funds to develop and know more on the market in a given time. On training, if you look at our pack house here, we have one of the modern packing lines in the country and our staffs are efficiently trained to do the right job here. CASE D

Yes, we commit resources, we actually opened the first perishable export office in Ghana, before the World Bank came in to build Shed 9 at the Tema Port, we were already operating an office only for perishable exports. Staff training is an important part of our business; apart from that it is a corporate policy to have everybody well trained here. CASE E

So far, for farmers organization is a very difficult to set aside funds of members so I cannot say that we have much investment; rather we have been depending upon good will and grants. Many Non-government Organizations (NGOs) have been giving us training throughout the year to assist produce quality produce for the export markets. CASE F

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We have invested in a warehouse in Ghana, we have bought equipment, and we have two trucks that go into the hinterland to buy the produce for exports. We send our staff to local training, whenever we hear about a seminar or local workshop and we take advantage of courses offered by agencies as well. CASE G

All cases except two (CASE A and CASE F) indicated it was difficult to set aside funds to develop their export business due to payment on credit and unavailability of funds. All other cases were committed to the export business by plugging back the profit into the business for expansion, investment and product development.

Export Challenges in the Supply Chain System

The interview inquired about the common barriers the exporters confront in their business with regards to outsourcing agricultural produce for exports. The exporters used the quotes below to express and emphasis the barriers in the operations of the business.

Freight and Shipping

The challenges are so many. Vegetables are perishable and unfortunately in Ghana we do not really have any cargo planes. Its only one man who owes Air Ghana and he brings in one cargo plane a week on Mondays. We all rush there, so in between we have to use the commercial flights like BA, KLM and Lufthansa, and the problem is that if they have many passengers, then obviously they don't have enough freight. The vegetables are mainly produced for the export market, therefore when you miss the flight, literally you have to dump the load and it is very expensive. Again, our roads are not so good, so for instance if you want the quality to be good, you have to make sure you harvest the same day early enough and sort out the good ones and make sure that you go and catch a flight. CASE A

The common problems are with shipping, for example if you want to go to America there is no dedicated shipping line. Some lines are there but they take too long to get to the US, even another shipping line sends the goods first to Aljazeera or to a port in another country and they do trans-shipment which it is not good for us, because the goods arrives in the US forty-five days after shipment. That is the main challenge. CASE G

Unavailability of Produce and Land Tenure Issues

Currently the challenge has to do with local land tenancy, raw material and getting the right quality of raw material to process and export. You will be surprised for the past few years we have been importing pineapples from Benin and Togo because the local market cannot meet our demand. We think if government can open up this kind of area and encourage farming or develop the agricultural sector. I keep telling people that the agricultural sector is dying. When you speak to farmers, there is no succession plan for anybody to take over from them. The number of farmers has come down. CASE B

In fact from past years we use to have out growers, but currently we mainly export from our farm, because the main reason for this work we are doing is to export, we do the right things to avoid having problems outside. I will talk of land, pineapple is a land issue, it needs vast acres of land to produce,

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the challenge we are facing is that, land ownership is not well defined in this country. At times, you have problems when you acquire the land and another person comes to claims it and at some point, you just have to let go of the land. It also slows down your production projections. CASE D

Quality of the Produce

The major problem is in quality. Quality is the biggest issue. It is the only issue actually and a lot of people simply don't know the products, most probably because they do not grow them themselves they go buy and export so you end up having big problems with the quality of the fruits. Since 2009, some countries have been sending alerts on quality products, and some countries have actually instituted a ban on those products to be imported into their countries so that more or less is a challenge in the industry. CASE C

On the agricultural sector, we seem to have very good fruits, even though what we are looking at now is bad, if we do not take care we will lose that one too, because the pest and disease that are coming in now are too much. We are buying from Ghana and we are recording as much as 60% rejects, which is quite on the higher side. We buy from other countries in West Africa and we do not even get 10% rejects. Therefore, these are the things we should look at, other than that the raw material base will be wiped out from the agricultural sector and if that gets wiped out the manufacturing sector will not be there. CASE E

Lack of Funding

The impression we have is that there is a big potential of non-traditional exports. Particularly, mangoes in fact many of the workshops we have attended, mango has been graded as probably going to be the second apart from cocoa. Some of us even think that if we organise properly we can overtake cocoa. So aware of that potential in export we need more support, our farmers' access to funding; these are the things. This amalgamation of peasant farmers who are now been groomed to be business. You do not expect them to go to the bank and get loans at fantastic interest rates. Even when they go to the banks the guarantees the banks require cannot be provide by the farmers. CASE F

The in-depth interviews with the exporters revealed that, there are diverse barriers confronting exporters in the agricultural industry of Ghana. For instance, CASE A and G stressed the difficulty they encounter in sending their produce through air or sea, which results in affecting their business financially. Two cases (B and D) identified land tenure issues as barriers affecting the availability of raw material for their exports, which results in importing fruits from other African countries by CASE B. Quality is important when it comes to exporting as the foreign market environment have regulatory frameworks concerning standards. CASE C and E clearly stated quality as one of the main barriers affecting their export operations, in the sense that, they face high reject rates at the entry points in foreign markets which leads to the institutional bans on some produce from Ghana. CASE F reiterated the lack of funds and high interest rates on bank loans as the main challenge confronted by small famers getting groomed to become businessmen.

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Export Performance

In relation to export performance, three measures: personal satisfaction with export performance, strategic and financial measures was presented to the exporters to choose the most important measure they will select to measure the performance outcomes of the firm. The under listed codes emphasizes their preferred export performance measures.

All are important because we need money to run the business. I will prefer personal satisfaction with export performance. The good thing with the Asian vegetables is that they are cash crop, and it takes six or eight weeks to grow them and harvest, so at least we are helping and it gives me the personal satisfaction. CASE A

I will consider both financial and strategic, this company that is growing above 20% annually, on that level financially I think we are making some headway. Strategically yes, continuously we have to be looking at the positive areas of our strength and develop those areas. I think financial is important to us, to remain profitable and strategic we need to advance and gain the modern trend of accuracy. CASE B

Well, it is the three actually, but financial is very important, otherwise I will be out of business completely. CASE C

Financially, I will use financial. Financial measurements are the very important to me. CASE D

I will choose personal satisfaction and strategic because our business helps the grass root farmers in Ghana. As a Manager, personal satisfaction is important to me because when I load a container and it gets there I have achieved my objective. CASE E

The exporters buy from us at a slightly higher price; therefore the financial measurement is important to me as a business person. CASE F

Well, I will say financial and strategic. We have been successful because we have been able to establish a bridgehead. We hired a warehouse in New Jersey and distribute our yams and we have done a bit more of geographic expansion to the eastern border of the USA. For now strategic is very important, we will move from strategic to financial and them to personal satisfaction. CASE G

The finding from this research indicates that three out of three cases (CASES B, E and G) selected financial and strategic to measure the export performance of the firm. Three cases (C, D and F) also selected financial performance to measure the success of the firm. Only CASE A selected personal satisfaction to measure the export performance of the firm. Five cases selected financial performance as the important variable to measure the export performance of the firm. Two cases selected personal satisfaction and strategic variables as important measurements of export performance respectfully. From the analysis, although the exporters were unable to readily provide financial information about the firm, they selected perceptual financial measurement to measure the success of the firm, which is good for long term export performance assessment.

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Discussion and Implication of Findings

Internal Managerial Capabilities of the Firm

The findings of this chapter are based on interviews to contribute to theory building and knowledge by providing multiple case studies to demonstrate managerial learning and export barriers in the operations of the firm. Precisely, it contributes to the existing literature by offering practical and theoretical insights for managers and policy makers in developing countries. First, we discovered that initiation of exporting is associated with different factors in this research. Key factors emphasised across the interviews revealed that, the initiation of exporting was associated with the potential in exporting, experience and networks from abroad, unavailability of market in the local market and diversification of business. To some extent, living and working abroad have an influence on the initiation of exporting in Ghana as well as previous similar experience.

We also find that networks abroad and experience in previous export activities prompted interest in the same line of business. Farmers and out growers in Ghana started exporting, because they were compelled to look for foreign markets due to unavailability of buyers in the local market. Exporting is recognised as a potential business in Ghana for prosperity which confirms previous findings that, through exporting, management of firms enhance societal prosperity and help national development by creating jobs (Leonidou, Katsikeas, & Samiee, 2002). International exposure is also used by firms to improve their competitiveness at home through enhanced managerial skills and capability gained from operating in foreign markets (Madsen, 1987) which is the case in this study.

This study further revealed interesting findings, although some views of the exporters indicated that the local market could not supply the right quality produce they need for processing; conversely, out growers were also seeking international markets for their produce. If we critically analyse this finding, this situation could be attributed to the competitive price offered on the international market compared to pricing on the local market.

International experience is associated with export performance in this study, except for two exporters, who did not have any intentional outlook before the commencement of the business. The findings are in line with other studies which have examined international experience of the firm with export performance (Lado et al., 2004; Lages et al., 2008) and the direct relationships were significant. We found that the international outlook of the manager refers to specific characteristics such as previous international experience, time spent abroad and experiential knowledge are associated with exporting (Sousa et al., 2008). Experiential knowledge is acquired through conducting international business over a period of time in many countries. Literature posits from an RBV perspective that international experience could be considered as proxies for a firm's knowledge on the domestic and overseas market, especially through experiential learning (Forsgren, 2002).

We identified high commitment on part of the exporters, which supports previous studies. The commitment by the organisation to exports has been referred as export commitment or top management commitment (Lages & Montgomery, 2001). This signifies how important a firm considering exporting have to allocate substantial amount of resources towards the export activity (Castaldi, Sengupta, & Silverman 2001). Financial and human resources are committed to the export activity to enhance performance as found in this study, which is similar to other works (Navarro, Acedo, Robson, Ruzo, & Losada, 2010; Sousa et al., 2008).

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Evidence has shown that commitment is an important determinant of export performance for over two decades (Katsikeas, 1996; Lado et al., 2004; Lages et al., 2008; Sousa et al., 2008). Julian (2003) argued that, if commitment uncertainty is reduced, marketing strategies can be implemented effectively to enhance better performance. This finding supports the assertion from previous studies that export commitment improves the efficiency and effectiveness of resource allocation, providing vital motivations to boost both export sales and managers' satisfaction with the firm's performance (Navarro, Losada, et al., 2010).

Export Barriers

Previous studies have classified export barriers into internal and external. Internal barriers are constraints associated with organisational resources and capabilities and external barriers are challenges emanating from the home environment within which the firm operates and sometimes do not have control over. Export barriers refer to all the constraints thwarting the firm's capacity to develop or sustain business operations in foreign markets (Leonidou, 1995). The aggregated analysis identified four main barriers encountered by exporters in the agricultural industry of Ghana.

Logistics Barriers

Case A asserted there were many challenges in the industry. Case A mentioned that the unavailability of cargo planes is one of the main challenges facing the industry as they have access to only one cargo plane which reports weekly. In between, Case A noted that the firm has to use commercial flights to send products overseas, which is not often available due to less freight. This situation causes financial loss to the firms as they literally have to dump all the produce if there is no access to freight to fly the farm produce abroad. These are environmental barriers in the home market which are affected by rapid changes incorporated with high level of uncertainty and fall beyond the control of the individual firm (Leonidou, 1995).

Operational inflexibility arises in the operation of the firm which affects performance. Other external barriers identified by Case A were infrastructure including bad roads and transport which delays the transportation of the produce for exports. Case G reiterated the same problems encountered are logistical as there is no dedicated shipping line reporting to Ghana. This causes delays in shipment and long duration of sea travel tend to affect the quality of the produce before arrival, causing financial loss to the firm. Previous studies have documented transport delays and unexpected events may arise to a number demerits for the exporter such as extra cost when using faster transport to send goods abroad, lost sales and profits which is reported in this study (Leonidou, 2004).

Functional Barriers

The study revealed two cases were confronted with land issues and scarce raw materials to efficiently operate to achieve production targets. Case B asserted that, the firm was confronted with local land tenancy issues and unavailability of raw materials for processing. Case B's firm have imported pineapples severally from other West African countries because the local market cannot meet their demands. This generates a gap in the supply chain system of the agricultural industry. Lack of land tenancy issues was mentioned by Case D as the main challenge confronting the firm. For the firm to increase production,

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Case D argued that land acquisition is paramount to expansion of the pineapple plantation. Thus, this slows down the production projections of the firm. Functional barriers in previous studies have been related to the inefficiencies of the various firm functions such as production with regards to exporting in terms of unavailability of production capacity which affects the performance of the firm (Leonidou, 2000; Tesfom et al., 2006).

Marketing Barriers

Product quality problems are rated as important issues in export barriers. Product quality in the agricultural sector is partially attributed to poor quality of the fruits produced for the export market. Case C noted quality is a major problem in the industry, as many firms do not export the right quality fruits, and that results in the ban of some produce into certain countries as the fruits don't meet the quality standards at those countries. Previous studies have suggested that product adaptation problems are related to the firm's capacity and flexibility to adapt products to the needs of the customer, and lack of adequate resources to adapt the product to foreign market standards results in rejections at the entry points (Teskem et al., 2006).

Case E asserted the high level of rejections at the entry points was alarming, thus prompting many countries to send alerts on quality products and banning the importation of certain fruits. Case D noted that due to quality issues, the firm exports mainly from their farm to prevent having problems in foreign markets. Previous studies revealed that many foreign government use special legislation to set up quality standards for certain categories of goods, making product adaptation mandatory (Fillis, 2001; Leonidou, 1995). Regulations are implemented to protect the health and safety of the host country's population, which compels the exporter to comply at an extra cost. The findings in this study confirm previous studies recommendation of product adaptation to suit the characteristics of the foreign market to prevent rejection at the entry points (Leonidou et al., 2002).

Lack of Funding

Literature has documented funding is a major challenge especially for small firms exporting (Leonidou, 2000). The export financing system in Ghana and the financial sector are expected to meet the financial needs of exporters. Case F asserted their farming organisation lacks financially support to grow their business and develop. Additionally, the farmers are unable to solicit for funds in the financial institutions due to strict credit requirements. Previous studies have acknowledged engagement in export operations requires extensive expenditures in export operations, which creates excessive financial burdens for small firms especially if the latter is already strained financially because of internal problems (Leonidou, 1995). Other studies also found that some exporters get credit through collaterals while others lack the fixed assets that are needed for financial support (Leonidou, 2004)

CONCLUSION AND IMPLICATIONS

The preceding analysis in the study has demonstrated that exporters in the agricultural industry of Ghana are beset by many constraints associated with the operation of their business. Some of these obstacles are connected to environmental barriers in the home market which generates high level of uncertainty

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and fall beyond the control of the individual firms. Moreover, land ownership and tenure problems arise within the domestic market which affects production. In this instant, the exporters could liaise with the right authorities to settle the land title issues and confirm ownership. In general, internal barriers found within the firm are more controllable and sometimes easy to manage through planning as opposed to external problems.

For managers, this research confirmed product quality problems are important issues in export marketing which needs to be addressed. The foreign market is coupled with legal and regulatory frameworks and high standards to protect the customer in the import market, so managers must allocate financial resources to adapt their products to meet the strict quality criteria at the import market. Managers have to adapt products to the needs of the customer and put in all efforts to meet foreign market standards by meeting customer specifications.

The analysis has also revealed that the frequency of export barriers vary according to different time and firm size. This highlights the fact that the impact of barriers in exporting is largely dependent on the characteristics of the managerial, organisational and environmental background of the firm. Managers should adopt a proactive outlook against these barriers and prioritize these problems according to their impact on the achievement of export goals based on analysis of the challenges.

The major barriers faced by Ghanaian agricultural exporters are logistics, functional barriers, product quality and lack of funding to support the export business. This study can be applicable in other developing and lower emerging economies in Africa and beyond as there are similar characteristic of business practices and operations. Therefore, the findings of this research could be generalised to reflect other African countries and beyond to address export barriers and challenges confronting the outcomes of exporting. The study concludes that providing the support to small farmers' organisations and firms and disassembling export barriers in local environment of the firm will allow management of exporting firms to undertake a commanding role in pursuit for strong economic and industrial development in their operations.

REFERENCES

- Bala, K. (2014). Supply Chain Management: Some issues and challenges - A review. *International Journal of Current Engineering and Technology*, 4(2), 947–953.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. doi:10.1177/014920639101700108
- Bessant, J., & Tsekouras, G. T. (2000). *Developing learning networks*. London: A.I. and Society.
- Boulding, K. (1956). General systems theory-the skeleton of science. *Management Science*, 2(3), 197–208. doi:10.1287/mnsc.2.3.197
- Budget, G. (2010). *Budget statement and economic policy for 2010*. Ghana: Retrieved from <http://www.ghana.gov.gh/documents/2010budget.pdf>
- Budget, G. (2012). *Budget statement and economic policy for 2012*. Ghana Government Retrieved from <http://www.modernghana.com/news/361684/1/2012-budget-full-statement.html>

Supply Chain System and Barriers of Exporting

- Cavusgil, T., & Zou, S. (1994). Marketing strategy-performance relationship: An investigation of the empirical link in export market ventures. *Journal of Marketing*, 58(1), 1–21. doi:10.2307/1252247
- Chetty, S., & Hamilton, R. T. (1993). Firm-level determinants of export performance. *International Marketing Review*, 10(3), 25–34. doi:10.1108/02651339310040643
- Christopher, M. (1998). *Logistics and supply chain management*. Harlow: Pearson Education Publishing.
- Cox, A. (1999). Power, value and supply chain management. *Supply Chain Management: An International Journal*, 4(4), 167–175. doi:10.1108/13598549910284480
- Crick, D., & Spence, M. (2005). The internationalisation of ‘high performing’ UK high-tech SMEs: A study of planned and unplanned strategies. *International Business Review*, 14(2), 167–185. doi:10.1016/j.ibusrev.2004.04.007
- Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Douglas, S., & Craig, C. (1989). The evolution of global marketing strategy: Scale scope and synergy. *The Columbia Journal of World Business*, 1(Fall), 47–58.
- Eisenhardt, K. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Filipe Lages, L., & Montgomery, D. B. (2004). Export performance as an antecedent of export commitment and marketing strategy adaptation: Evidence from small and medium-sized exporters. *European Journal of Marketing*, 38(9/10), 1186–1214. doi:10.1108/03090560410548933
- Fillis, I. (2001). Small firm internationalisation: An investigative survey and future research directions. *Management Decision*, 39(9), 767–783. doi:10.1108/00251740110408683
- Forsgren, M. (2002). The concept of learning in the Uppsala internationalisation process model: A critical review. *International Business Review*, 11(3), 257–277. doi:10.1016/S0969-5931(01)00060-9
- Gençtürk, E., & Kotabe, M. (2001). The effect of export assistance program usage on export performance: A contingency explanation. *Journal of International Marketing*, 9(2), 51–72. doi:10.1509/jimk.9.2.51.19886
- Glavas, C., & Mathews, S. (2014). How international entrepreneurship characteristics influence Internet capabilities for the international business processes of the firm. *International Business Review*, 23(1), 228–245. doi:10.1016/j.ibusrev.2013.04.001
- GSS. (2014). *Ghana economic performance*. Accra- Ghana: Ghana Statistical Services Retrieved on September 4, 2014, from: <http://statsghana.gov.gh/>
- Gummesson, E. (2000). *Qualitative methods in management reserach*. London: Sage Publications.
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measure and metrics in a supply chain environment. *International Journal of Operations & Production Management*, 21(1/2), 71–87. doi:10.1108/01443570110358468

Supply Chain System and Barriers of Exporting

- Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management: An International Journal*, 6(5), 205–207. doi:10.1108/EUM0000000006039
- Hultman, M., Katsikeas, C., & Robson, M. J. (2011). Export promotion strategy and performance: The role of international experience. *Journal of International Marketing*, 19(4), 17–39. doi:10.1509/jim.11.0022
- Johanson, J., & Mattsson, G. L. (1998). In N. Hood & J.-E. Vahlne (Eds.), *Internationalization in industrial systems - A network approach*. London: Croom Helm.
- Julian, C. (2003). Export marketing performance: A study of Thailand firms. *Journal of Small Business Management*, 41(2), 213–221. doi:10.1111/1540-627X.00077
- Julian, C., & Ahmed, Z. (2005). The impact of barriers to export on export marketing performance. *Journal of Global Marketing*, 19(1), 71–94. doi:10.1300/J042v19n01_05
- Katsikeas, C. (1996). Ongoing export motivation: Differences between regular and sporadic exporters. *International Marketing Review*, 13(2), 4–19. doi:10.1108/02651339610115737
- Kolavalli, S., Robinson, E., Diao, X., Alpuerto, V., Folledo, R., & Slavova, M. (2012). Economic transformation in Ghana: Where will the path lead? *IFPRI Discussion Paper*. Retrieved from <http://dspace.cigilibrary.org/jspui/bitstream/123456789/32682/1/IFPRI%20Discussion%20Paper%2001161.pdf?1>
- La Londe, B. J., & Masters, J. M. (1994). Emerging logistics strategies: Blueprints for the next century. *International Journal of Physical Distribution & Logistics Management*, 24(7), 35–47. doi:10.1108/09600039410070975
- Lado, N., Martinez-Ros, E., & Valenzuela, A. (2004). Identifying successful marketing strategies by export regional destination. *International Marketing Review*, 21(6), 573–597. doi:10.1108/02651330410568024
- Lages, F., & Jap, S. D. (2002). Marketing mix adaptation and performance in international marketing relationships. *European Union Working Paper*, 411.
- Lages, F., Jap, S. D., & Griffith, D. A. (2008). The role of past performance in export ventures: A short-term reactive approach. *Journal of International Business Studies*, 39(2), 304–325. doi:10.1057/palgrave.jibs.8400339
- Lages, F., & Montgomery, D. B. (2001). Export assistance, price adaptation to the foreign market, and annual export performance improvement: A structural model examination. Stanford University, Graduate School of Business, 1-45.
- Leonidou, L. (1995). Export barriers: Non-exporters' perceptions. *International Marketing Review*, 12(1), 4–25. doi:10.1108/02651339510080070
- Leonidou, L. (1995). Empirical research on export barriers: Review, assessment, and synthesis. *Journal of International Marketing*, 3(1), 29–43.
- Leonidou, L. (2000). Barriers to export management: An organizational and internationalization analysis. *Journal of International Management*, 6(2), 121–148. doi:10.1016/S1075-4253(00)00022-3
- Leonidou, L. (2004). An analysis of the barriers hindering small business export development. *Journal of Small Business Management*, 42(3), 279–302. doi:10.1111/j.1540-627X.2004.00112.x

Supply Chain System and Barriers of Exporting

- Leonidou, L., Katsikeas, C., & Piercy, N. F. (1998). Identifying managerial influences on exporting: Past research and future directions. *Journal of International Marketing*, 6(2), 74–102.
- Leonidou, L., Katsikeas, C., & Samiee, S. (2002). Marketing strategy determinants of export performance: A meta-analysis. *Journal of Business Research*, 55(1), 51–67. doi:10.1016/S0148-2963(00)00133-8
- Loane, S. (2006). The role of the internet in the internationalization of small and medium sized companies. *Journal of International Entrepreneurship*, 10(1), 263–277.
- Loane, S., & Bell, J. (2006). Rapid internalisation among entrepreneurial firms in Australia, Canada and New Zealand. *International Marketing Review*, 23(5), 467–485. doi:10.1108/02651330610703409
- Madsen, T. K. (1987). *Empirical export performance studies: A review of conceptualization and findings*. (S. T. Cavusgil, Ed.). Greenwich, CT: JAI Press.
- Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: Empirical evidence from the agri-food industry. *Supply Chain Management*, 12(3), 177–186. doi:10.1108/13598540710742491
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Soonhoong, M., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining Supply Chain Management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Miles, M. B., & Huberman, M. A. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverley Hills, CA: Sage Publications.
- Mmieh, F., Owusu-Frimpong, N., & Mordi, C. (2012). Evaluating the contribution of the export sector to real GDP growth rate under structural adjustment programme (SAP): The case of Ghana. *Thunderbird International Business Review*, 54(4), 493–507. doi:10.1002/tie.21479
- Mostafa, R. H., Wheeler, C., & Jones, M. V. (2006). Entrepreneurial orientation, commitment to the internet and export performance in small and medium sized exporting firms. *Journal of International Entrepreneurship*, 3(1), 291–302.
- Navarro, A., Acedo, F. J., Robson, M. J., Ruzo, E., & Losada, F. (2010). Antecedents and consequences of firms' export commitment: An empirical study. *Journal of International Marketing*, 18(3), 41–61. doi:10.1509/jimk.18.3.41
- Navarro, A., Losada, F., Ruzo, E., & Díez, J. A. (2010). Implications of perceived competitive advantages, adaptation of marketing tactics and export commitment on export performance. *Journal of World Business*, 45(1), 49–58. doi:10.1016/j.jwb.2009.04.004
- Puertas, R., Martí, L., & García, L. (2014). Logistics performance and export competitiveness: European experience. *Empirica*, 41(3), 467–480. doi:10.1007/s10663-013-9241-z
- Ramanathan, U., & Gunasekaran, A. (2014). Supply chain collaboration: Impact of success in long-term partnerships. *International Journal of Production Economics*, 147 Part B, 252-259.
- Reid, S. (1981). The decision-maker and export entry and expansion. *Journal of International Business Studies*, 12(2), 101–112. doi:10.1057/palgrave.jibs.8490581

Supply Chain System and Barriers of Exporting

Sousa, C., Martínez-López, F. J., & Coelho, F. (2008). The determinants of export performance: A review of the research in the literature between 1998 and 2005. *International Journal of Management Reviews*, 10(4), 343–374. doi:10.1111/j.1468-2370.2008.00232.x

Stadler, H. (2005). Supply chain management and advanced planning—basics, overview and challenges. *European Journal of Operational Research*, 163(3), 575–588. doi:10.1016/j.ejor.2004.03.001

Stock, G. N., Greis, N. P., & Kasarda, J. D. (2000). Enterprise logistics and supply chain structure: The role of fit. *Journal of Operations Management*, 18(5), 531–547. doi:10.1016/S0272-6963(00)00035-8

Stoian, M. C., Rialp, A., & Rialp, J. (2011). Export performance under the microscope: A glance through Spanish lenses. *International Business Review*, 20(2), 117–135. doi:10.1016/j.ibusrev.2010.07.002

Tesfom, G., Lutz, C., & Ghauri, P. (2006). Solving export marketing problems of small and medium-sized firms from developing countries. *Journal of African Business*, 7(1-2), 57–87. doi:10.1300/J156v07n01_04

Yin, R. (1981). The case study crisis: Some answers. *Administrative Science Quarterly*, 26(1), 58–65. doi:10.2307/2392599

Yin, R. (2009). *Case study research. Design and methods*. United States of America: Sage.

Zahra, S. A., Korri, J. S., & Yu, J. F. (2001). Cognitive and international entrepreneurship: Implications for research on international opportunity recognition and exploitation. *International Business Review*, 14(2), 112–146.

Chapter 17

Cultivating Global Entrepreneurs in the Food Supply Chain

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ABSTRACT

Food supply chain from an entrepreneur's perspective has many needs today. To cultivate food entrepreneurs addressing the growing global demand in food, there is an emerging trend in integrating vital players in food supply chain to form food clusters. Like most of start-up entrepreneurs in other industries, food entrepreneurs have their challenges of identifying market opportunities, building a trusted management team, and securing funding sources to run the businesses. They also need facilities to produce their foods, the facilities needed to be certified by local food authorities, securing product liability insurance, and marketing channels to distribute their food products. In this paper, we discussed how LSU Food Incubator is established and developed to address those challenges. Specifically, it is a "Flying High, Landing Soft" platform. We plan to empower the platform with mobile cloud learning practices and capabilities and extend this platform to emerging markets like Turkey.

INTRODUCTION

Food supply chain has been an important research topic in global supply chain management. Early literature focused on (1) "farm to fork" (Bourlakis and Weightman, 2004), including consumer (Brom, 2000), risk & safety (Yeung and Morris, 2001), procurement (Stiner, 1991) & third party logistics (Selviaridis and Spring, 2007), livestock systems (McMichael, et al, 2007) & crop production (Oerke, et al, 2012), food manufacturers (Mercer and Tao, 1996) organic foods (Magnusson, 2001), retailing (Cotterill and Mueller, 1979) & supermarket supply networks (Duffy and Fearn, 2004), wholesaling (Dawson, 2004),

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and catering (Macrae, et al, 1993); and globalization of food supply chain and its management (Eastham, et al, 2007), including diversity of partnerships for quality assurance (Willem and Trienekens, 1999) and traceability of global networks of food supply (Barrett, et al., 1999).

Corporate social responsibility (CSR) emerged later as a research focus in the global food supply chain, including motivations in CSR engagement (Piacentini, et al, 2000), the global evolution of the food supply chains and their role in rural economy development (Marsden, et al, 2000), reputation for quality and reliability (McWilliams and Siegel, 2001), general food supply chain CSR issues and solutions (Maloni and Brown, 2006), potential and limits (Vogel, 2006), CSR within food stores (Jones, et al., 2007), impact on consumer trust (Pivato, et al, 2008), CSR drivers including economy, environment, and society (Hartmann, 2011), CSR in emerging markets (Kong, 2012), cross-cultural comparison (Loose and Remaud, 2013); and Nutrition Information Disclosure (Ye, et al, 2014).

More recent research focus of food supply chain management consists of addressing growing global issues (Pullman and Wu, 2012) such as (1) food waste and sustainability (Leal Filho and Kovaleva, 2014), including food waste valorized through different technologies (Vandermeersch, et al, 2014), design for sustainability through social practice approaches (Niimi, et al, 2014), and prevention by reducing food surplus throughout the food supply chain. (Papargyropoulou, et al, 2014); (2) food safety (Wallace, et al, 2011; Bhat and Gomez-Lopez, 2014), including managed through assurance systems (Zwietering, et al, 2014) and achieving food safety by using nanotechnology tools (Ayala-Zavala, et al, 2014); (3) food security (Woertz, 2013), including using sustainable intensification strategies (Godfray and Garnett, 2014); and (4) climate change (Paloviita and Järvelä, 2015), including impacts on food availability (Shackleton, 2014) and threat to future global food security (Tai, et al, 2014). Global entrepreneurship in food supply chain is believed to be an effective solution to address the growing global issues (Tripathi and Agarwal, 2014; Kline, et al, 2014).

BACKGROUND

To cultivate food entrepreneurs to address the growing global demand and issues in food, there is an emerging trend in integrating vital players in food supply chain to form food clusters (Lee and Wall, 2012; Woods, 2014; Cooperhouse and Surgi, 2014), including agribusinesses people (Green and Phillips, 2014), agricultural associations (P Vlachos, 2014) & cooperatives (Cranwell, et al, 2005), government agencies (Rutten, 2014), existing food companies (Chiffolleau and Touzard, 2014), food service companies (Laura Sidali and Hemmerling, 2014), food logistic companies (Sánchez-Díaz, Sánchez-Díaz, 2014), value-added technology companies (Pang, et al, 2012), faculty and students in regional universities (Alonso, 2011), and start-up food entrepreneurs (Abrham, 2014).

Based on the food clusters and their existing resources (Forsman, 2008) and networks (Ng, et al, 2003; Marsden and Smith, 2005; Tregear, 2005), various food incubators (Edward and Policy, 2012; Khanduja, 2013; Salinger, 2013) are created to cultivate new food entrepreneurs (Tarr, 2011); McFadden and Marshall, 2014).

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CHALLENGES

Food supply chain from an entrepreneur's perspective has many needs today (Cooperhouse, 2014; Dakup, et al., 2014; Okello and Were, 2014), including (1) information on product markets, process development with quality assurance and food safety, and capital access (Padilla-Zakour, 2004); (2) assembling a management team which has the needed professional expertise to run the food business; (Smith, 2008); (3) the expertise to develop competitive food products (Nicholas, 2014); (4) certified food production facility (Paull, 2008); (5) alternative networks allowing entrepreneurs to add value in the food supply chain (Tudisca, et al., 2014) (6) the ability to reduce cost so that products can be competitive in the marketplace (Holloway, 1991); (7) the ability to access capital to run the business; and (8) the ability to scale up the business operation (Jablonski, 2014). In this paper, we discuss how LSU Food Incubator is established and developed to address those challenges.

THE PLATFORM

The LSU AgCenter Food Incubator (LAFI, 2014) is an entrepreneurship platform grounded in the theory of Strategic Entrepreneurship and docility-based distributed cognition. Strategic entrepreneurship (Hitt et al. 2011), rooted in the resource-based view of the firm (Barney 1991), creates value for individuals, organizations, and society in three dimensions: (1) resource inputs, consisting of environmental factors, organizational resources, and individual resources; (2) resource orchestration processes (Sirmon et al. 2011), consisting of structuring the firm's resource inputs into portfolios, bundling resource portfolios into capabilities, and leveraging the capabilities to create value for shareholders; and (3) outputs, consisting of creating individual benefits, organizational benefits, and societal benefits. Docility is "*the tendency to depend on suggestions, recommendations, persuasion, and information obtained through social channels as a major basis of choice*" (Simon 1993, p.156). Furthermore, "because of docility, social evolution often induces altruistic behavior in individuals that has net advantage for average fitness in the society. Altruism includes influencing others to behave altruistically" (Simon 1993, p.157). The docility-based distributed cognition (Secchi, 2010) has three dimensions: (1) developing learning communities with communication standards and docile people who are willing to share resources and networks to help others in advancing the common interests of the communities; (2) developing coaching procedures for advice giving and taking through accessible social channels; and (3) telling success stories with bandwagon effects as the feedbacks to the communities.

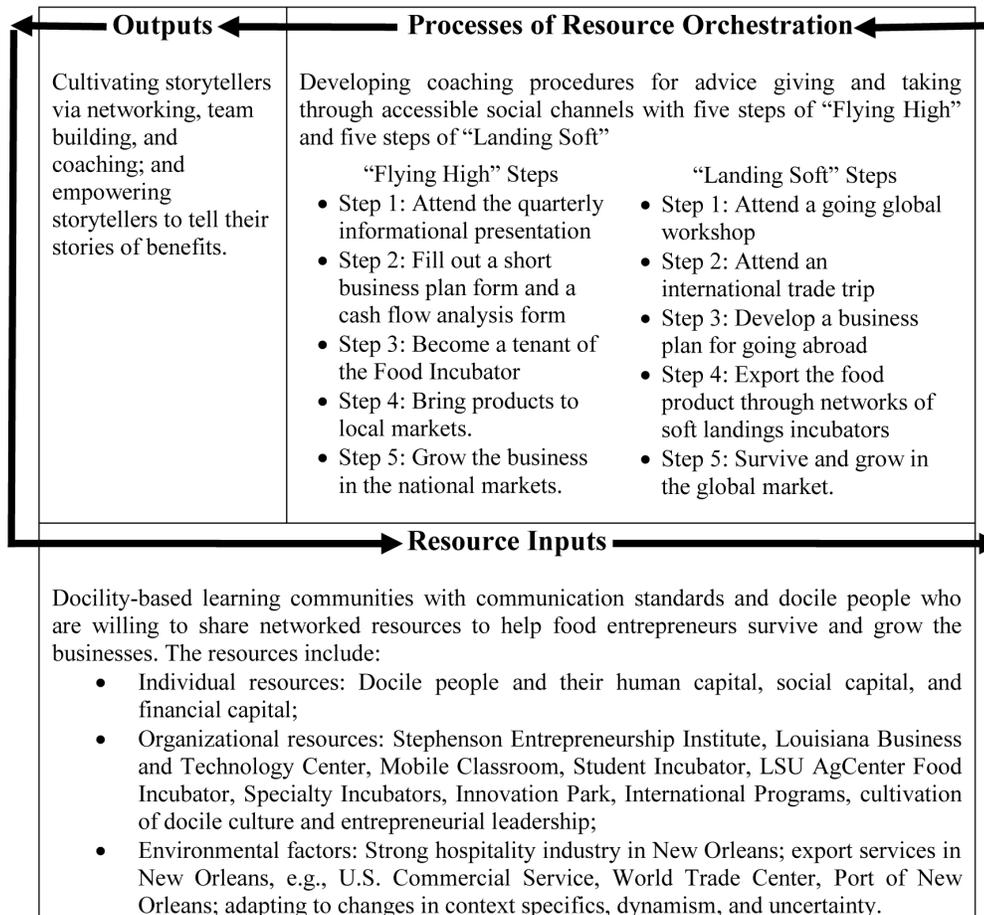
Specifically, the platform consists of four major components as is shown in Table 1: (1) docility-based learning communities in food with shareable networked resources; (2) processes of resource orchestration with accessible social channels and effective coaching in nutrition and food education and business development; (3) cultivating storytellers with effective storytelling in food entrepreneurship; and (4) fostering a virtuous cycle of continuous improvement in food entrepreneurship.

Resource Inputs

LSU has developed resource inputs with an action-oriented program cultivating entrepreneurs and helping growing companies go abroad through the collaboration of the following entities:

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Table 1. The platform for cultivating global entrepreneurs in the food supply chain



1. **Stephenson Entrepreneurship Institute (SEI):** SEI (2014), allowing LSU to be ranked 3rd as America’s most entrepreneurial campus by the Princeton Review and Forbes in 2004, offers entrepreneurship education, organizes seminars, and provides business plan development advice.
2. **Louisiana Business and Technology Center (LBTC):** LBTC (2014), designated the 2005 National Business Incubator of the Year and the Soft Landings International Incubator in 2011 by National Business Incubation Association, provides incubating facilities that assure the successful implementation of business plans developed by entrepreneurs. LBTC also provides space and services to companies from international markets or joint ventures with U.S. firms to give them a starting place in which to develop their businesses in U.S.). For example, LBTC was recently awarded to host a two-week agribusiness session to help entrepreneurs in Latin America access international markets (USDS, 2014).
3. **Mobile Classroom (MC):** MC (2014), dubbed the “Driving Louisiana’s Economy” initiative, is a community outreach vehicle of LBTC used to house seminars and workshops for small business

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owners. LBTC received the 2009 Economic Development Administration Excellence in Economic Development Award for Rural Economic Development, recognizing the tremendous service the Mobile Classroom provides.

4. **Student Incubator (SI):** SI (2014) allows student entrepreneurs to develop their businesses by leveraging the networked resources of LBTC and LSU.
5. **LSU AgCenter Food Incubator (LAFI):** LAFI (2014) helps food entrepreneurs survive and grow their start-up businesses by providing resources, business support, and access to scientists and services within the Food Science and Nutrition Department.
6. **Specialty Incubators:** In addition to LAFI, there are other specialty incubators such as Louisiana Emerging Technology Center (LETC, 2014), focusing on the biotechnology, life sciences, agricultural and environmental industries; and Pennington Biotech Initiative (PBTI, 2014), focusing on impacting patient health and care through technological advances.
7. **LSU Innovation Park (LIP):** LIP (2014) is a collaborative community offering businesses and entrepreneurs to develop, foster, and enhance innovation utilizing vast networked resources of LSU.
8. **International Programs at LSU (IP):** IP (2014) leverages the networked resources of LSU international students from international markets. IP also provides the linkages to the international business programs in the world.

The eight entities form docility-based learning communities with communication standards and procedures for information sharing. The communities have docile individuals who are willing to share their networked resources to help food entrepreneurs survive and grow the businesses. For example, LBTC has a strong advisory board consisting of university vice chancellors for research and economic development; five deans at LSU; the secretary of the Louisiana Department of Economic Development; the president of Baton Rouge area chamber of commerce; and many successful professionals. A major responsibility of board members is to provide advices and resources to empower food entrepreneurs to succeed. The docile individuals and their behaviors cultivate a culture of docility and entrepreneurial leaders. For example, SEI's Entrepreneurship Fellows Program helps produce future leaders of entrepreneurship. Both docile culture and entrepreneurial leadership are vital elements of our organizational resources. The individual resources and organizational resources allow us to tap into the established food networks of the hospitality industry in New Orleans and adapt to changing environmental factors. For examples, the International Programs at LSU help us tap into the diverse groups of international students and visitors when the local communities have the context specific needs of foreign countries; SEI's LSU 100 – Fastest Growing Tiger Businesses identify rising new business ventures responding to the market dynamics; and SEI's Entrepreneurship Bootcamp for Veterans help veterans address the uncertainty of life and find business opportunities after they retire from the services.

Processes of Resource Orchestration

The processes of resource orchestration in Table 1 draws upon the recent work of Sirmon et al. (2011). The processes consist of structuring the resource inputs into portfolios, bundling resource portfolios into capabilities, and leveraging the capabilities to create value for shareholders. There are five steps for "Flying High" to develop and grow the food business:

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- **Step 1:** Attend the quarterly informational presentation. Interested food entrepreneurs inquire the Food Incubator online and schedule to attend the quarterly informational presentation.
- **Step 2:** Fill out a short business plan form and a cash flow analysis form. The Food Incubator partners with Louisiana Business and Technology Center for a food entrepreneur's business plan development.
- **Step 3:** Become a tenant of the Food Incubator. The tenant is guided through each step of food production, including permitting, licensing, safety, and product liability insurance (NLAFI, 2014). The tenant can access a commercial kitchen; dry, cold and pallet storage; specialized processing equipment; analytical and testing services by the food scientist on staff and the Food Science and Nutrition Department (DIGBR, 2014);
- **Step 4:** Bring products to local markets. The Food Incubator helps food entrepreneurs bring their culinary products to store shelves in the food markets (BR, 2014). In addition, a tenant may also learn from the experiences of other tenants in the Food Incubator to grow the business (NLAFI, 2014).
- **Step 5:** Grow the business in the national market. If a food entrepreneur succeeds in the local market, the LBTC can help develop a strategic plan to grow in the regional and national markets through established food networks such as Whole Food (NLAFI, 2014).

There are also five steps for “Landing Soft” in Table 1. Soft landings (Chen, et. al., 2011), originally developed by the National Business Incubation Association (NBIA, 2014), is a process to help a company from one country land softly – without crashing – into the market of another country through a designated incubator. The purpose is to help the soft landings companies identify business opportunities and succeed in the new market with least risks and costs (Chen, et al., 2010). The five steps are:

- **Step 1:** Attend a going global workshop. New Orleans, an hour and half driving distance south of LSU, has several organizations specializing in export services, e.g., U.S. Commercial Service, World Trade Center, and Port of New Orleans. The LBTC has relationships with them to help SMEs go abroad. Attending a food export education workshop, such as SUSTA (2014), will help food entrepreneurs understand how to bring the business abroad.
- **Step 2:** Attend an international trade trip. U.S. Commercial Service constantly takes SMEs in U.S. to visit foreign markets with emerging opportunities. The LBTC assists interested SMEs in the process.
- **Step 3:** Develop a business plan for going abroad. The LBTC has a one-on-one consultation service for SMEs interested in going abroad.
- **Step 4:** Export the food product through networks of soft landings incubators. The LBTC is one of twenty-four international soft landings incubators designated by National Business Incubation Association (SLIID, 2014). Rutgers Food Innovation Center, one of the designated international soft landings incubator, has the outreach capacity to reach food businesses throughout the world (RFIC, 2014). U.S. Commercial Service also offers Gold Key services to help SMEs do the matching in exporting (Kapo, 2013).
- **Step 5:** Survive and grow in the global market. An objective of soft landings is to connect the soft landings company with networks of key decision makers in the new market, a key success factor

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of soft landings (Mencin & Erikson 2009). Another objective is to provide revenue generation services for the soft landings company, another key success factor of soft landings (Mencin & Erikson 2009). For a SME growing in the domestic market, it takes typically two or three years for the SME to survive and grow in the new foreign market through well-planned international soft landings.

Outputs

The outputs in Table 1 focuses on cultivating storytellers and empowering them to tell their stories in each of the five steps of “Flying High” and “Landing Soft” through networking, team building, and coaching. We tell the stories and feature the storytellers via website news, monthly newsletters, social media platforms such as Facebook and Twitter, and annual top-performer awards to gain bandwagon effects.

Expanded Resource Inputs

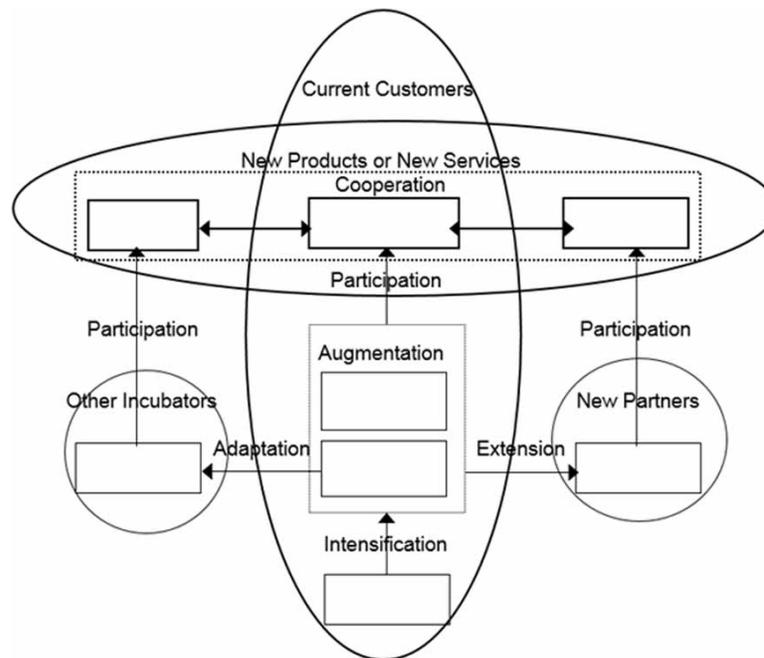
Those storytellers and the networked resources behind the success stories become the new resources to the resource inputs. In his study of distributed cognition, Secchi (2010) reported that pro-social behaviors, such as philanthropy and social responsibility, are the byproducts of docility; and the more people are docile, the stronger the intensity of the byproducts. Our experiences confirm these. The success stories and storytellers, derived from the resource inputs of docility-based communities, are added as feedbacks to the communities so that the resource inputs are enlarged and expanded. The arrows in Table 1 show this feedback loop in accordance with continuous learning and improving performance principles. For example, start-up food companies cultivated from the Food Incubator generate individual benefits, organizational benefits, and societal benefits as the outputs. Individual benefits include the start-up companies and the employees they hire (such as student interns, student workers, and full time workers). Organizational benefits include creating partnership opportunities for clients at the incubators to produce new innovation and new technology in food innovation and production. Societal benefits include creating wealth and increasing economic growth for the local communities.

FUTURE RESEARCH DIRECTIONS

The major goal of the platform is to cultivate global entrepreneurs in the food supply chain. A useful model for accomplishing this goal may be described as an airplane with the “Flying High, Landing Soft” platform depicted in Table 1 as the main body of the plane and “other incubators” and “new partners” serving as its two wings. The airplane is powered by the collaborative entities at LSU. The plane’s elevation, distance, and direction are controlled by the following six strategies adapted from the process-driven business strategies of Hammer (1996). Figure 1 summarizes the intrinsic essence of the six strategies as it is applied to the “Flying High, Landing Soft” platform. The strategies allow the platform to excel in the current food entrepreneurship *vertically* by providing an excellent service to current customers and expand the services *horizontally* to new partners, other incubators, and new products/services through process diversification.

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Figure 1. Visualizing the six strategies of advancing the platform



Intensification

Intensification refers to empowering the platform with mobile learning (Polat, et. al., 2014) and cloud computing practices to cultivate global food entrepreneurs more efficiently and effectively. The empowered platform is planned to have more digitalized features in order to maximize interactivity and time-space independency between teachers and learners through the mobile Internet infrastructure and mobile devices such as smart phones, tablets. Characteristics of best practices in online learning include student-faculty interaction, active learning, and prompt feedback (Chickering and Ehrmann, 1996); learner-centered and community building (Baran, et. al., 2011); outcomes, interaction and evaluation, psycho-social expectations, technical and faculty support, and standards (Schoen, 2010); mindset, connections, social learning, and community learning (Brown and Adler, 2008). Based on these online learning characteristics, we plan to enrich the learners of the entrepreneurship platform with the following focused areas: (1) understand the learner's attributes, e.g., anxiety and self-selected ability; (2) help the learner identify his/her passionate niche in food; (3) help the learner manage his/her time efficiently and effectively; (4) interact and collaborate with online teachers in food supply chain to pursue pedagogical inquiry and creativity for the learner. The goal is to cultivate new food entrepreneurs to tell good stories.

Recent literature indicates that online teachers and course designers recognize the potential usage of mobile technologies ((Beckmann, 2010; Vyas, et. al., 2010) by the students and expect to incorporate them into the online learning environment with the cloud computing capability (Dinh, et. al, 2011; Xu, et. al, 2011). Mobile cloud learning is a combination of both mobile learning and cloud computing. It is a new online learning model with an increased demand of anytime and anywhere access to the personalized content. Mobile cloud learning has four characteristics (Wang, et. al., 2014): virtual storage and sharing, universal accessibility, collaborative interactions, and learner centered. Grounded

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in transactional distance theory, four types of learner-centered mobile learning are identified (Park, 2011): high transactional distance socialized mobile-learning, high transactional distance individualized mobile-learning, low transactional distance socialized mobile-learning, and low transactional distance individualized mobile-learning.

Based on our experiences at LSU Food Incubator, we found that the fourth type of mobile learning, low transactional distance individualized mobile-learning, is the most useful for the entrepreneurship platform discussed above. Specifically, such a mobile cloud learning platform will help us do the following activities: understand the learner's attributes; help the learner identify his/her passionate food niche; help the learner manage his/her time efficiently and effectively through the platform; interact and collaborate with online teachers to pursue pedagogical inquiry and creativity for the learner; and cultivate new storytellers and empower them to tell their success stories to inspire new online learners.

Augmentation

Augmentation refers to expanding the platform of traditional food entrepreneurship by including any business ventures which are related to food. For example, alligator processors in Louisiana and neighboring southern states annually produce roughly 2 million pounds of waste, including alligator bones, connective tissues, and associated materials (LA, 2007). Traditionally, the waste was discarded. Instead, a researcher in the Food Science Department, where LSU AgCenter Food Incubator is located, has developed a method of extracting collagen from the waste which can be used in medicine, cosmetics, and foods (LA, 2007).

Adaptation

Adaptation refers to taking the proven food entrepreneurship and incubation as a model for other academic disciplines to develop their entrepreneurship programs. Consider textile entrepreneurship using imperfect alligator skins as an example. With a grant from the Louisiana Alligator Advisory Council, students in the LSU College of Agriculture's Textile, Apparel Design and Merchandising Department created looks using imperfect alligator skins for the Marsh on the Catwalk competition (LSUAgCenter, 2014). With an abundance of these skins, rejected by large fashion houses, and skills they learn, students can create their fashion businesses and promote the Louisiana alligator products (LSUAgCenter, 2014).

Extension

Extension refers to use the proven food entrepreneurship and incubation programs to work with new partners to help participative entrepreneurs to gain new market opportunities. For example, we plan to extend the LSU food incubator platform to emerging markets, such as Turkey, to cultivate global entrepreneurs in food supply chain.

Participation

Participation refers to using the platform and its networked resources to engage in community outreach activities and create economic value. LSU has a rich history of entrepreneurial outreach activities. Consider Louisiana Business & Technology Center (LBTC, 2014) as an example. Established in 1988 to

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enhance economic development in Louisiana, LBTC has received numerous awards including the 2005 Randall M. Whaley Incubator of the Year by the National Business Incubation Association and the 2009 Economic Development Administration Excellence in Economic Development Award for Rural Economic Development, recognizing the tremendous service the Mobile Classroom (MC, 2014) provides. LSU also gained a national reputation for its rapid and effective response to Hurricane Katrina and emerged as a leader in a time of extreme crisis through the establishment of Stephenson Disaster Management Institute (SDMI, 2014). Both LBTC and SDMI also played significant roles in providing effective solutions to address the environmental disaster due to oil spill in 2010. As a strategy of capacity building for extension and community outreach, LSU Student Incubator (SI, 2014) enables entrepreneurial students to leverage the networked resources of LBTC and SDMI to create effective business solutions to address the growing problems in the coastal regions (CWPPRA, 1997; Burgess, 2013; Sandeen, 2013; USGS, 2014).

We plan to develop a wetland entrepreneurship program that allows students to participate in exploring and developing businesses to maintain a healthy wetland (ACRP, 2012; Hagekhalil, 2012) to have positive impact on public health. For example, alligators are common in wetland and Louisiana accounts for 80 percent of American alligators' production (Millar, 2012). When looking at the traveling of alligators in the global economy, there are various business opportunities for entrepreneurial students, including egg hunting, incubation, farming and its supply chain, skin processing and high-end merchandise production, social media marketing for meat consumption, and recycling. In addition, documenting and filming the role each species plays in developing healthy wetland ecology is itself a fertile ground for creative digital media business cultivation. This is to take advantage of Louisiana's growing film industry to benefit K-16 students in sustainability education including enhancement of environmental science education for all local schools; eco-tourism and economic development; enhancing options for Louisiana tourism and providing opportunities for small business development in conjunction with LBTC and SDMI.

Cooperation

Cooperation refers to enriching resource inputs in Table 1 with sharable resources of other incubators and new partners to advance the platform of cultivating global entrepreneurs in food supply chain. For example, Office of Research & Economic Development at LSU has seven focal areas as its strategic plan, including costal sustainability & environment and individual behavior & community context (LSUO-REC, 2012). A strategic goal is to advance and support the economic and work force development in Louisiana (LSU, 2014). There are cooperative opportunities for the LSU AgCenter Food Incubator to work with the focal areas to enrich and advance the platform.

CONCLUSION

Food supply chain from an entrepreneur's perspective has many needs today. To cultivate food entrepreneurs addressing the growing global demand in food, there is an emerging trend in integrating vital players in food supply chain to form food clusters. Like most of start-up entrepreneurs in other industries, food entrepreneurs have their challenges of identifying market opportunities, building a trusted management team, and securing funding sources to run the businesses. They also need facilities to produce their foods, the facilities needed to be certified by local food authorities, securing product liability insurance,

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and marketing channels to distribute their food products. In this paper, we discussed how LSU Food Incubator is established and developed to address those challenges. Specifically, it is a “Flying High, Landing Soft” platform with four major components: docility-based learning communities in food with shareable networked resources; processes of resource orchestration with accessible social channels and effective coaching in nutrition and food education and business development; cultivating storytellers with effective storytelling in food entrepreneurship; and fostering a virtuous cycle of continuous improvement in food entrepreneurship. We plan to empower the platform with mobile cloud learning practices and capabilities and extend this platform to emerging markets like Turkey.

REFERENCES

- Abrham, J. (2014). Clusters in tourism, agriculture and food processing within the Visegrad Group. *Zemědělská Ekonomika [Agricultural Economics]*, 60(5), 208–218.
- ACRP. (2012). *Authority, Coastal Restoration & Protection. Louisiana’s Comprehensive Master Plan for a Sustainable Coast*. Baton Rouge: The State of Louisiana.
- Alonso, A. D. (2011). Educational institutions offering hospitality degrees and farmers: Is there a link? A case study from Alabama. *Journal of Agricultural & Food Information*, 12(1), 75–90. doi:10.1080/10496505.2011.539497
- Ayala-Zavala, J. F., González-Aguilar, G. A., Ansorena, M. R., Alvarez-Párrilla, E., & de la Rosa, L. (2014). Nanotechnology Tools to Achieve Food Safety. *Practical Food Safety: Contemporary Issues and Future Directions*, 341-353.
- Baran, E., Correia, A. P., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education*, 32(3), 421–439. doi:10.1080/01587919.2011.610293
- Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. doi:10.1177/014920639101700108
- Barrett, H. R., Ilbery, B. W., Brown, A. W., & Binns, T. (1999). Globalization and the changing networks of food supply: The importation of fresh horticultural produce from Kenya into the UK. *Transactions of the Institute of British Geographers*, 24(2), 159–174. doi:10.1111/j.0020-2754.1999.00159.x
- Beckmann, E. A. (2010). Learners on the move: Mobile modalities in development studies. *Distance Education*, 31(2), 159–173. doi:10.1080/01587919.2010.498081
- Bhat, R., & Gomez-Lopez, V. M. (2014). *Practical Food Safety: Contemporary Issues and Future Directions*. Wiley. doi:10.1002/9781118474563
- Bourlakis, M. A., & Weightman, P. W. (Eds.). (2004). *Food supply chain management*. Blackwell Publication.
- Brom, F. W. (2000). Food, consumer concerns, and trust: Food ethics for a globalizing market. *Journal of Agricultural & Environmental Ethics*, 12(2), 127–139. doi:10.1023/A:1009586529518

Cultivating Global Entrepreneurs in the Food Supply Chain

- Brown, J. S., & Adler, R. P. (2008). Minds on Fire: Open Education, the Long Tail, and Learning 2.0. *EDUCAUSE Review*, (January/February): 17–32.
- Burgess, R. (2013, October 8). *Critters, weeds invading Louisiana, destroying habitat*. Retrieved from <http://theadvocate.com/home/7156714-125/critters-weeds-invading-la-destroying>
- Chen, Y., Watson, E., & Azevedo, R.F.L. (2011). Soft Landings Curriculum of U.S.-China Entrepreneurship. *China Currents*, 10(2).
- Chen, Y., Watson, E., Liu, C., Cornachione, E., & Wu, S. (2010, June 25-29). Soft Landing Curriculum of Entrepreneurship in Emerging Markets. *Proceedings of the Academy of International Business 2010 Annual Meeting*, Rio de Janeiro, Brazil.
- Chickering, A., & Ehrmann, F. C. (1996). Implementing the Seven Principles: Technology as Lever. *AAHE Bulletin*, (October): 3–6.
- Chiffolleau, Y., & Touzard, J. M. (2014). Understanding local agri-food systems through advice network analysis. *Agriculture and Human Values*, 31(1), 19–32. doi:10.1007/s10460-013-9446-6
- Cooperhouse, L. (2014). Kitchen Incubation. *Proceedings of the National Business Incubation Association 28th Conference*, New Orleans.
- Cooperhouse, L., & Surgi, M. L. (2014). Maximizing Your Food Incubation Program. *National Business Incubation Association 28th Conference*, New Orleans.
- Cotterill, R. W., & Mueller, W. F. (1979). *The Food Retailing Industry: Market Structure, Profits, and Prices*. New York: Praeger.
- Cranwell, M. R., Kolodinsky, J. M., Donnelly, C. W., Downing, D. L., & Padilla-Zakour, O. I. (2005). A model food entrepreneur assistance and education program: The Northeast Center for Food Entrepreneurship. *Journal of Food Science Education*, 4(4), 56–65. doi:10.1111/j.1541-4329.2005.tb00063.x
- CWPPRA. (1997). Wetland Loss in Louisiana (Government Publication). *LA Coast*. Retrieved from <http://lacoast.gov/reports/rtc/1997/5.htm>
- Dakup, K., Fulford, H., & Sutherland, B. J. (2014). Investigating the adoption of sustainable green initiatives in Scottish food and drink SMEs. *Proceedings of the 9th European Conference on Innovation and Entrepreneurship*. Academic Conferences and Publishing International.
- Dawson, J. (2004). Food retailing, wholesaling and catering. *Food supply chain management*, 116-35.
- DIGBR. (2014, July 15). Incubating Perfection, Dig Baton Rouge. Retrieved from <http://digbatonrouge.com/incubating-perfection-lsu-ag-center-incubator>
- Dinh, H. T., Lee, C., Niyato, D., & Wang, P. (2011). A survey of mobile cloud computing: Architecture, applications, and approaches. *Wireless Communications and Mobile Computing*, 1587-1611.
- Duffy, R., & Fearne, A. (2004). Partnerships and alliances in UK supermarket supply networks. *Food supply chain management*, 136-52.
- Eastham, J., Sharples, L., & Ball, S. (Eds.). (2007). *Food supply chain management*. Taylor & Francis.

Cultivating Global Entrepreneurs in the Food Supply Chain

Edward J. Bloustein School of Planning and Public Policy. (2012). Community Food Hubs. Retrieved from <http://rwv.rutgers.edu/wp-content/uploads/2013/07/FoodHubFinalReport.pdf>

Forsman, S. (2008). How do small rural food-processing firms compete? A resource-based approach to competitive strategies. *Agricultural and food science*, 13(Supplement), 129.

Godfray, H. C. J., & Garnett, T. (2014). Food security and sustainable intensification. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 369(1639), 20120273. doi:10.1098/rstb.2012.0273 PMID:24535385

Greater Baton Rouge Business Report. (2014). LSU incubator helps entrepreneurs bring new culinary products to store shelves. Retrieved from <http://www.businessreport.com/article/business-report-lsu-incubator-helps-entrepreneurs-bring-new-culinary-products-to-store-shelves>

Green, G. P., & Phillips, R. G. (Eds.). (2014). *Local Food and Community Development*. Routledge.

Hagekhalil, A. (2012). Adel Hagekhalil on Significance of South LA's Wetlands Park. *The Planning Report*. Retrieved from <http://www.planningreport.com/2012/02/26/adel-hagekhalil-significance-south-la-s-wetlands-park>

Hammer, M. (1996). *Beyond Reengineer*. Harper Business.

Hartmann, M. (2011). Corporate social responsibility in the food sector. *European Review of Agriculture Economics*, 38(3), 297–324. doi:10.1093/erae/jbr031

Hitt, M. A., Ireland, R. D., Sirmon, D. G., & Trahms, C. A. (2011). Strategic Entrepreneurship: Creating Value for Individuals, Organizations, and Society. *The Academy of Management Perspectives*, 25(2), 57–75. doi:10.5465/AMP.2011.61020802

Holloway, G. J. (1991). The farm-retail price spread in an imperfectly competitive food industry. *American Journal of Agricultural Economics*, 73(4), 979–989. doi:10.2307/1242425

Jablonski, B. B. (2014). 'Better Butter' opportunities for Local Food and Entrepreneurship. *Journal of Food Distribution Research*, 45(3).

Jones, P., Comfort, D., & Hillier, D. (2007). Marketing and corporate social responsibility within food stores. *British Food Journal*, 109(8), 582–593. doi:10.1108/00070700710772381

Kapo, I. (2013). Gold Key: The Match.com of Exporting, Global Outreach, U.S. Census Bureau (<http://globalreach.blogs.census.gov/2013/01/30/gold-key>)

Khanduja, J. (2013). *Shared Tastes* [Doctoral dissertation]. Columbia University.

Kline, C., Shah, N., & Rubright, H. (2014). Applying the Positive Theory of Social Entrepreneurship to Understand Food Entrepreneurs and Their Operations. *Tourism Planning & Development*, 1-13.

Kong, D. (2012). Does corporate social responsibility matter in the food industry? Evidence from a nature experiment in China. *Food Policy*, 37(3), 323–334. doi:10.1016/j.foodpol.2012.03.003

LAFI. (2014). LSU AgCenter Food Incubator Retrieved from http://www.lsuagcenter.com/en/our_offices/departments/food_science/extension_outreach/incubator

Cultivating Global Entrepreneurs in the Food Supply Chain

Laura Sidali, K., & Hemmerling, S. (2014). Developing an authenticity model of traditional food specialties: Does the self-concept of consumers matter? *British Food Journal*, 116(11), 1692–1709. doi:10.1108/BFJ-02-2014-0056

LBTC. (2014). Louisiana Business and Technology Center. Retrieved from <http://www.lbtc.lsu.edu>

Leal Filho, W., & Kovaleva, M. (2014). Food Waste and Sustainable Food Waste Management in the Baltic Sea Region.

Lee, A., & Wall, G. (2012). *Food clusters: Towards a creative rural economy*. Martin Prosperity Institute, Rotman School of Management, University of Toronto.

LETC. (2014). Louisiana Emerging Technology Center. Retrieved from <http://laetc.com/the-la-emerging-tech-center>

LIP. (2014). LSU Innovation Park. Retrieved from <https://sites01.lsu.edu/wp/innovationpark>

LSU. (2014). International Programs at LSU. Retrieved from <http://international.lsu.edu>

LSU. (2014, January 21). Gov. Jindal Announces Funding Hike for Higher Education & New Workforce Incentive Fund. Retrieved from <https://sites01.lsu.edu/wp/lovepurple/2014/01/21/gov-jindal-announces-funding-hike-for-higher-education-new-workforce-incentive-fund>

LSU. (2014). Mobile Classroom. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/mobile-classroom>

LSU. (2014). LSU Student Incubator. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/lsu-student-incubator>

LSU Ag Center. (2007). Alligator Collagen: New Source for Medical, Cosmetic Uses. *Louisiana Agriculture*. Retrieved from <http://www.lsuagcenter.com/en/communications/publications/agmag/Archive/2007/Winter/Alligator+Collagen+New+Source+for+Medical+Cosmetic+Uses.htm>

LSUAgCenter. (2014). Runway show features student designers. *Headline News*, May 16th. Retrieved from http://www.lsuagcenter.com/news_archive/2014/may/headline_news/Runway-show-features-student-designers.htm

LSUOREC. (2012). The Constant Pursuit of Discovery. LSU Office of Research & Economic Development. Retrieved from <https://sites01.lsu.edu/wp/lsu2015/files/2013/04/20130409ResearchMtgOREDStrategicPlan.pdf>

Macrae, R., Robinson, R. K., & Sadler, M. J. (Eds.). (1993). *Encyclopaedia of Food Science, Food Technology, and Nutrition: Catering-drying* (Vol. 2). Academic Press.

Magnusson, M. K., Arvola, A., Koivisto Hursti, U.-K., Åberg, L., & Sjöden, P.-O. (2001). Attitudes towards organic foods among Swedish consumers. *British Food Journal*, 103(3), 209–227. doi:10.1108/00070700110386755

Maloni, M. J., & Brown, M. E. (2006). Corporate social responsibility in the supply chain: An application in the food industry. *Journal of Business Ethics*, 68(1), 35–52. doi:10.1007/s10551-006-9038-0

Cultivating Global Entrepreneurs in the Food Supply Chain

- Marsden, T., Banks, J., & Bristow, G. (2000). Food Supply Chain Approaches: Exploring their Role in Rural Development. *Sociologia Ruralis*, 40(4), 424–438. doi:10.1111/1467-9523.00158
- Marsden, T., & Smith, E. (2005). Ecological entrepreneurship: Sustainable development in local communities through quality food production and local branding. *Geoforum*, 36(4), 440–451. doi:10.1016/j.geoforum.2004.07.008
- McFadden, D. T., & Marshall, M. I. (2014). Local Food Systems and Interactions with Entrepreneurship. *Journal of Food Distribution Research*, 45(3).
- McMichael, A. J., Powles, J. W., Butler, C. D., & Uauy, R. (2007). Food, livestock production, energy, climate change, and health. *Lancet*, 370(9594), 1253–1263. doi:10.1016/S0140-6736(07)61256-2 PMID:17868818
- McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26(1), 117–127.
- Mercer, A., & Tao, X. (1996). Alternative inventory and distribution policies of a food manufacturer. *The Journal of the Operational Research Society*, 47(6), 755–765. doi:10.1057/jors.1996.96
- Millar, D. (2012). Louisiana alligator industry stages a comeback, thanks to growing demand for skins. *The Times-Picayune*, June 17th. Available at http://www.nola.com/business/index.ssf/2012/06/louisianas_alligator_industry.html
- Mueller Loose, S., & Remaud, H. (2013). Impact of corporate social responsibility claims on consumer food choice: A cross-cultural comparison. *British Food Journal*, 115(1), 142–166. doi:10.1108/00070701311289920
- NBIA. (2014). National Business Incubation Association (http://www.nbia.org/member_services/soft_landings)
- Ng, D., Sonka, S., & Westgren, R. (2003). Co-evolutionary processes in supply chain networks. *Journal on Chain and Network Science*, 3(1), 45–58. doi:10.3920/JCNS2003.x029
- Nicholas, P. K., Mandolesi, S., Naspetti, S., & Zanolli, R. (2014). Innovations in low input and organic dairy supply chains—What is acceptable in Europe? *Journal of Dairy Science*, 97(2), 1157–1167. doi:10.3168/jds.2013-7314 PMID:24359835
- Niimi, M., Wakes, S. J., & McGuire, M. H. (2014). Design for Sustainability: Addressing Food Waste Behaviour Through Social Practice Approaches. *Food Design on the Edge*, 29.
- NLAFI. (2014). To Market, to Market...., News - LSU AgCenter Food Incubator, November 9 (<http://www.lsu.edu/departments/nfs/outreach/incubator.htm>)
- Oerke, E. C., Dehne, H. W., Schönbeck, F., & Weber, A. (2012). *Crop production and crop protection: estimated losses in major food and cash crops*. Elsevier.
- Okello, J. O., & Were, S. (2014). Influence of supply chain management practices on performance of the Nairobi Securities Exchange's listed, food manufacturing companies in Nairobi. *International Journal of Social Sciences and Entrepreneurship*, 1(11), 107–128.

Cultivating Global Entrepreneurs in the Food Supply Chain

- Padilla-Zakour, O. I. (2004). Promoting the Development of Value-added Specialty Foods through University-based Food Venture Centers. *Journal of Food Science*, 69(3), CRH110–CRH112.
- Paloviita, A. and Järvelä, M. (2015), *Climate Change Adaptation and Food Supply Chain Management*. Routledge Advances in Climate Change Research.
- Pang, Z., Chen, Q., Han, W., & Zheng, L. (2012). Value-centric design of the internet-of-things solution for food supply chain: Value creation, sensor portfolio and information fusion. *Information Systems Frontiers*, 17(2), 1–31.
- Papargyropoulou, E., Lozano, R. K., Steinberger, J., Wright, N., & Ujang, Z. B. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76, 106–115. doi:10.1016/j.jclepro.2014.04.020
- Park, Y. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *International Review of Research in Open and Distance Learning*, 12(2), 78–102.
- Paull, J. (2008). Green food in China. *Elementals: Journal of Bio-Dynamics Tasmania*, 91, 48-53.
- PBTI. (2014). Pennington BioTech Initiative. Retrieved from <http://www.lsu.edu/ur/ocur/lsunews/MediaCenter/News/2013/08/item62883.html>
- Piacentini, M., MacFadyen, L., & Eadie, D. (2000). Corporate social responsibility in food retailing. *International Journal of Retail & Distribution Management*, 28(11), 459–469. doi:10.1108/09590550010356822
- Pivato, S., Misani, N., & Tencati, A. (2008). The impact of corporate social responsibility on consumer trust: The case of organic food. *Business Ethics (Oxford, England)*, 17(1), 3–12. doi:10.1111/j.1467-8608.2008.00515.x
- Polat, I. H., Akser, M., & Uzunoglu, S. (2014, November 3–5). The Impacts of Tablet Use for Eliminating the Time-Space Barriers in University Education: A Turkish Experience. *Proceedings of the 13th World Conference on Mobile and Contextual Learning mLearn 2014, Istanbul, Turkey* (pp. 212-221). Springer.
- Pullman, M., & Wu, Z. (2012). *Food Supply Chain Management—Economic, Social, and Environmental Perspectives*.
- RFIC. (2014). Rutgers Food Innovation Center. Retrieved from <http://foodinnovation.rutgers.edu>
- Rutten, R., Benneworth, P., Irawati, D., & Boekema, F. (Eds.). (2014). *The Social Dynamics of Innovation Networks*. Routledge.
- Salinger, J. H. (2013). Economic Development Policies through Business Incubation and Co-working: A Study of San Francisco and New York City.
- Sánchez-Díaz, I., Holguín-Veras, J., & Wang, X. (2014). An exploratory analysis of spatial effects on freight trip attraction. *Transportation*, (pp. 1–20).
- Sandeen, M. (2013, March 11). *Louisiana facing highest sea level rise on earth*. Retrieved from <http://sustainabletransition.blogspot.com/2013/03/louisiana-facing-highest-sea-level-rise.html>

Cultivating Global Entrepreneurs in the Food Supply Chain

- Schoen, L. T. (2010). Teaching out of the box: 20 Research-based Principles to Guide the Transition to High Quality Online Graduate Programs. *EDUCAUSE Southeast Regional Conference*, June.
- SDMI. (2014). Stephenson Disaster Management Institute. Retrieved from <http://sdmi.lsu.edu>
- Secchi, D. (2010). *Extendable Rationality: Understanding Decision Making in Organizations*. Springer.
- SEI. (2014). Stephenson Entrepreneurship Institute. Retrieved from <http://www.business.lsu.edu/Stephenson-Entrepreneurship-Institute/Pages/SEI.aspx>
- Selviaridis, K., & Spring, M. (2007). Third party logistics: A literature review and research agenda. *International Journal of Logistics Management*, *18*(1), 125–150.
- Shackleton, S. (2014). Impacts of Climate Change on Food Availability: Non-Timber Forest Products. In *Global Environmental Change* (pp. 695–700). Springer Netherlands. doi:10.1007/978-94-007-5784-4_117
- Simon, H. A. (1993). 'Altruism and Economics'. *The American Economic Review*, *83*(2), 156–161.
- Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management*, *37*(5), 1390–1412. doi:10.1177/0149206310385695
- SLIID. (2014). Soft Landings International Incubator Designation. Retrieved from https://www.nbia.org/member_services/soft_landings
- Smith, B. G. (2008). Developing sustainable food supply chains. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *363*(1492), 849–861. doi:10.1098/rstb.2007.2187 PMID:17766237
- Stiner, M. C. (1991). Food procurement and transport by human and non-human predators. *Journal of Archaeological Science*, *18*(4), 455–482. doi:10.1016/0305-4403(91)90038-Q
- SUSTA. (2014, June 18). Expand into International Markets: Export Seminar for Food and Agriculture Companies, Southern United States Trade Association. Retrieved from <http://www.susta.org/services/ert.html>
- Tai, A. P., Martin, M. V., & Heald, C. L. (2014). *Threat to future global food security from climate change and ozone air pollution*. Nature Climate Change.
- Tarr, N. W. (2011). Food Entrepreneurs and Food Safety Regulation. *J. Food L. & Pol'y*, *7*, 35.
- Tregear, A. (2005). Lifestyle, growth, or community involvement? The balance of goals of UK artisan food producers. *Entrepreneurship & Regional Development*, *17*(1), 1–15. doi:10.1080/08985620420002497777
- Tripathi, R., & Agarwal, S. (2014). An empirical study of marketing for guava and its sub-products by farmers in Allahabad: An approach towards agripreneurship through food processing units. *International Journal of Business and Globalisation*, *13*(1), 69–75. doi:10.1504/IJBG.2014.063395

Cultivating Global Entrepreneurs in the Food Supply Chain

Tudisca, S., Trapani, A. M. D., Sgroi, F., Testa, R., & Giamporcaro, G. (2014). Role of alternative food networks in Sicilian farms. *International Journal of Entrepreneurship and Small Business*, 22(1), 50–63. doi:10.1504/IJESB.2014.062130

USDS. (2014, December 24). The United States and Pacific Alliance Advance Cooperation on Entrepreneurship. Media Note. Retrieved from <http://www.state.gov/r/pa/prs/ps/2014/12/235517.htm>

USGS. (2014, March 12). *Louisiana Coastal Wetlands: A Resource at Risk*. Retrieved from <http://pubs.usgs.gov/fs/la-wetlands>

Vandermeersch, T., Alvarenga, R. A. F., Ragaert, P., & Dewulf, J. (2014). Environmental sustainability assessment of food waste valorization options. *Resources, Conservation and Recycling*, 87, 57–64. doi:10.1016/j.resconrec.2014.03.008

P Vlachos, I., Skoumpopoulou, D., & Gutnik, S. (2014). Electronic Supply Chain Management Tools in International Business: Evidence from Austrian Food Clusters. *E-commerce Platform Acceptance: Suppliers, Retailers, and Consumers*, 3-21.

Vogel, D. (2006). *The market for virtue: The potential and limits of corporate social responsibility*. Brookings Institution Press.

Vyas, R., Albright, S., Walker, D., Zachariah, A., & Lee, M. Y. (2010). Clinical training at remote sites using mobile technologies: An India-USA partnership. *Distance Education*, 31(2), 211–226. doi:10.1080/01587919.2010.498856

Wallace, C., Sperber, W., & Mortimore, S. E. (2011). *Food safety for the 21st century: Managing HACCP and food safety throughout the global supply chain*. John Wiley & Sons.

Wang, M., Chen, Y., & Khan, M. J. (2014). Mobile Cloud Learning for Higher Education: A Case Study of Moodle in the Cloud. *International Review of Research in Open and Distance Learning*, 15(2), 254–267.

Willem Ziggers, G., & Trienekens, J. (1999). Quality assurance in food and agribusiness supply chains: Developing successful partnerships. *International Journal of Production Economics*, 60, 271–279. doi:10.1016/S0925-5273(98)00138-8

Woertz, E. (2013). *Oil for Food: The Global Food Crisis and the Middle East*. Oxford University Press. doi:10.1093/acprof:oso/9780199659487.001.0001

Woods, T. A. (2014). Innovation in Agri-Food Clusters: Theory and Case Studies. *American Journal of Agricultural Economics*, 2014, 96(2), 610–611. doi:10.1093/ajae/aat082

Xu, B., Wang, N., & Li, C. (2011). A cloud computing infrastructure on heterogeneous computing resources. *Journal of Computers*, 6(8), 1789–1796. doi:10.4304/jcp.6.8.1789-1796

Ye, C., Cronin, J. J. Jr, & Peloza, J. (2014). The Role of Corporate Social Responsibility in Consumer Evaluation of Nutrition Information Disclosure by Retail Restaurants. *Journal of Business Ethics*, 130(2), 1–14.

Yeung, R. M., & Morris, J. (2001). Food safety risk: Consumer perception and purchase behaviour. *British Food Journal*, 103(3), 170–187. doi:10.1108/00070700110386728

Cultivating Global Entrepreneurs in the Food Supply Chain

Zwietering, M. H., Ross, T., & Gorris, L. G. M. (2014). Food safety assurance systems: Microbiological testing, sampling plans, and microbiological criteria. In *Encyclopedia of Food Safety* (Vol. 4, pp. 244-253). Academic Press.

ADDITIONAL READING

Akhtar, P., & Khan, Z. (2014). The linkages between leadership approaches and coordination effectiveness: A path analysis of selected New Zealand-UK international agri-food supply chains. *British Food Journal*, 117(1).

Barnard, R. (2014). The food supply chain in the post-petroleum bioeconomy. *Australasian Biotechnology*, 24(3), 48.

Bijman, J. (Ed.). (2006). *International agri-food chains and networks: Management and organization*. Wageningen Academic Pub. doi:10.3920/978-90-8686-573-4

Bloom, J. D., & Hinrichs, C. C. (2011). Moving local food through conventional food system infrastructure: Value chain framework comparisons and insights. *Renewable Agriculture and Food Systems*, 26(01), 13–23. doi:10.1017/S1742170510000384

Chen, R. Y. (2014). Autonomous tracing system for backward design in food supply chain. *Food Control*.

Day-Farnsworth, L., & Miller, M. (2014, June). Networking across the Supply Chain: Transportation Innovations in Local and Regional Food Systems. In *Networking across the Supply Chain*, 2014(6).

Dujak, D., Ferencic, M., & Franjkovic, J. (2014). Retail Ready Packaging—What'S In It For Food Manufacturers? *Business Logistics in Modern Management*, 14, 31–42.

Farber, J., Crichton, J., & Snyder, O. P. Jr. (2014). An Introduction to Retail Food Safety. In *Retail Food Safety* (pp. 1–2). Springer New York.

Forsman, S., & Paananen, J. (2002). Customer value creation in the short food supply chain: theoretical aspects and explorative findings. *Paradoxes in food chains and networks*, 153-162.

Fredriksson, A., & Liljestr nd, K. (2014). Capturing food logistics: a literature review and research agenda. *International Journal of Logistics Research and Applications*, 1-19.

Hinrichs, C. C. (2003). The practice and politics of food system localization. *Journal of Rural Studies*, 19(1), 33–45. doi:10.1016/S0743-0167(02)00040-2

Izdebski, Waldemar, & Kry s P. (2014). Efficient Consumer Response (ECR) in food supply chain. *Proceedings of the International Forum on Agri-Food Logistics and Domestic Scientific Conference AGROLOGISTYKA 2014*.

Jakkhupan, W., Arch-int, S., & Li, Y. (2014). An RFID-based traceability system. *Telecommunication Systems*, 58(3), 1–16.

Cultivating Global Entrepreneurs in the Food Supply Chain

- Leal Filho, W., & Kovaleva, M. (2015). Methods of Food Waste Reduction. In *Food Waste and Sustainable Food Waste Management in the Baltic Sea Region* (pp. 51–80). Springer International Publishing.
- Lizarazo, D. X. C., Castro, P. A. F., Lopez, C., Garcia, P. J. R., Molins, R., & Herrman, T. J. (2014). Manual of Good Practices for Food or Feed Recalls. *International Journal of Regulatory Science*, 2(1), 28–35.
- López-Gómez, A., Cerdán-Cartagena, F., Suardíaz-Muro, J., Boluda-Aguilar, M., Hernández-Hernández, M. E., López-Serrano, M. A., & López-Coronado, J. (2014). Radio frequency Identification and Surface Acoustic Wave Technologies for Developing the Food Intelligent Packaging Concept. *Food Engineering Reviews*, 1-22.
- Meneghetti, A., & Monti, L. (2015). Greening the food supply chain: An optimisation model for sustainable design of refrigerated automated warehouses. *International Journal of Production Research*, 1–21. doi:10.1080/00207543.2015.1008107
- Paloviita, A. (2010). Consumers' sustainability perceptions of the supply chain of locally produced food. *Sustainability*, 2(6), 1492–1509. doi:10.3390/su2061492
- Peterson, H. C. (2009). Transformational supply chains and the 'wicked problem' of sustainability: Aligning knowledge, innovation, entrepreneurship, and leadership. *Journal on Chain and Network Science*, 9(2), 71–82. doi:10.3920/JCNS2009.x178
- Piniór, B., Conraths, F. J., Petersen, B., & Selhorst, T. (2014). Decision support for risks managers in the case of deliberate food contamination: The dairy industry as an example. *Omega*.
- Preziosi, M. (2014, February). Main drivers to traceability systems in the food supply chain. Proceedings of the XXVI National Congress of Commodity Sciences.
- Qiang, Q., Huang, Z., Ke, K., & Yang, Y. X. (2014). Overview of supply chain risk management and the current issues of closed-loop supply chain in China. *International Journal of Business Continuity and Risk Management*, 5(3), 236–243. doi:10.1504/IJBCRM.2014.066162
- Rota, C., Zanasi, C., & Reynolds, N. (2014). Assessing the Impact of Sustainability Improvement Options on the Agri-food Supply Chain Governance Structures: Development of an Evaluation Tool. *International Journal on Food System Dynamics*, 5(3), 159–171.
- Scholz, K., Eriksson, M., & Strid, I. (2015). Carbon footprint of supermarket food waste. *Resources, Conservation and Recycling*, 94, 56–65. doi:10.1016/j.resconrec.2014.11.016
- Singh, R. K. (2014). Assessing Effectiveness of Coordination in Food Supply Chain: A Framework. [IJISSCM]. *International Journal of Information Systems and Supply Chain Management*, 7(3), 104–117. doi:10.4018/ijisscm.2014070105
- Tregear, A., Arfini, F., Belletti, G., & Marescotti, A. (2007). Regional foods and rural development: The role of product qualification. *Journal of Rural Studies*, 23(1), 12–22. doi:10.1016/j.jrurstud.2006.09.010
- Trienekens, J., van Uffelen, R., Debaire, J., & Omta, O. (2008). Assessment of innovation and performance in the fruit chain: The innovation-performance matrix. *British Food Journal*, 110(1), 98–127. doi:10.1108/00070700810844812

Cultivating Global Entrepreneurs in the Food Supply Chain

Wang, H. B. (2014). Management of the food supply chain-based networking technology. *Proceedings of the Manufacturing and Engineering Technology ICMET '14* (p. 291).

Wang, J., Wang, H., He, J., Li, L., Shen, M., Tan, X., & Zheng, L. et al. (2015). Wireless sensor network for real-time perishable food supply chain management. *Computers and Electronics in Agriculture, 110*, 196–207. doi:10.1016/j.compag.2014.11.009

Wiskerke, J. S., & Roep, D. (2007). Constructing a sustainable pork supply chain: A case of techno-institutional innovation. *Journal of Environmental Policy and Planning, 9*(1), 53–74. doi:10.1080/15239080701254982

KEY TERMS AND DEFINITIONS

Food Incubator: An organization designed to help food entrepreneurs with business plan development, food product production, going to the market, and grow the start-up business.

Global Entrepreneurship: An entrepreneur who starts a new business for the local market, grows in domestic market, and expands to a foreign market.

Mobile Classroom: A mobile vehicle effectively providing critically needed business counseling and related assistance for women- and minority-owned businesses in rural communities.

Mobile Cloud Learning: An online learning platform empowering the learners with mobile devices, applications, and a cloud computing environment.

Soft Landings: A process to help a company from one country land softly – without crashing – into the market of another country through a designated incubator.

Strategic Entrepreneurship: Entrepreneurship culture developed in a large corporation as a part of its growth strategy.

Student Incubator: An incubator providing individual coaching and networking services to allow students to advance their business plans.

Chapter 18

Supply Chain Management: Developments, Theories and Models

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ABSTRACT

This chapter aims to develop a holistic framework of supply chain management (SCM) through extensive review of the pertinent literature. To this end, the chapter offers a detailed account of developments, dynamics and complexities of SCM through describing its history, theories and models. The chapter provides the reader with a navigation pane towards various theoretical and conceptual issues that encapsulate the essence of almost 30 years of research in the subject matter. Important implications for supply chain practitioners have also been explained.

INTRODUCTION

Despite the many advances in the Supply Chain Management (SCM) research and practice, there are still gaps in its knowledge base (Burgess, Singh, & Koroglu, 2006). As an interdisciplinary area of research (Chen & Paulraj, 2004), SCM entails many different functions within and between organisations. This is echoed in Burgess et al.'s (2006) remarks that suggest much of the knowledge in SCM still resides in its constituent parts such as purchasing, logistics, information technology, and marketing. The latter has given rise to functional silos that make successful implementation of SCM a complex and challenging task for managers. Moreover, one of the areas of attention in SCM relates to its definition and theoretical base. Some scholars question the theoretical coherence of SCM (Burgess et al., 2006; Chen & Paulraj, 2004; Croom, Romano, & Giannakis, 2000) and attribute it to the diversity of paradigms and theories applied in this area of research.

In light of the above, this chapter addresses gaps related to the conceptual structure of the SCM through extensive and critical review of its developments, theories and models discussed in the literature. The chapter begins by presenting the historical background of SCM, which not only portrays the

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emergence and evolution of the discipline, but also sheds light on how SCM is perceived today. Next, key organisational theories used to inform supply chain investigations and models developed to understand supply chain operations are detailed. An integrated view of these theories and models is summarised in a framework which provides a holistic view of the SCM. The chapter concludes with a discussion of its practical implications.

EVALUATING DEVELOPMENTS OF SUPPLY CHAIN MANAGEMENT

Definitions of Supply Chain Management

The term ‘supply chain management’ was initially coined by consultants in the 1980s (Oliver & Webber, 1982); however, it is believed to originate from the physical distribution and transport, as well as total cost view, of the logistics process (Croom et al., 2000; Forrester, 1961; Lewis, 1957). Since then, SCM has been inspired by many fields and disciplines. For instance, Croom et al. (2000), when reviewing the extant SCM literature, placed the subject areas related to SCM in six categories: strategic management, relationships and partnerships, logistics, best practices, marketing and organisational behaviour. While this has made SCM an all-encompassing business topic, it has also caused its pertinent literature to become somewhat fragmented.

A number of SCM definitions can be found in the literature (see Table 1). The multidisciplinary and evolutionary nature of SCM underpins the diversity in its definitions (Ellram & Cooper, 2014). This can also be attributed to the functional perspective of SCM, which often identifies it as purchasing/supply management, logistics or transportation (Tan, 2001). Ho, Au and Newton (2002) argued that scholars have approached SCM from a restrictive functional view and operationally integrated linkages (between buyers and suppliers) to an end-to-end management of, for example, information and material flows, quality and design. To complicate matters, SCM has been occasionally referred to using terms such as ‘distribution channels’, ‘network sourcing’, ‘supply pipeline management’, ‘value chain management’ and ‘value stream management’ (Croom et al., 2000; Harland, Lamming, Zheng & Johnsen, 2001). This diversity stems from different ways of denoting the SCM concept because its pertinent definitions—while different in focus and articulation—are consistent across core aspects, such as cost, value-creation, and customer satisfaction.

In their investigations of SCM, scholars have focused on internal supply chains, dyadic relationships, external supply chains or the network of interconnected organisations (Harland, 1996). The network appears to be the ideal context in which the SCM focus should be centred. For example, Christopher (2005) maintained that SCM entails “management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole” (p. 5). In a similar way, Chen and Paulraj (2004) defined supply chains as a “network of materials, information, and services processing links with the characteristics of supply, transportation, and demand” (p. 119) (see Figure 1). These definitions reflect the importance of the network view to supply chain understanding, which can hint to managers to be cautious of the dynamics of contemporary, globalised supply chains.

Mentzer et al.’s (2001) analysis of SCM definitions resulted in grouping the definitions into three meaningful classes—management philosophy, management practices and management processes—to facilitate improved comprehension of the SCM concept. At the philosophy level, supply chain entails a whole, rather than a set of fragmented parts; focuses on the cooperative efforts within and between

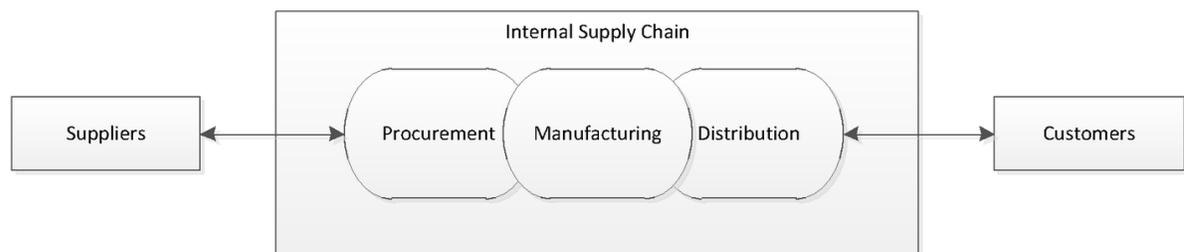
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Table 1. Key definitions of SCM

| Authors | Definitions |
|---|--|
| Mentzer et al. (2001, p. 18) | "...the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole." |
| Monczka, Trent and Handfield (1998, as cited in Mentzer et al., 2001, p. 6) | SCM requires traditionally separate material functions to report to an executive who is responsible for coordinating the entire materials process. It also requires joint relationships with suppliers across multiple tiers. SCM is a concept, "whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers". |
| Harland (1996, p. S64) | "...management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers." |
| Berry, Towill and Wadsley (1994, p. 20) | "Supply chain management aims at building trust, exchanging information on market needs, developing new products, and reducing the supplier base to a particular OEM [original equipment manufacturer] so as to release management resources for developing meaningful, long term relationship." |
| La Londe and Masters (1994, p. 38) | SCM entails "...two or more firms in a supply chain entering into a long term agreement; ... the development of trust and commitment to the relationship; ... the integration of logistics activities involving the sharing of demand and sales data; ... the potential for a shift in the locus of control of the logistics process". |
| Christopher (2005, p. 17) | "...network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer." |
| Ellram (1991, p. 13) | "A network of firms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery." |
| Stevens (1989, p. 3) | "The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of materials from suppliers in order to effect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost." |
| Jones and Riley (1985, p. 16) | "...deal[s] with the planning and control of total materials flow from suppliers through end-users." |

Figure 1. Illustration of a company's supply chain

Source: Chen and Paulraj (2004, p. 120)



organisations; and seeks individualised sources of customer value and satisfaction (Mentzer et al., 2001). The SCM definitions that relate to management practices are those that stress a set of activities (e.g., information sharing, risk/reward sharing, cooperation and managing long-term relationships) necessary for businesses to operate and fulfil the philosophical concerns noted earlier. Finally, the process-based SCM definitions focus on a set of structured and measured activities for particular customers or markets, such as customer relationships management, demand management, order fulfilment, procurement and product development (La Londe & Masters, 1994; Mentzer et al., 2001).

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Ho et al. (2002) proposed one of the most comprehensive definitions of SCM as follows:

[A] philosophy of management that involves the management and integration of a set of selected key business process from end user through original suppliers, that provides products, services, and information that add value for customers and other stakeholders through the collaborative efforts of supply chain members (p. 4422).

This definition not only summarises Mentzer et al.'s (2001) classification of SCM definitions, but also highlights the significance of value-creation, key business process integration and collaboration to SCM understandings. Overall, the SCM definitions discussed in this section have all contributed to understandings of the discipline and its domain of entailment. The subsequent sections examine how these definitions have contributed and informed almost three decades of development in SCM research.

Evolution of Supply Chain Management

In the early 1980s, Oliver and Webber (1982) have considered 'supply chain management' as a management technique to reduce the stocks held by companies participating in the same supply chains. Prior to this, other terms were used that largely referred to physical transportation and distribution processes (and not the value-adding process), influenced by the work of Forrester (1961) on industrial dynamics. It is perceived that a total cost management approach to the transportation and distribution process (Heckert & Miner, 1940) cultivated the concept of SCM in its current rendition.

Table 2 shows the historical evolution of SCM based on the works of Bechtel and Jayaram (1997), Croom et al. (2000) and Halldórsson et al. (2008). In the evolution of the SCM concept, there was a shift from internal, to dyadic, to chain, and eventually to network (micro to macro) perspectives of supply chain operations (Zacharia, Sanders, & Fugate, 2014). This transition also underpinned change in the

Table 2. Schools of thought in SCM

| Evolution stage | Key authors | Main ideas |
|--|--|--|
| Supply chain awareness | Houlihan (1987), Jones and Riley (1985), Novack and Simco (1991), Oliver and Webber (1982) | Recognises the chain of functions through which materials flow from suppliers to end users. Maintains that this chain of functions should be managed. |
| Linkage/logistics | Scott and Westbrook (1991), Turner (1993) | Deals with the actual linkages among the functional areas, such as suppliers, production and distribution. The focus is on how the sequence of functional linkages can be exploited for competitive advantage. |
| Information | Towill, Naim and Wikner (1992) | Emphasises the bilateral information exchange between supply chain members. |
| Process integration | Cooper and Ellram (1993), Ellram and Cooper (1990) | Focuses on the integration of the key business processes, regardless of the configuration of functional areas, in order to satisfy ultimate customers. |
| Seamless supply chain (relational and process integration) | Childerhouse (2002), Stevens (1989) | Stresses holistic inter- and intra-organisational integration in terms of both processes and relationships. |

Source: Adapted from Bechtel and Jayaram (1997); Croom et al. (2000); and Halldórsson, Larson and Poist (2008)

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level of analysis adopted by supply chain researchers (Croom et al., 2000). An internal view of supply chains has its roots in the pre-existing foundation of materials management and value chains (Ammer, 1968; Porter, 1985). The move towards external supply chains (dyadic, chain and network) reflects an increase in complexity and therefore the need for an end-to-end view of supply chain operations to better understand their dynamics.

Today, effective management of supply chains requires significant changes in the way businesses have been traditionally viewed and managed. Contemporary supply chains are currently more exposed to global issues, such as economic volatility and political uncertainty, than ever before, and require certain factors to enable them to achieve the promises of an effective SCM, such as cost reduction and customer satisfaction. Some of these enabling factors are explained in the following section.

Enablers of Supply Chain Management

SCM is a source of performance improvement and competitive advantage for the members of the chain (Ho et al., 2002). Research has shown that supply chain orientation has the potential to shift mindsets from internal-focused operations to more diverse and collaborative schemes that result in a higher profit margin (Mentzer et al., 2001). As a result, companies can extend their profit maximisation and cost minimisation efforts to the entire supply chain (Croom et al., 2000) and contribute to the sustainability of supply chain excellence.

Achieving the performance advantage of SCM outlined above demands organisational commitment and contribution. For example, top management's support is a widely recognised factor that enables effective SCM by engaging functional managers in supply chain decision making and supporting relevant initiatives (Chen & Paulraj, 2004; Halldórsson et al., 2008). Other enabling factors discussed in the literature include an integrated information system (Fawcett & Magnan, 2002), a flat organisational structure (Cooper, Lambert & Pagh, 1997) and a cross-functional driven reward system (Lee & Whang, 2000). These factors make streamlined operation of the supply chain more attainable.

Organisations that do not actively incorporate the above SCM enablers might face challenges when executing their SCM activities. For instance, lack of top management support or unwillingness to share risks and rewards (such as giving penalties for unacceptable performance) can potentially hinder the success of SCM programmes. This can also be caused by issues such as lack of trust among supply chain partners (Fawcett, Magnan, & McCarter, 2008a), resistance to change (Fawcett et al., 2008a), ineffective collaboration (Singh & Power, 2009), and a defensive organisational culture and attitude (Gimenez, 2004).

EVALUATING THEORIES OF SUPPLY CHAIN MANAGEMENT

Evidence from the literature shows that researchers (Halldórsson, Kotzab, Mikkola, & Skjøtt-Larsen, 2007; Ketchen & Hult, 2007a, 2007b; Shook, Adams, Ketchen, Jr & Craighead, 2009; Stock, 1997) have called for greater application of organisational theories to explain, describe and predict complex organisational behaviours in the supply chain (Flynn, Sakakibara, Schroeder, Bates, & Flynn, 1990). This is a fair point because theories such as those outlined in Table 3 have been influential in shedding light on some of the complexities germane to decision making in supply chain environments (such as outsourcing, partner selection, resource management and relationship management). Consequently, the

Supply Chain Management*Table 3. Organisational theories used for supply chain analysis*

| Characteristics | Transaction cost economics | Agency theory | Resource-based view | Resource-dependence theory | Network theory | Relational exchange theory |
|-----------------------------------|---|---|---|--|---|---|
| Key assumptions | Bounded rationality, opportunism | Bounded rationality, asymmetric information, goal conflicts | Bounded rationality, trust | Existence of coalitions, uncertainty (variability and complexity in acquiring resources) | Bounded rationality, trust | Embeddedness, trust |
| Problem orientation | Efficient governance structure: why do firms exist? | Contract design: what is the most efficient contract? | Internal competence development: why do firms differ? | Reduce uncertainty and manage dependency: why do firms form strategic alliances? | Network relationships: why do firms need to establish networks? | Why can moral control diminish opportunism? |
| Time dimension | Static | Static | Static/dynamic | Static | Static/dynamic | Static/dynamic |
| Primary focus of analysis | Transaction attributes (e.g. asset specificity) | Contracts and incentives | Resource attributes | Inter-firm dependence | Dynamic network connections | Norm as an internal form of governance |
| Function of relationships | Market failures | Efficient division of labour (ownership and control) | Access to complementary resources | Set of power relations based on exchange of resources | Access and control actors, activities and resources | Distrust relationships are fragile |
| Primary domain of interest | Exchange and transaction | Alignment of incentives in dyads | Production and firm resources/capabilities | Maximise organisational power | Relationship with heterogeneous and homogeneous actors | Social exchange between firms |

Source: Adapted from Arlbjørn and Halldórsson (2002), Halldórsson et al. (2007) and McCarthy and Golicic (2005)

majority of works published in the supply chain field employ single or multiple theories to communicate their contentions and findings (see, for example, Hartmann & Moeller, 2014; Vanpoucke, Vereecke & Boyer, 2014; Vanpoucke, Vereecke, & Wetzels, 2014).

Notably, due to the shift in researchers' interest towards understanding different dynamics of the supply chain, the application of multiple theories is gaining more attention (e.g., Halldórsson & Skjøtt-Larsen, 2006; Handfield & Bechtel, 2002; Knemeyer, Zinn, & Eroglu, 2009; Peck, 2005; Zsidisin, Melnyk, & Ragatz, 2005). Miles and Snow (2007) viewed strategic choice, resource management, and network consideration as the key pillars of knowledge expansion over three decades of research in SCM. This resembles the ontological transformation in the supply chain concept initiated from the efficient movement of products and services, to the exploitation of partners' skills and expertise in the value-creation process, and finally to knowledge creation and dissemination through network coupling.

A similar contention can be found in Ketchen and Hult's (2007a, p. 573) separation of "traditional" and "best value" supply chains. The traditional supply chain focuses on limited outcome factors (such as speed and cost), while the best value supply chain "...excel[s] along an array of uniquely integrated priorities", such as cost, quality, speed and flexibility (Ketchen & Hult, 2007a, p. 573). Hence, dramatic

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changes in the organisational values (both internal and external) influenced by competitive forces can be considered the driving factor behind the so-called paradigm shift in the business management that has urged the application of multiple theories for better understanding. A brief explanation of the selected organisational theories presented in Table 3 (ordered chronologically) provides further insights to their descriptive and predictive power for understanding the SCM.

Transaction Cost Economics

Transaction cost economics (TCE) argues that, during any economic exchange, the cost of the product or service should include all hidden costs (Williamson, 1981, 2002). For example, when establishing a relationship between a buyer and supplier, hidden costs might include the time spent developing the relationship, the creation of contracts by a lawyer, or travel between various locations. The explicit focus for TCE is the reduction of transaction exposure by accounting for all organisational costs (that is, transaction and production costs) (Williamson, 2002). In its analytical structure, TCE often uses constructs such as asset specificity and uncertainty (Grover & Malhotra, 2003) and exclusively translates the many trade-offs in a make or buy decision into cost, which mainly implies tangibility.

Consequently, TCE makes assumptions about how relationships are structured, and the development of ensuing forms of leverage. In this way, TCE overlooks two key considerations. The first involves contractual obligations and the way transaction costs are often dissipated throughout the supply chain. The second centres on the locus of control in supply chains and, in particular, how often minor players are able to exert considerable leverage through structural manipulation. For example, it has been widely noted that in some of the “...best value supply chains...”, issues such as time, quality, risk and flexibility can be easily manipulated by second-tier agents (Ketchen & Hult, 2007a, p. 573). Despite its limitations, the use of TCE to examine SCM issues has been found to be promising and valuable (Grover & Malhotra, 2003).

Agency Theory

In agency relationships, one party (the principal) delegates work to another party (the agent) (Eisenhardt, 1989a; Jensen & Meckling, 1976; Ross, 1973) to compensate for the lack of expertise or to focus on core competencies. When the agent is acting for the principal, it resembles behaviours such as performing for the benefit of the principal or acting as the principal’s representative or employee (Mitnick, 1973). As Eisenhardt (1989a) stated, while the profit maximisation approach and self-interest persists, “...the focus of agency theory [centres] on determining the most efficient contract governing the principal–agent relationship” (p. 58). The notion of the contract is used here as a metaphor to describe the agency relationship (Jensen & Meckling, 1976) and is designed based on the outcome (such as commissions) or behaviour (such as salaries) of the agent (Eisenhardt, 1989a).

Two streams of agency theory (AT) can be found in the extant literature: principal–agent research and positivist agency theory (Eisenhardt, 1989a). In agency relationships, the principal will typically seek to minimise agency costs, such as specifying, rewarding, monitoring and policing the agent’s behaviour, while the agent works towards maximising rewards and reducing principal control (Fleisher, 1991). Efficient management of agency problems, such as information acquisition (or communication), preference mismatch (or conflict of interest), effort (or moral hazard) and capability (or adverse selec-

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tion)—mainly associated with the agent (Fleisher, 1991)—is also imperative in any principal–agent relationship. AT provides a useful framework to analyse relationships and behaviours in supply chains because these chains are replete with the principal–agent dyads.

Resource-Based View

The resource-based view (RBV) explains how the unique deployment and combination (referred to as ‘capabilities’) of tangible and intangible resources might assist companies to achieve a sustainable competitive advantage (Grant, Review, & Berkeley, 1991; Penrose, 1959; Prahalad & Hamel, 1990; Priem & Swink, 2012). While the early work of Penrose (1959) viewed firms as a bundle of idiosyncratic resources, developments on the RBV have directed attention towards the nature of resources and their positioning (Rumelt, 1984; Wernerfelt, 1984) that might create barriers and economic rents for competitors (Lavie, 2006). In this regard, Barney (1991) identified value, rarity, imperfect imitability and imperfect substitutability as essential characteristics of resources to generate barriers and advance competitive advantage.

As highlighted by Lavie (2006), traditional RBV assumed that ownership and control of resources are the sole domain of the organisation. This contrasts with the premises of outsourcing, purchasing or supply management, in which taking advantage of partners’ capabilities to compensate for internal competency impairment or to focus on core competencies is crucial. Hence, the ‘proprietary resource’ assumption of traditional RBV might hinder its application to collaborative arrangements in which shared and non-shared resources are managed to build competitive advantage (Lavie, 2006). However, in its reformulated rendition (e.g., Lavie, 2006), RBV considers a network resource notion to use its explanatory power in supply chain environments.

Applications of RBV in SCM are mainly focused on structural analysis (de Oliveira Wilk & Fensterseifer, 2003; Miller & Ross, 2003) and identification of the antecedents for competitive advantage in the supply chain (Barratt & Oke, 2007; Lewis, 2000; Pandza, Horsburgh, Gorton & Polajnar, 2003; Pandza, Polajnar, Buchmeister & Thorpe, 2003; Pearson, Masson & Swain, 2010). Halldórsson et al. (2007) maintained that the majority of SCM decisions are underpinned by RBV, at least implicitly. In order to respond to uncertainties and changes, companies form inter-organisational arrangements to enjoy resource-position barriers built through collaborative efforts. This is particularly true in situations where scarce resources or intense competition make organisations realise that relying only on internal resources is insufficient to secure competitive advantage (Jap, 2001).

Resource-Dependence Theory

Resource-dependence theory (RDT) focuses on a set of power relationships based on exchange of resources (Pfeffer & Alison, 1987). It recognises that companies do not possess all the resources they might require in the process of value-creation, hence will often become dependent on each other (Emerson, 1962; Hunt & Morgan, 1996). The key issue then becomes how organisations manage their power-dependence relationships to maintain their functional and operational requirements (Pfeffer & Salancik, 1978). In this regard, RDT assumes that organisations often form coalitions to increase their power and make other organisations dependent on themselves (Heide, 1994). Resource manipulation and control exertion are the strategies offered by RDT to manage uncertainty and dependence in business transactions.

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In their argument on the issue of resource dependence in supply chains, Ketchen and Hult (2007a) highlighted the dissimilar nature of dependence in the traditional and best value supply chains. While traditional supply chains have a tendency to behave opportunistically in relation to their power-dependence advantage along the chain, best value supply chains exploit dependency as a means of fostering trust and commitment to fulfil supply chain requirements (Crook & Combs, 2007; Ireland & Webb, 2007). This indicates a dramatic change in the resource-dependence prediction caused by the realities of contemporary business, such as the need for collaboration.

Network Theory

Network theory (NT) provides a broader view of the inter-organisational interactions in a network environment. It highlights the dynamics of network environments and recognises the influence of partner-partner relationships on an organisation's operations (Halldórsson et al., 2007). By emphasising the notion of strong and weak ties, NT states that a network resource view assists managers to develop a more realistic assessment of individual node resources and their implications for business. Resource accession and coordination are considered key triggers for inter-organisational connectedness, and are advocated to be embraced in today's turbulent business environment (Fawcett, Allred, Magnan, & Ogden, 2009; Fayezi, Zutshi, & O'Loughlin, 2010; Knoppen & Christiaanse, 2007).

It is important to note that NT pays significant attention to the fit between organisations that are planning to form cooperative relations (Halldórsson et al., 2007). This necessitates the alignment between the actors, activities and resources that constitute key network components (Håkansson, 1987; Harland, 1996). Moreover, the theory is useful for investigating trust and longevity in bilateral relationships (Gadde & Håkansson, 2001). By taking a network approach, organisations can design their supply chains so they can benefit from things such as the advantages of strong ties to build reliability, and weak ties to create flexibility to manage their responsiveness. A further implication of the NT is its usefulness for supply chain innovation by demonstrating network-wide knowledge-sharing mechanisms and management (Miles & Snow, 2007).

Relational Exchange Theory

Relational exchange theory (RET) centres on the idea of embeddedness which suggests that cooperative parties act based on certain norms, as opposed to contractual obligations (Granovetter, 1985; Joshi & Stump, 1999). It emphasises soft control mechanisms to attenuate opportunism (Larson, 1992). That is, RET predicts that trust-based relationships are less prone to partners' opportunism (Granovetter, 1985). In addition, trusting relationships assist in dedicating resources to developing and maintaining relationships, rather than managing transactional tensions or abnormal behaviours in the supply chain (Joshi & Stump, 1999).

By extending the RBV of the firm, Dyer and Singh (1998) emphasised the importance of relational rents resulting from relation-specific assets, knowledge-sharing routines, complementary resources and capabilities and effective governance in cooperative arrangements. These are essential for building a sustainable competitive advantage for supply chain organisations. Overall, RET is significant to SCM because it provides a framework to manage relationship flows, which is important to facilitate resource exchange within and between supply chain organisations.

EVALUATING MODELS OF SUPPLY CHAIN MANAGEMENT

Despite the potential contributions of organisational theories for explaining, describing and predicting SCM dynamics, there is still little consensus on any grand SCM theoretical base (Burgess et al., 2006; Chen & Paulraj, 2004). This has been attributed to the fragmented nature of supply chain literature and the diverse operational issues it entails (Bagchi, Ha, Skjøtt-Larsen & Soerensen, 2005; Charles, Luras, & Wassenhove, 2010; Fawcett & Magnan, 2002). Moreover, research reveals that supply chain practices seldom result in the conceptual ideals of SCM discussed in the literature and often communicated via its definitions.

For instance, by studying SCM practices in New Zealand, Basnet, Corner, Wisner, and Tan (2003) found that despite a reasonable awareness of the basic SCM concepts, managers struggled to embrace any new SCM theory. This was echoed by Böhme (2009), who maintained that companies' practices rarely resemble the theoretical models of integration in the supply chain literature. From these contentions, it can be concluded that SCM, as a practitioner-oriented field, is still in a developing stage (Burgess et al., 2006). In light of the above debate, researchers have proposed a number of models to improve understanding of the realities of SCM by using insights from both theory and practice.

From an extensive review of the literature, four classes of these models in terms of operational, network, strategic and behavioural models were identified. When viewed in an integrative way, these models offer an overarching framework to understand SCM comprehensively and attenuate problems associated with the lack of theoretical base in a supply chain. The following section presents further details and key contributions with respect to the identified SCM models.

Strategic Models of Supply Chain Management

Bechtel and Jayaram (1997) stated that the core philosophies or paradigms adopted by organisations (such as total quality management, systems thinking, cost analysis modelling and agility) can influence strategy formulation and implementation in their supply chains. Strategic models of SCM contribute to this line of thought by describing and often prescribing the strategy implications of diversity across product characteristics, demand uncertainties or business strategies for effective SCM. For example, in the context of responsiveness, Brown and Bessant (2003) described the role that manufacturing strategy plays in the development of agile capabilities, while Fisher (1997) proposed a supply chain responsiveness taxonomy based on demand predictability.

Fisher's (1997) proposal is simple and practical: the demand characteristics of various products guide supply chains' strategic response. For example, functional (predictable) products are likely to generate a strategic response based on efficiency. Conversely, novel and innovative (unpredictable) products require an organisation to develop strategies that are responsive in order to accommodate variations in supply and demand. Importantly, Fisher (1997) argued that cost advantages are largely found where functional demand patterns exist, rather than in novel supply chains. Consequently, organisations seeking to maximise supply chain efficiencies, manage costs and exploit their commercial advantage are likely to concentrate on functional strategic alignment with their existing supply chain partners. However, novel and innovative products with an unpredictable demand and short lifecycle require a responsive supply chain strategy to cater for changing customer needs and requirements (Fisher, 1997).

An effort to augment Fisher's (1997) original strategic SCM model was made by Lee (2002). Lee considered further alignment of strategies with attention to supply uncertainty, in addition to demand

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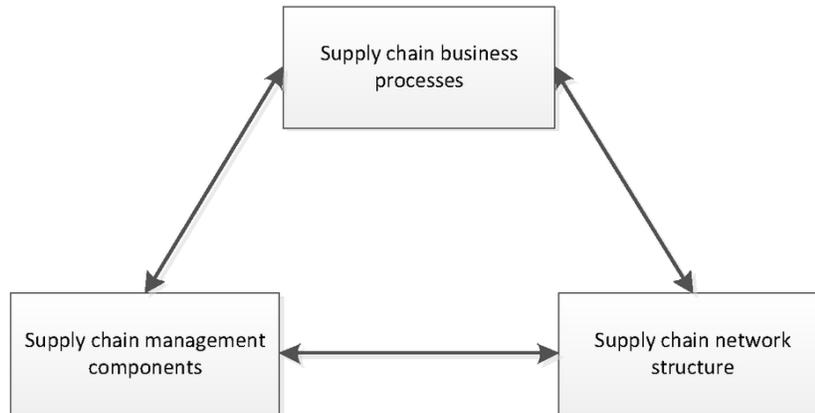
uncertainty, to propose four contingent, strategic models for SCM: efficient, risk-hedging, flexible (responsive) and agile supply chains. The risk-hedging and agile strategies were new additions to the strategic models of Fisher (1997). Resource (e.g., inventory) pooling and sharing through provision of alternative supply sources underpins the risk-hedging strategy to mitigate vulnerability against exposure to high supply uncertainty. In contrast, agile supply chains can handle both supply and demand uncertainties, as they build flexibility and responsiveness into their systems and processes. According to Lee (2002), the agile strategy has an encompassing nature in the sense that it embraces the advantages of both risk-hedging and flexible (responsive) supply chain strategies. As discussed above, strategic models of SCM play a fundamental role in enabling contingent-based strategy design that promises improved SCM through targeted focus on supply, demand, products, and the manufacturing process.

Operational Models of Supply Chain Management

Operational models aim to mitigate increasing concern regarding the conceptual basis of SCM and its core elements, scope and scale. While the SCM discipline suffers from a lack of one theory to precisely explain and predict its behaviours, operational models play an important role in setting the boundaries of SCM, and informing SCM understandings and investigations. However, the complexity and dynamism of supply chains make any generalisation hard to accept. This was highlighted when Ho et al. (2002) identified issues such as functional silos, inadequate operationalisation and lack of attention to context drives dominating the SCM literature. Upon realising these concerns, researchers started to incorporate contingency elements into their investigations (e.g., Stonebraker & Afifi, 2004), which made their findings accessible to diverse settings resulting from differences in the industries, organisational cultures and products constituting the supply chain.

Seminal works by Cooper and Ellram (1993), Cooper et al. (1997), Betchel and Jayaram (1997); Lambert and Cooper (2000), Croxton, García-Dastugue, Lambert, and Rogers (2001), Mentzer et al. (2001), and Chen and Paulraj (2004) established the core and common elements involved in SCM, regardless of contextual differences, such as those across industries, products and services, and structures. Both definitional and conceptual understandings in the literature have been undertaken to portray the elemental factors and operating domains of SCM. For example, by expanding on a number of SCM definitions, Mentzer et al. (2001) suggested an interrelated hierarchical conception of SCM that entails philosophical aspects, management practices and processes. This holistic operational model distinguishes between what is termed 'supply chain orientation' (management philosophy) and its operating counterpart (that is SCM). The former necessitates systematic and strategic purview to SCM, which requires deviation from functional silos (a myopic view) to a more holistic approach (e.g., Mentzer et al., 2001, p. 12, 19).

Lambert and Cooper's (2000) model considers SCM as comprising three interrelated elements: supply chain network structure, supply chain business processes and management components (see Figure 2). The network structure element entails issues such as assessment of the level of coordination and integration required across a portfolio of links (relationships) and nodes (partners) in the supply chain. In addition, the network structure directs attention to a range of other details, such as types of members, structural dimensions and types of process links in the supply chain, and their subsequent implications for management. The latter function of network structure is important because it enables better decision making regarding the organisation's relationship type and intensity with different partners, which results in controlling costs and serving supply chain operations more prudently.

Supply Chain Management*Figure 2. SCM framework**Source: Adapted from Lambert and Cooper (2000)*

To this end, the assessment of network structure can be based on factors such as product complexity, supplier availability and raw material accessibility (Kraljic, 1983). As a result, companies might decide to extend their application of the loose coupling strategy (Gosain, Malhotra, & Sawy, 2004) in identified value streams, or build long-term, collaborative relationships with their suppliers of strategic components.

The idea of integration across a set of key business processes in order to maintain the continuous flow of information and materials across supply chain organisations is central to the concept of SCM (Cooper et al., 1997; Lambert & Cooper, 2000). Accordingly, the business process element in Lambert and Cooper's (2000) SCM framework explains the importance of making the right decision about the processes in supply chain operations that should be integrated with other partners. This requires a good understanding of key supply chain processes and the parameters and concerns associated with each of them.

Furthermore, findings from research on how business processes interact with each other and contribute to the total supply chain performance improvement can be instrumental in informing decisions of process integration (e.g., Squire et al., 2009; Swafford, Ghosh, & Murthy, 2006). For example, procurement and demand management are among the key processes that—apart from their internal integration (due to their interrelatedness)—require external integration with suppliers and customers to streamline supply chain operations.

The management components in Lambert and Cooper's (2000) SCM framework entail some technical and behavioural aspects that can drive the ways that business processes are managed, and thus networks are structured, within supply chains. As shown in Table 4, both the physical and technical, and managerial and behavioural classes of management components are cornerstones to planning and controlling

Table 4. Management components of SCM framework

| Physical and technical | Managerial and behavioural |
|--|---|
| Planning and control methods Work flow/activity structure Organisation structure Communication and information flow facility structure Product flow facility structure | Management methods Power and leadership structure Risk and reward structure Culture and attitude |

Source: Adapted from Lambert and Cooper (2000)

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the supply chain operations. The technical factors, which are tangible management components, can be considered the necessary hardware for business operations. The behavioural management components are intangible, soft tools that enable efficient and effective use of the physical infrastructure of the organisation. Consequently, it is necessary to give careful attention to the management components of a supply chain to understand its smooth operations.

The supply chain operations reference (SCOR) model, initially developed during the mid-1990s, is also among the important SCM models that has established a systematic view of supply chain processes and operations. SCOR can also be considered a supply chain performance assessment technique that is organised around five major components: planning, sourcing, manufacturing, delivering and returning (Supply-Chain Council, 2008). Within each of these five components, common process elements are defined and detailed.

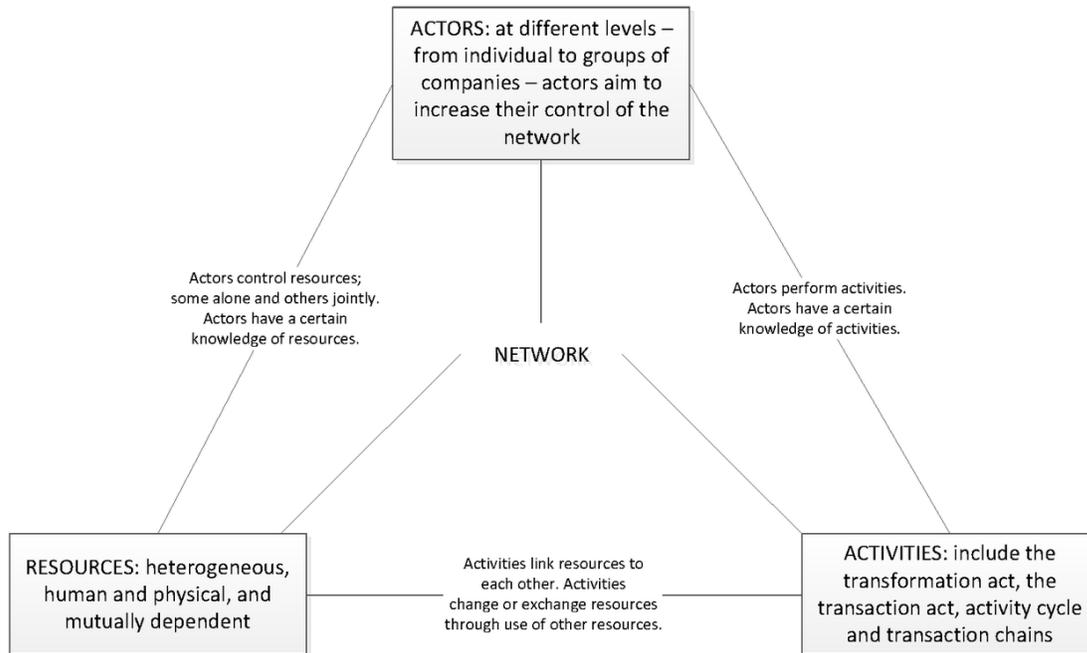
In effect, the SCOR model links business process, metrics, best practices and technology features into a unified structure that facilitates communication among supply chain participants (Supply-Chain Council, 2008). Despite its strengths and benefits, a key problem with the application of the SCOR model is its inability to cater for differences in real-world supply chains, which ultimately plagues its benchmarking utility (Huang & Mak, 2000). As per the discussion presented in this section, operational models of supply chain decipher the context of the base on which strategic models should be designed and operated.

Network Models of Supply Chain Management

The significance of network dynamics in SCM has been partly discussed by the operating models when emphasising supply chain structures and their implications for managing business operations. However, there is a considerable body of literature that specifically explores, describes and explains network models of SCM (Mena, Humphries, & Choi, 2013). For example, recognition of the network perspective to SCM can be seen in Harland's (1996) work, in which internal, dyadic, chain and network uses of SCM concept were identified and explained. Specifically, the literature shows that issues related to network models of SCM have been addressed, with particular attention given to aspects such as competitive positioning in a network, the components of a network and the different structures of a network (Harland, 1996). These have highlighted some of the key network dynamics that are vital for managers to be aware of when making supply chain decisions.

Figure 3 presents the network model proposed by Håkansson (1987), which sheds light on the important components of networks—namely, the actors, activities and resources. Network actors can be considered a compilation of the people, objects and events (Mitchell, 1969) that are responsible for controlling and managing activities and resources, which in turn define the actor's identity (Harland, 1996). Actors are linked through their activity and resource portfolios (Harland, 1996). Examples of intra- and inter-actor activities in a network are production and exchange, respectively (Harland, 1996).

In light of the above, Håkansson's (1987) network model demonstrates how resource access and mobility can be achieved through inter-actor relationships. In addition to providing a useful tool for explaining and understanding network behaviours, the generic network model indicates the potential complexities associated with research at this level. For example, as Harland (1996) suggested, interpretation of research findings in the network literature should be undertaken with care, as one must know whether the focus of a particular study has been on a network of actors or a network of activities.

Supply Chain Management*Figure 3. Network model**Source: Håkansson (1987, as cited in Harland, 1996, p. S68)*

In a series of studies, Choi and his colleagues (e.g. Choi & Kim, 2008; Choi & Krause, 2006; Choi & Wu, 2009; Kim, Choi, Yan & Dooley, 2011; Villena, Revilla & Choi, 2011) investigated structural dynamics with a specific focus on upstream actors in the supply chain. The central tenet of these studies was to shed light on the interaction effects, beyond the immediate visibility of the focal firm and its subsequent implications for effective SCM. In this context, Choi and Kim (2008) introduced the notion of “structural embeddedness” (p. 5), which refers to the supplier’s level of dependence on its own supply network and its implications for supplier performance evaluation. Understanding structural embeddedness has the potential to broaden the buyer’s perspective with respect to their sub-supplier’s state of technology and operations advantage/disadvantage for strategic relationship planning and management. For example, a buyer might decide to retain their relationship with one of their non-performing suppliers because it acts as a gateway to reach and connect some innovative organisations important to the buyer’s strategic intent and direction.

Finally, emphasising triad as the smallest unit of analysis in networks, Choi and Wu (2009) discussed nine archetypes in buyer–supplier–supplier relationships to model some of the dynamics in supply network interactions. The implications of this study are important for understanding the complexity of relationships and behaviours in real-world supply chains, beyond the prevailing dyadic debate in the literature. Overall, this and other similar studies have informed the network models of SCM and assisted organisations to incorporate the pertinent issues into their strategy and operations decision parameters. Managing the network relationship and its pertinent issues is another crucial aspect of SCM with which behavioural models have dealt, as is explained in the following section.

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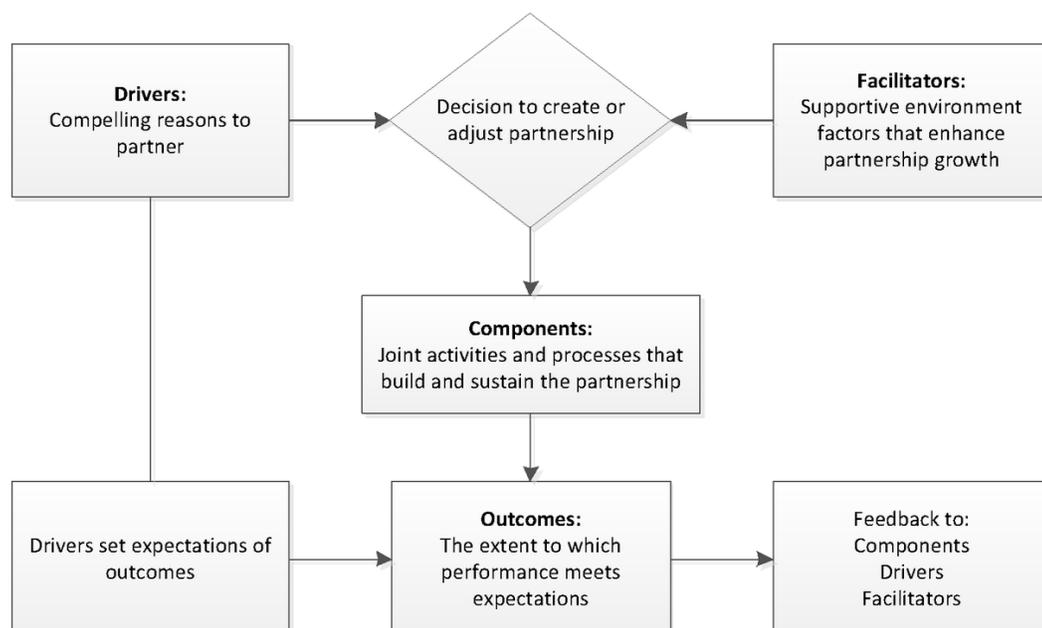
Behavioural Models of Supply Chain Management

Models of SCM attending to the behavioural dynamics of inter-organisational interactions dominate the literature (Barratt, 2004; Cassivi, 2006; Danese, 2011; Emberson & Storey, 2006; Fawcett, Magnan, & McCarter, 2008b; Hoyt & Huq, 2000; Humphries & Wilding, 2004; Kampstra, Ashayeri, & Gattorna, 2006; Matopoulos, Vlachopoulou, Manthou, & Manos, 2007; Min et al., 2005; Sari, 2008; Simatupang & Sridharan, 2005b; Stank, Keller, & Daugherty, 2001; Wilding & Humphries, 2006). Opportunistic and collaborative behaviours are often suggested as two competing ends of a spectrum in supply chain relationships (Das & Teng, 1998; Hoyt & Huq, 2000; Wilson, 2006).

In this regard, various behavioural models to control and manage practices, processes, and activities across the supply chain have been proposed. For example, Lambert, Emmelhainz and Gardner (1996) developed one of the early partnership models for SCM (see Figure 4). The model provides a clear understanding of the rationale underpinning partnership development, and can be used as a guiding tool to develop and maintain collaborative relationships. For example, under the collaboration components part of the model, Lambert et al. (1996) discussed how communication, risk and reward sharing, trust and commitment and contract style help build and sustain partnership relationships. The implications are important for the effective management of relationships with key input suppliers or important customers upon which the manufacturer is dependent (such as retailers for a commodity manufacturer).

When explaining the behavioural dynamics of SCM, Barratt (2004) proposed a collaboration model that demonstrates the important roles of culture and strategy in managing supply chain collaboration. In Barratt's (2004) model, the foundation for collaboration is attributed to the cultivation of collaborative culture among cooperating parties, which can entail factors such as trust, mutuality, information exchange

Figure 4. The partnering process
Source: Lambert et al. (1996, p. 4)



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and communication. Collaborative culture was suggested to foster collaboration capability among supply chain organisations (Barratt, 2004). The other supporting factor relates to the sustainability of collaboration arrangement, and principally deals with more strategic elements, such as corporate-wide focus, inter-organisational support, appropriate technology and business case development for collaborative initiatives. Based on Barratt's (2004) study, while maintaining cultural and strategic levers, collaboration success is contingent on careful attention being given to cross-functional activities, process alignment, joint decision making, and development of supply chain-wide performance metrics.

By taking a temporal and transitional perspective, Spekman et al. (1998) also suggested a classification of behavioural elements across buyer-supplier relationships in the supply chain (see Figure 5). This model highlights the self-maximisation behaviour of the exchange parties in open market negotiation transactions. It also suggests that where collaboration permeates relationships, resource sharing and mutual planning are the primary concerns for the collaborating parties. Similar ideas have shaped the genesis of the so-called 'collaboration index' proposed by Simatupang and Sridharan (2005a), which is used to measure the extent of collaboration between supply chain members.

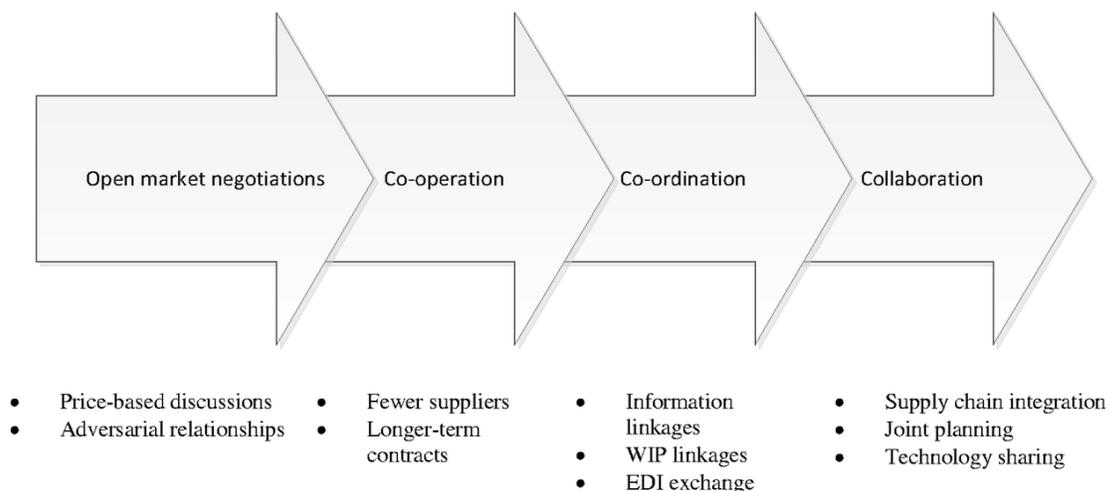
Specifically, Simatupang and Sridharan (2005a) considered three components of information sharing, decision synchronisation and incentive alignment to measure the collaboration extent. Simatupang and Sridharan's (2005a) model for collaborative behaviour assessment can also be used to appraise relationships and strategies across the supply chain, which is critical for relationship performance reviews.

LINKING SUPPLY CHAIN THEORIES AND MODELS

The theories and models of the SCM explained in the preceding sections provide a context to understand the strategic, operational, network and behavioural dynamics and complexities of supply chains and their corresponding management actions. This section of the chapter combines these theories and models of SCM into a holistic framework that demonstrates the important pillars of the SCM discipline

Figure 5. Supply chain relationships maturity model

Source: Spekman, Kamauff and Myhr (1998, p. 634)



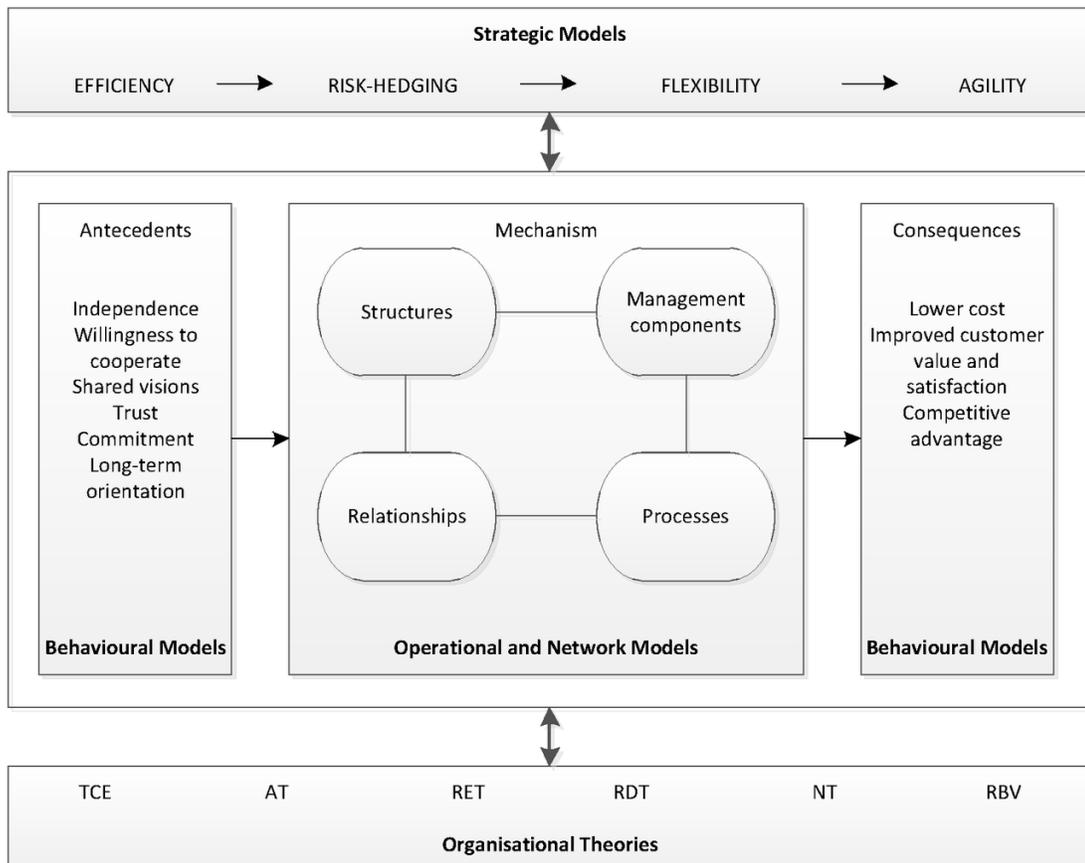
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(see Figure 6). The justification for integrating these theories and models is that theories can explain interconnections between concepts, and models can assist understanding of the operating nature of supply chains. Therefore, a holistic view of SCM is presented in Figure 6, which also illustrates the theoretical structure of the discipline.

As aforementioned, organisational theories have been used to explain and predict how social and economic factors can explain institutions' behaviour in supply chain environments. In this context, the implications for structuring and managing supply chains have been identified and communicated by scholars. For example, TCE assisted supply chain firms to better understand transactions, in terms of explicit and implicit costs, within and between organisational boundaries. This led to better decisions regarding process and relationship management issues, such as outsourcing and new product development. In addition, the application of multiple organisational theories to explain and predict supply chain dynamics was shown to be promising by some scholars (e.g. Halldórsson & Skjøtt-Larsen, 2006; Knemeyer et al., 2009; Logan, 2000; Shook et al., 2009; Zsidisin et al., 2005).

The reason for applying multiple theories has been found to be a matter of supplementation, in which one theory's weaknesses (such as underpinning assumptions) are offset by another theory's strengths, without compromising the explanatory power derived from their synergy. For example, Halldorson et al. (2007) argued that RBV complements TCE and allows firms' boundary decisions to be made more

Figure 6. A holistic view of SCM theories and models



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accurately. This is because TCE explains possible structures based on transaction characteristics, while RBV factors the resource and capability conditions of the firm and its potential partner into the transaction insourcing/outsourcing decision.

Such understanding has informed operational and network models of SCM, in which the emphasis is on the constituent elements of supply chain systems in terms of actors, activities, resources and relations. Consequently, SCM decisions can be improved by theories that provide explanation and prediction (for the decision options) and models that unfold the layers of complexity that should be considered (in relation to the decision process).

In light of the above, the key organisational theories of TCE, AT, RET, RDT, NT and RBV are shown at the bottom of Figure 6. The strategic models are located at the top of the framework, while the behavioural, operational and network models are in the middle section. This framework depicts how organisational theories and strategic models might affect SCM in terms of its antecedents (explained by behavioural models), mechanisms (explained by operational and network models) and consequences (explained by behavioural models).

For example, the placement of organisational theories at the bottom indicates their fundamental role to inform models and practice, and the position of the strategic models at the top implies their strategic nature and dependence on the behavioural, operational and network models of SCM.

PRACTICAL IMPLICATIONS

The discussion presented throughout the chapter, particularly the previous section, has a number of significant implications for practitioners working in various functions associated with supply chain. First, the presented discussion improves practitioners' understanding of the building blocks of the SCM in its holistic rendition. This is important as often the silo mentality impedes functional managers to understand how their behaviours might influence the preceding or succeeding function, process, activity or task. This is in contrast with the notion of supply chain and has the potential to increase the chances of sub-optimised decisions across the chain.

Second, practitioners can gain further insights as to how organisational theories explain, predict or contradict some of their supply chain-related decisions. This provides an opportunity for these practitioners to reflect on their decisions whether they have been based on instinct or data. Finally, the framework presented in Figure 6 assists practitioners to further recognise the interactions between their supply chain strategies (i.e., efficiency, risk-hedging, flexibility, agility) and behaviours, operations and networks internal and external to their organisation. This is a bilateral relationship informing how strategies influence behaviours, operations and networks as well as how behaviours, operations and networks can be engineered to support strategy implementation.

CONCLUSION

The chapter aimed to develop a holistic framework of SCM. Therefore, an extensive and critical review of the literature was used to shed light on some key theories and models used in the extant supply chain

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research, which provided better understanding of the discipline. Theories such as TCE, AT, RET, RDT, NT and RBV were reviewed. Moreover, supply chain models were explained in terms of strategic, operational, network and behavioural models, which unfolded some of the realities of SCM. An integrated view of the theories and models of SCM was constructed to facilitate understanding of the SCM discipline and ensuing implications for practitioners were outlined.

REFERENCES

- Ammer, D. S. (1968). *Manufacturing management and control*. New York: Appleton-Century-Crofts.
- Bagchi, P. K., Chun Ha, B., Skjoett-Larsen, T., & Boege Soerensen, L. (2005). Supply chain integration: A European survey. *The International Journal of Logistics Management*, 16(2), 275–294. doi:10.1108/09574090510634557
- Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17(1), 99–120. doi:10.1177/014920639101700108
- Barratt, M. (2004). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal*, 9(1), 30–42. doi:10.1108/13598540410517566
- Barratt, M., & Oke, A. (2007). Antecedents of supply chain visibility in retail supply chains: A resource-based theory perspective. *Journal of Operations Management*, 25(6), 1217–1233. doi:10.1016/j.jom.2007.01.003
- Basnet, C., Corner, J., Wisner, J., & Tan, K.-C. (2003). Benchmarking supply chain management practice in NZ. *Supply Chain Management: An International Journal*, 8(1), 57–64. doi:10.1108/13598540310463369
- Bechtel, C., & Jayaram, J. (1997). Supply chain management: A strategic perspective. *The International Journal of Logistics Management*, 8(1), 15–34. doi:10.1108/09574099710805565
- Berry, D., Towill, D. R., & Wadsley, N. (1994). Supply chain management in the electronics products industry. *International Journal of Physical Distribution & Logistics Management*, 24(10), 20–32. doi:10.1108/09600039410074773
- Böhme, T. (2009). *Supply chain integration: A case-based investigation of status, barriers, and paths to enhancement* [Doctoral thesis]. University of Waikato, Hamilton, New Zealand. Retrieved from <http://researchcommons.waikato.ac.nz/handle/10289/3289>
- Brown, S., & Bessant, J. (2003). The manufacturing strategy-capabilities links in mass customisation and agile manufacturing—An exploratory study. *International Journal of Operations & Production Management*, 23(7), 707–730. doi:10.1108/01443570310481522
- Burgess, K., Singh, P. J., & Koroglu, R. (2006). Supply chain management: A structured literature review and implications for future research. *International Journal of Operations & Production Management*, 26(7), 703–729. doi:10.1108/01443570610672202

Supply Chain Management

- Cassivi, L. (2006). Collaboration planning in a supply chain. *Supply Chain Management: An International Journal*, 11(3), 249–258. doi:10.1108/13598540610662158
- Charles, A., Luras, M., & Van Wassenhove, L. (2010). A model to define and assess the agility of supply chains: Building on humanitarian experience. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), 722–741. doi:10.1108/09600031011079355
- Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: The constructs and measurements. *Journal of Operations Management*, 22(2), 119–150. doi:10.1016/j.jom.2003.12.007
- Childerhouse, P. (2002). *Enabling seamless market-orientated supply chains* [Doctoral thesis]. Cardiff University, Wales, UK. Retrieved from <http://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.273642>
- Choi, T. Y., & Kim, Y. (2008). Structural embeddedness and supplier management: A network perspective. *Journal of Supply Chain Management*, 44(4), 5–13. doi:10.1111/j.1745-493X.2008.00069.x
- Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, 24(5), 637–652. doi:10.1016/j.jom.2005.07.002
- Choi, T. Y., & Wu, Z. (2009). Taking the leap from dyads to triads: Buyer–supplier relationships in supply networks. *Journal of Purchasing and Supply Management*, 15(4), 263–266. doi:10.1016/j.pur-sup.2009.08.003
- Christopher, M. (2005). *Logistics and supply chain management: Creating value-adding networks*. London: Prentice Hall.
- Cooper, M. C., & Ellram, L. M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *The International Journal of Logistics Management*, 4(2), 13–24. doi:10.1108/09574099310804957
- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *The International Journal of Logistics Management*, 8(1), 1–14. doi:10.1108/09574099710805556
- Crook, T. R., & Combs, J. G. (2007). Sources and consequences of bargaining power in supply chains. *Journal of Operations Management*, 25(2), 546–555. doi:10.1016/j.jom.2006.05.008
- Croom, S., Romano, P., & Giannakis, M. (2000). Supply chain management: An analytical framework for critical literature review. *European Journal of Purchasing & Supply Management*, 6(1), 67–83. doi:10.1016/S0969-7012(99)00030-1
- Croxton, K. L., García-Dastugue, S. J., Lambert, D. M., & Rogers, D. S. (2001). The supply chain management processes. *The International Journal of Logistics Management*, 12(2), 13–36. doi:10.1108/09574090110806271
- Danese, P. (2011). Towards a contingency theory of collaborative planning initiatives in supply networks. *International Journal of Production Research*, 49(4), 1081–1103. doi:10.1080/00207540903555510
- Das, T. K., & Teng, B.-S. (1998). Between Trust and Control: Developing Confidence in Partner Cooperation in Alliances. *Academy of Management Review*, 23(3), 491–512.

Supply Chain Management

- de Oliveira Wilk, E., & Evaldo Fensterseifer, J. (2003). Use of resource-based view in industrial cluster strategic analysis. *International Journal of Operations & Production Management*, 23(9), 995–1009. doi:10.1108/01443570310491747
- Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review*, 23(4), 660–679.
- Eisenhardt, K. M. (1989a). Agency Theory: An Assessment and Review. *Academy of Management Review*, 14(1), 57–74.
- Ellram, L. M. (1991). Supply-Chain Management: The Industrial Organisation Perspective. *International Journal of Physical Distribution & Logistics Management*, 21(1), 13–22. doi:10.1108/09600039110137082
- Ellram, L. M., & Cooper, M. C. (1990). Supply chain management, partnership, and the shipper-third party relationship. *The International Journal of Logistics Management*, 1(2), 1–10. doi:10.1108/95740939080001276
- Ellram, L. M., & Cooper, M. C. (2014). Supply Chain Management: It's All About the Journey, Not the Destination. *Journal of Supply Chain Management*, 50(1), 8–20. doi:10.1111/jscm.12043
- Emberson, C., & Storey, J. (2006). Buyer-supplier collaborative relationships: Beyond the normative accounts. *Journal of Purchasing and Supply Management*, 12(5), 236–245. doi:10.1016/j.pursup.2006.10.008
- Emerson, R. M. (1962). Power-Dependence Relations. *American Sociological Review*, 27(1), 31–41. doi:10.2307/2089716
- Fawcett, S. E., Allred, C., Magnan, G. M., & Ogden, J. (2009). Benchmarking the viability of SCM for entrepreneurial business model design. *Benchmarking: An International Journal*, 16(1), 5–29. doi:10.1108/14635770910936496
- Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 32(5), 339–361. doi:10.1108/09600030210436222
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008a). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, 13(1), 35–48. doi:10.1108/13598540810850300
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008b). A three-stage implementation model for supply chain collaboration. *Journal of Business Logistics*, 29(1), 93–112. doi:10.1002/j.2158-1592.2008.tb00070.x
- Fayezi, S., Zutshi, A., & O'Loughlin, A. (2010, December). *Collaboration and risk mitigation capability in supply chains: A conceptual framework*. Paper presented at the 24th Australian and New Zealand Academy of Management, Adelaide, Australia. Retrieved from <http://dro.deakin.edu.au/view/DU:30032189>
- Fisher, M. L. (1997). What is the right supply chain for your product? *Harvard Business Review*, 75(2), 105–116.

Supply Chain Management

- Fleisher, C. S. (1991). Using an agency-based approach to analyze collaborative federated interorganizational relationships. *The Journal of Applied Behavioral Science*, 27(1), 116–130. doi:10.1177/0021886391271006
- Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., & Flynn, E. J. (1990). Empirical research methods in operations management. *Journal of Operations Management*, 9(2), 250–284. doi:10.1016/0272-6963(90)90098-X
- Forrester, J. W. (1961). *Industrial dynamics*. Cambridge, MA: MIT Press.
- Galde, L.-E., & Håkansson, H. (2001). *Supply network strategies*. Chichester, UK: Wiley.
- Gimenez, C. (2004). Supply chain management implementation in the Spanish grocery sector: An exploratory study. *International Journal of Integrated Supply Management*, 1(1), 98–114. doi:10.1504/IJISM.2004.004600
- Gosain, S., Malhotra, A., & Sawy, O. A. E. L. (2004). Coordinating for Flexibility in e-Business Supply Chains. *Journal of Management Information Systems*, 21(3), 7–45.
- Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3), 481–510. doi:10.1086/228311
- Grant, R. M. (1991). The Resource-based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114–135. doi:10.2307/41166664
- Grover, V., & Malhotra, M. K. (2003). Transaction cost framework in operations and supply chain management research: Theory and measurement. *Journal of Operations Management*, 21(4), 457–473. doi:10.1016/S0272-6963(03)00040-8
- Håkansson, H. (1987). *Industrial technological development: A network approach*. London: Croom Helm.
- Halldórsson, Á., Kotzab, H., Mikkola, J. H., & Skjøtt-Larsen, T. (2007). Complementary theories to supply chain management. *Supply Chain Management: An International Journal*, 12(4), 284–296. doi:10.1108/13598540710759808
- Halldórsson, Á., Larson, P. D., & Poist, R. F. (2008). Supply chain management: A comparison of Scandinavian and American perspectives. *International Journal of Physical Distribution & Logistics Management*, 38(2), 126–142. doi:10.1108/09600030810861206
- Halldórsson, Á., & Skjøtt-Larsen, T. (2006). Dynamics of relationship governance in TPL arrangements: A dyadic perspective. *International Journal of Physical Distribution & Logistics Management*, 36(7), 490–506. doi:10.1108/09600030610684944
- Handfield, R. B., & Bechtel, C. (2002). The role of trust and relationship structure in improving supply chain responsiveness. *Industrial Marketing Management*, 31(4), 367–382. doi:10.1016/S0019-8501(01)00169-9
- Harland, C. M. (1996). Supply chain management: Relationships, chains and networks. *British Journal of Management*, 7(s1S1), S63–S80. doi:10.1111/j.1467-8551.1996.tb00148.x
- Harland, C. M., Lamming, R. C., Zheng, J., & Johnsen, T. E. (2001). A taxonomy of supply networks. *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, 37(4), 21–27.

Supply Chain Management

- Hartmann, J., & Moeller, S. (2014). Chain liability in multitier supply chains? Responsibility attributions for unsustainable supplier behavior. *Journal of Operations Management*, 32(5), 281–294. doi:10.1016/j.jom.2014.01.005
- Heckert, J. B., & Miner, R. B. (1940). *Distribution costs*. New York: Ronald Press.
- Heide, J. B. (1994). Interorganizational Governance in Marketing Channels. *Journal of Marketing*, 58(1), 71–85. doi:10.2307/1252252
- Ho, D. C. K., Au, K. F., & Newton, E. (2002). Empirical research on supply chain management: A critical review and recommendations. *International Journal of Production Research*, 40(17), 4415–4430. doi:10.1080/00207540210157204
- Houlihan, J. B. (1987). International supply chain management. *International Journal of Physical Distribution & Logistics Management*, 17(2), 51–66. doi:10.1108/eb014652
- Hoyt, J., & Huq, F. (2000). From arms-length to collaborative relationships in the supply chain: An evolutionary process. *International Journal of Physical Distribution & Logistics Management*, 30(9), 750–764. doi:10.1108/09600030010351453
- Huang, G. Q., & Mak, K. L. (2000). WeBid: A web-based framework to support early supplier involvement in new product development. *Robotics and Computer-integrated Manufacturing*, 16(2-3), 169–179. doi:10.1016/S0736-5845(00)00005-3
- Humphries, A. S., & Wilding, R. D. (2004). Long term collaborative business relationships: The impact of trust and C3 behaviour. *Journal of Marketing Management*, 9(10), 1107–1122. doi:10.1362/0267257042405240
- Hunt, S. D., & Morgan, R. M. (1996). The Resource-Advantage Theory of Competition: Dynamics, Path Dependencies, and Evolutionary Dimensions. *Journal of Marketing*, 60(4), 107–114. doi:10.2307/1251905
- Ireland, R. D., & Webb, J. W. (2007). A multi-theoretic perspective on trust and power in strategic supply chains. *Journal of Operations Management*, 25(2), 482–497. doi:10.1016/j.jom.2006.05.004
- Jap, S. D. (2001). “Pie Sharing” in Complex Collaboration Contexts. *JMR, Journal of Marketing Research*, 38(1), 86–99. doi:10.1509/jmkr.38.1.86.18827
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. doi:10.1016/0304-405X(76)90026-X
- Jones, T. C., & Riley, D. W. (1985). Using inventory for competitive advantage through supply chain management. *International Journal of Physical Distribution & Logistics Management*, 15(5), 16–26. doi:10.1108/eb014615
- Joshi, A. W., & Stump, R. L. (1999). Determinants of Commitment and Opportunism: Integrating and Extending Insights from Transaction Cost Analysis and Relational Exchange Theory. *Canadian Journal of Administrative Sciences*, 16(4), 334–352. doi:10.1111/j.1936-4490.1999.tb00693.x
- Kampstra, R. P., Ashayeri, J., & Gattorna, J. L. (2006). Realities of supply chain collaboration. *The International Journal of Logistics Management*, 17(3), 312–330. doi:10.1108/09574090610717509

Supply Chain Management

Ketchen, D. J. Jr, & Hult, G. T. M. (2007a). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management*, 25(2), 573–580. doi:10.1016/j.jom.2006.05.010

Ketchen, D. J. Jr, & Hult, G. T. M. (2007b). Toward greater integration of insights from organization theory and supply chain management. *Journal of Operations Management*, 25(2), 455–458. doi:10.1016/j.jom.2006.05.001

Kim, Y., Choi, T. Y., Yan, T., & Dooley, K. (2011). Structural investigation of supply networks: A social network analysis approach. *Journal of Operations Management*, 29(3), 194–211. doi:10.1016/j.jom.2010.11.001

Knemeyer, A. M., Zinn, W., & Eroglu, C. (2009). Proactive planning for catastrophic events in supply chains. *Journal of Operations Management*, 27(2), 141–153. doi:10.1016/j.jom.2008.06.002

Knoppen, D., & Christiaanse, E. (2007). Supply chain partnering: A temporal multidisciplinary approach. *Supply Chain Management: An International Journal*, 12(2), 164–171. doi:10.1108/13598540710737343

Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review*, 61(5), 109–117.

La Londe, B. J., & Masters, J. M. (1994). Emerging logistics strategies: Blueprints for the next century. *International Journal of Physical Distribution & Logistics Management*, 24(7), 35–47. doi:10.1108/09600039410070975

Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29(1), 65–83. doi:10.1016/S0019-8501(99)00113-3

Lambert, D. M., Emmelhainz, M. A., & Gardner, J. T. (1996). Developing and implementing supply chain partnerships. *The International Journal of Logistics Management*, 7(2), 1–18. doi:10.1108/09574099610805485

Larson, A. (1992). Network Dyads in Entrepreneurial Settings: A Study of the Governance of Exchange Relationships. *Administrative Science Quarterly*, 37(1), 76–104. doi:10.2307/2393534

Lavie, D. (2006). The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View. *Academy of Management Review*, 31(3), 638–658. doi:10.5465/AMR.2006.21318922

Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, 44(3), 105–119. doi:10.2307/41166135

Lee, H. L., & Whang, S. (2000). Information sharing in a supply chain. *International Journal of Manufacturing Technology and Management*, 1(1), 79–93. doi:10.1504/IJMTM.2000.001329

Lewis, M. A. (2000). Lean production and sustainable competitive advantage. *International Journal of Operations & Production Management*, 20(8), 959–978. doi:10.1108/01443570010332971

Lewis, W. A. (1957). International Competition in Manufacturers. *The American Economic Review*, 47(2), 578–587.

Logan, M. S. (2000). Using agency theory to design successful outsourcing relationships. *The International Journal of Logistics Management*, 11(2), 21–32. doi:10.1108/09574090010806137

Supply Chain Management

- Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: Empirical evidence from the agri-food industry. *Supply Chain Management: An International Journal*, 12(3), 177–186. doi:10.1108/13598540710742491
- McCarthy, T., & Golicic, S. (2005). A proposal for case study methodology in supply chain integration research. In H. Kotzab, S. Seuring, M. Müller, & G. Reiner (Eds.), *Research Methodologies in Supply Chain Management* (pp. 251–266). Heidelberg, Germany: Physica-Verlag. doi:10.1007/3-7908-1636-1_17
- Mena, C., Humphries, A., & Choi, T. Y. (2013). Toward a Theory of Multi-Tier Supply Chain Management. *Journal of Supply Chain Management*, 49(2), 58–77. doi:10.1111/jscm.12003
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Miles, R. E., & Snow, C. C. (2007). Organization theory and supply chain management: An evolving research perspective. *Journal of Operations Management*, 25(2), 459–463. doi:10.1016/j.jom.2006.05.002
- Miller, S. R., & Ross, A. D. (2003). An exploratory analysis of resource utilization across organizational units: Understanding the resource-based view. *International Journal of Operations & Production Management*, 23(9), 1062–1083. doi:10.1108/01443570310491774
- Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Glenn Richey, R. (2005). Supply chain collaboration: What's happening? *The International Journal of Logistics Management*, 16(2), 237–256. doi:10.1108/09574090510634539
- Mitchell, J. C. (1969). The concept and use of social networks. In J. C. Mitchell (Ed.), *Social Networks in Urban Relations: Analyses of Personal Relationships in Central African Towns* (pp. 1–50). Manchester, UK: Manchester University Press.
- Mitnick, B. M. (1973, September). *Fiduciary rationality and public policy: The theory of agency and some consequences*. Paper presented at the Annual Meeting of the American Political Science Association, New Orleans, LA. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1020859
- Novack, R. A., & Simco, S. W. (1991). The industrial procurement process: A supply chain perspective. *Journal of Business Logistics*, 12(1), 145–167.
- Oliver, R. K., & Webber, M. D. (1982). Supply-chain management: Logistics catches up with strategy. In M. Christopher (Ed.), *Logistics: The strategic issue* (pp. 63–75). London: Chapman & Hall.
- Pandza, K., Horsburgh, S., Gorton, K., & Polajnar, A. (2003). A real options approach to managing resources and capabilities. *International Journal of Operations & Production Management*, 23(9), 1010–1032. doi:10.1108/01443570310491756
- Pandza, K., Polajnar, A., Buchmeister, B., & Thorpe, R. (2003). Evolutionary perspectives on the capability accumulation process. *International Journal of Operations & Production Management*, 23(8), 822–849. doi:10.1108/01443570310486310
- Pearson, M., Masson, R., & Swain, A. (2010). Process control in an agile supply chain network. *International Journal of Production Economics*, 128(1), 22–30. doi:10.1016/j.ijpe.2010.01.027

Supply Chain Management

- Peck, H. (2005). Drivers of supply chain vulnerability: An integrated framework. *International Journal of Physical Distribution & Logistics Management*, 35(4), 210–232. doi:10.1108/09600030510599904
- Penrose, E. T. (1959). *The Theory of the Growth of the Firm*. New York: Wiley.
- Pfeffer, J., & Davis-Blake, A. (1987). Understanding Organizational Wage Structures: A Resource Dependence Approach. *Academy of Management Journal*, 30(3), 437–455. doi:10.2307/256008
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York, NY: Harper & Row.
- Porter, M. E. (1985). *Competitive advantage* (Vol. 15). New York: Free Press.
- Prahalad, C. K., & Hamel, G. (1990). The Core Competence of the Corporation. *Harvard Business Review*, 68(3), 79–91.
- Priem, R. L., & Swink, M. (2012). A Demand-side Perspective on Supply Chain Management. *Journal of Supply Chain Management*, 48(2), 7–13. doi:10.1111/j.1745-493X.2012.03264.x
- Ross, S. A. (1973). The economic theory of agency: The principal's problem. *The American Economic Review*, 63(2), 134–139.
- Rumelt, R. P. (1984). Towards a strategic theory of the firm. In R. Lamb (Ed.), *Competitive strategic management*. Englewood Cliffs, NJ: Prentice-Hall.
- Sari, K. (2008). On the benefits of CPFR and VMI: A comparative simulation study. *International Journal of Production Economics*, 113(2), 575–586. doi:10.1016/j.ijpe.2007.10.021
- Scott, C., & Westbrook, R. (1991). New strategic tools for supply chain management. *International Journal of Physical Distribution & Logistics Management*, 21(1), 23–33. doi:10.1108/09600039110002225
- Shook, C. L., Adams, G. L., Ketchen, D. J. Jr, & Craighead, C. W. (2009). Towards a “theoretical toolbox” for strategic sourcing. *Supply Chain Management: An International Journal*, 14(1), 3–10. doi:10.1108/13598540910927250
- Simatupang, T. M., & Sridharan, R. (2005a). The collaboration index: A measure for supply chain collaboration. *International Journal of Physical Distribution & Logistics Management*, 35(1), 44–62. doi:10.1108/09600030510577421
- Simatupang, T. M., & Sridharan, R. (2005b). An integrative framework for supply chain collaboration. *The International Journal of Logistics Management*, 16(2), 257–274. doi:10.1108/09574090510634548
- Singh, P. J., & Power, D. (2009). The nature and effectiveness of collaboration between firms, their customers and suppliers: A supply chain perspective. *Supply Chain Management: An International Journal*, 14(3), 189–200. doi:10.1108/13598540910954539
- Spekman, R. E., Kamauff, J. W. Jr, & Myhr, N. (1998). An empirical investigation into supply chain management: A perspective on partnerships. *International Journal of Physical Distribution & Logistics Management*, 28(8), 630–650. doi:10.1108/09600039810247542

Supply Chain Management

- Squire, B., Cousins, P. D., Lawson, B., & Brown, S. (2009). The effect of supplier manufacturing capabilities on buyer responsiveness: The role of collaboration. *International Journal of Operations & Production Management*, 29(8), 766–788. doi:10.1108/01443570910977689
- Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics*, 22(1), 29–48. doi:10.1002/j.2158-1592.2001.tb00158.x
- Stentoft Arlbjørn, J., & Halldorsson, A. (2002). Logistics knowledge creation: Reflections on content, context and processes. *International Journal of Physical Distribution & Logistics Management*, 32(1), 22–40. doi:10.1108/09600030210415289
- Stevens, G. C. (1989). Integrating the supply chain. *International Journal of Physical Distribution & Logistics Management*, 19(8), 3–8. doi:10.1108/EUM00000000000329
- Stock, J. R. (1997). Applying theories from other disciplines to logistics. *International Journal of Physical Distribution & Logistics Management*, 27(9/10), 515–539. doi:10.1108/09600039710188576
- Stonebraker, P. W., & Afifi, R. (2004). Toward a contingency theory of supply chains. *Management Decision*, 42(9), 1131–1144. doi:10.1108/00251740410565163
- Supply-Chain Council. (2008). Supply Chain Operations Reference-model, Version 9.0 (SCOR review). Retrieved from <http://archive.supply-chain.org/galleries/public-gallery/SCOR%209.0%20Overview%20Booklet.pdf>
- Swafford, P. M., Ghosh, S., & Murthy, N. N. (2006). A framework for assessing value chain agility. *International Journal of Operations & Production Management*, 26(2), 118–140. doi:10.1108/01443570610641639
- Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing & Supply Management*, 7(1), 39–48. doi:10.1016/S0969-7012(00)00020-4
- Towill, D. R., Naim, M. M., & Wikner, J. (1992). Industrial dynamics simulation models in the design of supply chains. *International Journal of Physical Distribution & Logistics Management*, 22(5), 3–13. doi:10.1108/09600039210016995
- Turner, J. R. (1993). Integrated supply chain management: What's wrong with this picture? *Industrial Engineering (American Institute of Industrial Engineers)*, 25(12), 52–55.
- Vanpoucke, E., Vereecke, A., & Boyer, K. K. (2014). Triggers and patterns of integration initiatives in successful buyer–supplier relationships. *Journal of Operations Management*, 32(1–2), 15–33. doi:10.1016/j.jom.2013.11.002
- Vanpoucke, E., Vereecke, A., & Wetzels, M. (2014). Developing supplier integration capabilities for sustainable competitive advantage: A dynamic capabilities approach. *Journal of Operations Management*, 32(7–8), 446–461. doi:10.1016/j.jom.2014.09.004
- Villena, V. H., Revilla, E., & Choi, T. Y. (2011). The dark side of buyer–supplier relationships: A social capital perspective. *Journal of Operations Management*, 29(6), 561–576. doi:10.1016/j.jom.2010.09.001
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. doi:10.1002/smj.4250050207

Supply Chain Management

- Wilding, R., & Humphries, A. S. (2006). Understanding collaborative supply chain relationships through the application of the Williamson organisational failure framework. *International Journal of Physical Distribution & Logistics Management*, 36(4), 309–329. doi:10.1108/09600030610672064
- Williamson, O. E. (1981). The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), 548–577. doi:10.1086/227496
- Williamson, O. E. (2002). The Theory of the Firm as Governance Structure: From Choice to Contract. *The Journal of Economic Perspectives*, 16(3), 171–195. doi:10.1257/089533002760278776
- Wilson, M. M. J. (2006). *Supply chains behaving badly: A dynamic model of inter-organisational supply chain exchange behaviour under rational, relational and chaotic paradigms*. (Doctoral thesis, Lincoln University, Lincoln, New Zealand). Retrieved from <http://researcharchive.lincoln.ac.nz/dspace/handle/10182/310>
- Zacharia, Z. G., Sanders, N. R., & Fugate, B. S. (2014). Evolving Functional Perspectives Within Supply Chain Management. *Journal of Supply Chain Management*, 50(1), 73–88. doi:10.1111/jscm.12022
- Zsidisin, G. A., Melnyk, S. A., & Ragatz, G. L. (2005). An institutional theory perspective of business continuity planning for purchasing and supply management. *International Journal of Production Research*, 43(16), 3401–3420. doi:10.1080/00207540500095613

ADDITIONAL READING

- Croson, R., Schultz, K., Siemsen, E., & Yeo, M. L. (2013). Behavioral operations: The state of the field. *Journal of Operations Management*, 31(1–2), 1–5. doi:10.1016/j.jom.2012.12.001
- Daugherty, P. J. (2011). Review of logistics and supply chain relationship literature and suggested research agenda. *International Journal of Physical Distribution & Logistics Management*, 41(1), 16–31. doi:10.1108/09600031111101402
- Giunipero, L. C., Hooker, R. E., Joseph-Matthews, S., Yoon, T. E., & Brudvig, S. (2008). A decade of SCM literature: Past, present and future implications. *Journal of Supply Chain Management*, 44(4), 66–86. doi:10.1111/j.1745-493X.2008.00073.x
- Gligor, D. M., & Holcomb, M. C. (2012). Understanding the role of logistics capabilities in achieving supply chain agility: A systematic literature review. *Supply Chain Management: An International Journal*, 17(4), 438–453. doi:10.1108/13598541211246594
- Soltani, E., & Ahmed, K., P., Ying Liao, Y., & U. Anosike, P. (. (2014). Qualitative middle-range research in operations management: The need for theory-driven empirical inquiry. *International Journal of Operations & Production Management*, 34(8), 1003–1027. doi:10.1108/IJOPM-11-2012-0486

Chapter 19

Structuring and Managing Supply Network: A Review of Current Literature and Conceptual Framework

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ABSTRACT

The concept of supply network has extended supply chain across national borders towards globalization. The aim of this chapter is to provide researchers, business practitioners and university students a picture of the architecture of supply networks. By analyzing two main trends of studies in the field of supply network management, components of supply network are classified into structural and infrastructural factors. Also a comparison is made to identify the difference between supply network and traditionally factory-based manufacturing system. Based on the literature review, a conceptual framework is further proposed which describes the supply network from four essential perspectives: Role/function, Relationship/alliance, Configuration/reconfiguration, and Risk and crisis management. After presenting detailed models and decision making areas of each perspective, suggestions are given on some emerging topics.

INTRODUCTION

Supply Chain Management (SCM) has boosted the development for both industrial management and academic research. The concept of supply network (SN) extended the concept of supply chain (SC) across national borders towards globalization. Current studies have provided frameworks (Soni & Kodali, 2011) on specific areas of supply chain such as purchasing, control, risk and performance; however, a more systematic review on the components and architecture can help to better understand the increasingly more complexity and dynamics of SN. The review should combine influential classical theories and recent novel research findings with a highlight on the most critical decision making areas and elements.

In early studies, Harland et al. (1996) divided the SN into two dimensions – structural and infrastructural factors, while Christopher (2005) suggested that a mature SN should achieve the 4R prin-

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ciples – ‘responsiveness, relationships, reliability, and resilience’. Govil and Proth (2002) proposed a process-oriented SN structure, containing ‘make, buy, move, store, and sell’. From then on, increasingly more research was conducted on a specific area of SN such as process, logistics and relationship. This chapter aims to generate a picture of SN architecture and identify the most important decision making areas, based on reviews of influential SN theories. It presented current research in terms of structural and infrastructural factors with different theories and practical perspectives. A conceptual framework is proposed with role/function, relationship/alliance, configuration/reconfiguration, and risk/crisis, along with recommendations for the future work.

LITERATURE REVIEW

SN is defined as ‘a network of connected and interdependent organisations mutually and co-operatively working together to control, manage, and improve the flow of materials and information from suppliers to end users’ (Christopher, 2005). There are two trends of analysis methods of how to describe the architecture of SN. The first trend is to identify the structural and infrastructural components of SN, whereas the second is a dynamic approach to map the growth path of manufacturing system from the factory level to the network level.

The First Trend: Structure and Infrastructure

SN architecture can be defined in two dimensions: structural and infrastructural. Structural elements refer to the static levers controlling the architectural configurations of SN (Shi and Gregory, 1998). Infrastructural elements, on the other hand, mean dynamic levers controlling the operational mechanism of SN (Shi & Gregory, 1998; Harland et al., 1999).

Structural

The concept of structural factors refers to the physical activities of SN. Hayes and Wheelwrights (1984) defined that structural elements have a long-term impact, difficult to be reversed or undone in place, and require a substantial capital investment to be altered or extended. In 1994, Saunders (1994) described SN structure as the aspects of make, transform, move, and store. Govil and Proth (2002) added two other important aspects “buy and sell” into Saunders’ (1994) model, and summarized the structure of SN as ‘buy, make, move, store, sell’. In addition, Govil and Proth (2002) highlighted two types of sharing process and a high-level decision making system, which are linked with the above five aspects by financial flows and strategic information flows.

To expand previous research framework, Harland et al. (1999) defined ‘capacity, SN actors’ configuration, SN facilities configuration and do-or-buy’ as SN structural elements. In this new model, the concept of facilities configuration includes fleet, buildings and materials handling systems, which combined the meaning of ‘move’ and ‘store’. As for the capacity, besides the elements of size, volume, and timing (Harland et al., 1999), Lawrence et al. (2000) highlighted the short-term and long-term capability of SN and suggested that the system capacity is determined by the bottleneck.

Most recently, Christopher (2005) emphasized the five factors to enhance the risk of SN: a focus on efficiency rather than effectiveness, the globalisation of supply chains, focused factories and centralised

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distribution, the trend to outsourcing, and the reduction of the supplier base. He also provided solutions on how to achieve supply chain resilience (Christopher, 2005). Ayers (2001) added “procurement” to the SN which has more comprehensive meaning than ‘buy’, containing the process of purchasing, the suppliers and the internal customers (Weele, 2000). Other works highlighted the production or manufacturing stages (Locke, 1996; Ross, 1997; Mentzer, 2001; Waller, 2003).

Another factor, technology, was also studied frequently. Welch and Nayak (1992) provided insourcing and outsourcing consideration which involves an analysis of process technology. Handfield et al. (2002) found that technology changes rapidly and provides significant competitive advantage. The concept of ‘Process’ is also highlighted as ‘a logical series of related transactions that converts input to results or output’ (Andersen, 1999). It involves demand management, sourcing, network logistics, operations, channel management, and customer services (Brewer et al, 2001). Handfield et al. (2002) listed key components of business process as NPD, new customer identification, procurement, inbound logistics, production planning and control, manufacturing and assembly, sales, customer order processing, outbound logistics, customer service and after-sales support, product research and development.

From the above review, structural elements of SN can be developed as seen in Table 1.

Infrastructural

Reviewing Harland et al.’s (1999) findings, it is said that SN is built on the ‘strategy, structure, infrastructure’ of operations strategy. The concept of ‘infrastructure’ is defined as ongoing decisions (Hayes & Wheelwright, 1984) linked with specific operating aspects of the business which generally do not require highly visible capital investments. To describe infrastructural factors, Harland et al. (1999) highlighted the decision making areas ‘SN human resource (HR) policies, SN quality systems, SN operations planning and control, new product/service development, network organisation, and performance measurement’.

This was similar to Saunders’ (1994) and Govil and Proth’s (2002) findings which highlighted the controlling of operations. Based on these factors, “relationship” was further added (Ayers, 2001; Bozarth & Handfield, 2006), which was also emphasized as ‘alliance’ (Bowersox & Closs, 1996), ‘partnership’ (Ross, 1997) and ‘alignment of channel objectives and goals’ (Ross, 1997). Slack et al. (2007) explained that the content of relationship with a business-consumer relationship matrix of SN: traditional market supply relationship, virtual operations, partnership, and customer relationship. Slone et al (2010) emphasized the key successful factors in collaborative relationships between firms and core suppliers.

Besides ‘relationship’, ‘information’ was proposed in the context of SN. One key aspect of SCM is the ability to make strategic decisions quickly based on accurate data, and this requires for an efficient and effective information system (Mentzer, 2001): business environment, intra-firm information systems, inter-firm information systems, and SC information systems. ‘Information technology’ (Ross, 1997; Waller,

Table 1. Summary of structural elements of supply network

| | | |
|--------------------|---------------------|--|
| Structural factors | Capacity/Capability | Size, volume, Timing, Long-term capacity , Short-term capacity |
| | Process | Production and manufacturing, Demand management, Procurement, Network Logistics, Operations, Channel management, Customer services |
| | Technology | Computer hardware and software, E-commerce and internet, Intelligent transportation technologies |
| | Position | Role configuration, Purchasing, Sourcing, Make or buy, Risk, Power |
| | Facility | Fleet, Location, Building, Materials, Handling system |

Structuring and Managing Supply Network*Table 2. Summary of infrastructural elements of SN*

| | | |
|-------------------------|---------------------------------|---|
| Infrastructural factors | SN Planning/ Control | Loading, Scheduling, Sequencing, Monitoring and Control |
| | Quality | Total quality management (TQM), Statistics process control and six sigma program, Quality inspection & acceptance sampling, Total cost of quality |
| | Network organization structure | Structure, Control/reward systems, Role of staff groups |
| | Performance measurement | Supplier performance, Utilization, Productivity, Performance(output), Customer satisfaction |
| | Information | Business environment, Intra-firm information systems, Inter-firm information systems, Supply chain information systems |
| | Relationship | Alliance, Coordination, Partnership, Shared goals, Contact, Customer & competitor, Virtual operations |
| | SN HR | SN HR |
| | New Product/service Development | Repeatability, Testability, Serviceability, Products volumes, Product costs, Match between the design and existing capabilities |
| | Social impact | Culture, Law, Policy, Context, Environment and sustainability |
| | Crisis management | Risk, Crisis |

2003) was highlighted as fundamental infrastructural aspect of SN. Other factors such as SN governance (Pilbeam et al., 2012), sustainability (Miemczyk et al., 2012), crisis management (Natarajarathinam et al., 2009) and configuration on a SN level (Srai & Gregory, 2008) are recently identified and reviewed.

Based on the above literature review, infrastructural elements of SN can be summarized as Table 2.

The Second Trend: Dynamic Growth

As the steps of globalisation become increasingly faster, the individual manufacturer becomes involved in and relies on the SN deeply. Manufacturing system grows from factory-based operations management towards inter-firm network operations and intra-firm internationalisation. Hayes and Wheelwright (1984) created the key decision areas of factory-base manufacturing system: capacity, facilities, technology, vertical integration of structural elements and workforce, quality, planning/control, organisation structure. Hill (1993) presented a similar framework containing competitive priorities, structure and infrastructure.

Saunders's (1994) four elements and Govil and Proth's (2002) five structural elements both saw SC at the factory level, but ignored 'information' and 'relationship'. From then on, most research focused on the new architecture of SN, and dimensions of infrastructural elements were created (Bowersox & Closs, 1996; Locke, 1996; Ross, 1997; Ayers, 2001; Mentzer, 2000, 2001; Waller, 2003; Bozarth, 2006; Slack et al., 2007). Table 3 describes the evolution architecture of SN from factory level to network level.

CONCEPTUAL FRAMEWORK

The literature review above shows that SN has different features from factory-based manufacturing systems. In terms of structural factors, both factory-based systems and SN contain capacity, technology, and facilities; however, SN also require for the management of process and position. Process can be divided according to the functional roles of the companies in the SN such as purchasing, manufacturing, transporting and services. Positioning and business process reengineering (BPR) can be defined as part

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Table 3. Evolution in architecture of SN

| | | |
|-----------------|----------------------------|---------------------------------|
| Structural | Factory level | Network level |
| | Capacity | Capacity/Capability |
| | Technology | Technology |
| | Facilities | Facilities |
| | Vertical integration | Process |
| | Internal/external sourcing | Position |
| Infrastructural | Planning/Control | SN Planning/ control |
| | Quality systems | Quality |
| | Organisation structure | Network organisation structure |
| | Workforce | Performance measurement |
| | Human resource | SN HR |
| | New product development | New product/service development |
| | | Information |
| | | Relationship |
| | | Social |

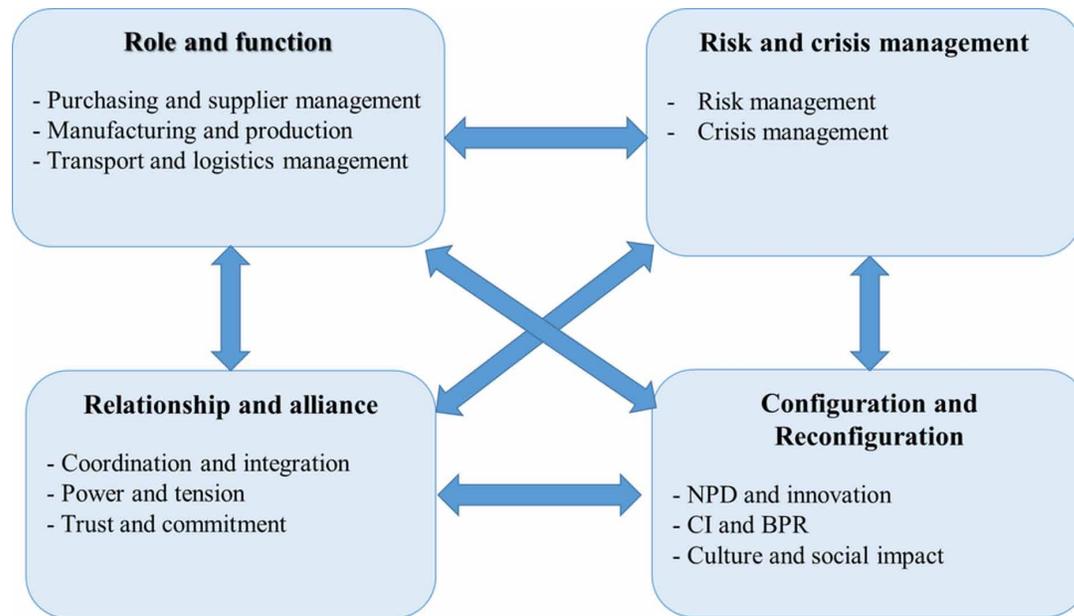
of SN (re-)configuration. If viewed from infrastructural perspectives, information, relationship, NPD and social impact should be considered. Information sharing is important to achieve coordination and long-term relationship, and NPD is supported by the innovative mechanism – part of SN (re-)configuration – of the network.

Social impact including cultural differences, policy, and other risk need the reactive changing of SN configuration. The issue of risk and crisis management are also important in the current expansion of the SN. Based on current research, a conceptual framework can be developed (Figure 1) to understand SN architecture as role/function, relationship/alliance, configuration/reconfiguration, and risk/crisis management.

The concept of role refers to the functional actors and stages within SN. Typical roles include NPD, purchasing, manufacturing, transportation and logistics, and service development, which are the structural elements of SN. If roles can be seen as nodes of the network, relationship is the linkage between different nodes. Different forms of relationship are coordination, power and tension, trust and commitment and shared goals. Configuration (reconfiguration) is the dynamic mechanism over the network which repositions the role, redesigns the internal linkages, and transforms the impact of external environment into the internal issues. Continuous improvement (CI), reengineering and positioning, culture and social impact are the considerations from configuration perspectives. Risk and crisis management can influence the changing of roles, relationship and SN configurations.

Role and Function

From process and functional role perspectives, SN can be described into inbound logistics operations, outbound logistics, sales and services (Porter, 1985). Here dominated studies can be seen from aspects of purchasing and supplier management, manufacturing and production, and transport and logistics management.

Structuring and Managing Supply Network*Figure 1. A conceptual framework of SN architecture***Purchasing and Supplier Management**

Purchasing is essential to the NPD and to the whole supply chain (Burt & Soukup, 1985), as it is related to the collaborative research and development (R&D), information management, and capacity management. The early studies on purchasing were from perspectives of capacity and technology. The strategic view of purchasing management was proposed by Kraljic (1983) with a model and implementation methods of the solution.

Classification, market analysis, strategic positioning, action plans were highlight, and detailed decision making areas include supply risk, storage risk, supplier's capacity utilisation, supplier's break-even stability, uniqueness of suppliers' product, annual volume purchased and expected growth in demand, past variations in capacity utilisation of main production units, potential costs in the event of non-delivery or inadequate quality (Kraljic, 1983). Models of supplier integration and global sourcing (Arnold, 1999) are provided for MNCs achieving purchasing advantages.

Manufacturing and Production

Manufacturing and production are the key stages in the whole supply chain. Traditionally, manufacturing studies are about the best practice / operations management in a single factory. Process and product design, capacity management, inventory management, quality management and human resource management (HRM) are popular research areas. As manufacturing system grows towards geographically dispersion and vertical integration, the alignment of manufacturing and corporate strategy is crucial and decision trade-offs are made between cost, quality, delivery, and flexibility (Skinner, 1969). A strategic model to match supply chain with products is suggested (Fisher, 1997).

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Shi and Gregory (1998) mapped the development of manufacturing system, and identified four types of international manufacturing with key strategic capability parameter, networking trend and implications for configuration. Resources accessibility, thriftiness ability, manufacturing mobility and learning ability are emphasised (Shi & Gregory, 1998). The importance of managing manufacturing resources in the supply network context instead of from factory level caught much attention. Kouvelis et al. (2006) reviewed the supply chain literature from production and operations aspects, in which supply chain design, uncertainty, coordination, capacity, and sourcing decisions are discussed.

Transport and Logistics Management

The study of logistics network and transport management has occurred over a long period of time. Early frameworks highlight the problems related with performance measurement and control the effects of environment (New, 1995). With the development of IT and lean concept, transportation and distribution requires for a new model. Cordeau et al. (2006) developed an integrated model for logistics network design in which two approaches were adopted. According to their analysis, four decision making areas should be considered: the number, location, capacity, and technology of manufacturing plants and warehouse; the selection of suppliers' the assignment of product ranges to manufacturing plants and warehouse; the selection of distribution channels and transportation modes' the flows of raw materials, semi-finished and finished products through the network. Various types of horizontal cooperation, the drivers, impediments and facilitators in logistics were identified (Cruijssen et al., 2007).

Relationship and Alliance

Relationship refers to the linkage between different components and functional roles in the SN. It includes collaborative modes, supply chain linkages, and operational mechanisms. Morgan and Hunt's (1994) key mediating variable (KMV) model – trust, commitment, cooperation, communication, shared values, uncertainty – is useful to explore relationships between organizations. Specifically, the relationship within SN contains upstream relationship – as purchaser, dealing with suppliers; and downstream relationship – as supplier dealing with customers (Mills & Schmitz, 1997). System levels of supply management are identified as the internal supply chain, the dyadic relationship, the external supply chain and the inter-business network (Harland, 1996).

Ongoing relationships and strategic partners (Mentzer et al., 2000) can be defined as alliance with commitment to shared goals. Typical types and decision making areas of relationships and alliance are coordination and integration, power and tension, shared goals, trust and commitment. The interactions among these factors are also explored.

Coordination and Integration

The SN requires the coordination and integration of different component companies. Lamming (1996) summarized the concept from lean production perspective and highlighted the relationship between suppliers, customers and other parties. Communication facilitates the coordination and integration, and it can be measured along dimensions of direction and intensity. The direct effect of information sharing – due

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to the changes in strategy by the parties involved – discourages the retailers from demand information sharing, while the indirect effect – leakage effect, due to the changes in strategy by other competing firms – discourages information sharing (Li, 2002).

Power and Tension

Power distance is defined as the extent to which the less powerful members of institutions and organizations within a country expect and accept that power is distributed unequally (Hofstede, 1991). The notion of power in SN can be seen from in what degree a firm can influence or control the other firm. Bargaining power is found particularly important for supply management. On a more general level, Barney (1999) explained how a firm's capabilities control and affect boundary decisions – market governance, intermediate governance and hierarchical governance are three effective approaches.

Trust and Commitment

Trust exists when one party has confidence in an exchange partner's reliability and integrity, and commitment is the belief that an ongoing relationship with one another is so important as to warrant maximum efforts at maintaining it (Morgan & Hunt, 1994). Shared values are antecedent to trust and commitment as they are the extent to which partners have beliefs in common about what behaviors, goals, and policies are important or unimportant, appropriate or inappropriate, and right or wrong (Morgan & Hunt, 1994).

Configuration Reconfiguration

Configuration can be seen as a state, whereas reconfiguration contains transformation and re-design concepts (Srai & Gregory, 2008). It reflects both the dynamic changing feature of the internal SN and how it interacts with external environment. The aim of establishing reconfiguration mechanism is to achieve the internal network's self-adaptation and continuous improvement, and to be responsive and active. Reconfiguration can be studied from the perspectives of NPD, BPR, and social interaction.

NPD and Innovation

NPD is associated with the idea and innovation with the process of supplying new products to the market. The changing feature of PLC requires for appropriated network structure – 'In the embryonic stage, emphasis is on design for time-to-market, with access to a skilled and flexible manufacturing capability. In the growth phase, changes to design for time-to-volume and efficiency of the manufacturing process become important. Efficient NPD requires for a relational contract model for buyer-supplier relationship which encourages innovation (Taylor & Plambeck, 2007). Choy et al. (2004) designed a system of an intelligent supplier relationship management system for new product development, and techniques to select and benchmark potential suppliers were discussed.

CI and BPR

Noori (2004) conducted collaborative continuous improvement (CCI) programs in supply chain management, and suggested CCI models fro relationship and resource management. Salvador, et al. (2004)

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explored on how a firm's supply chain can be configured when different degrees of customization are offered. Graves and Willems (2005) developed a dynamic programme to optimize the supply chain configuration for new products.

Culture and Social Impact

Culture and other social issues such as policy are found to influence SN sustainability. Morris (2005) suggested that cultures high in uncertainty avoidance tend to reduce risk into minimum, whereas collectivism strongly influences the level of trust. Griffith et al. (2006) investigated the influence of national culture on relationship and knowledge resources in inter-organizational relationships between Japan and US firms by using Hofstede's (1991) national culture framework. Factors of relationship, trust, power, and shared vision are also discussed from a cultural perspective.

Risk and crisis

As many factors today affect the supply network, the ability to handle uncertainty and risk is critical. Risk and crisis can influence the changing of roles or the development of the relationship and can be the drivers of reconfiguration.

Risk Management

Risks exists both within the SN and outside, rising from network dispersion and coordination problems. Internal risks come from process and control, while external risks may come from the uncertainty of demand in SC. Lee (2002) proposed a framework to link the right supply chain strategy – efficient, responsive, risk-hedging, and agile – to match product uncertainty. Infrastructure risk, especially the make vs. buy consideration needs to be assessed (Golda & Philippi, 2007).

Crisis Management

Crisis occurs when one or more supply chain members' activities are interrupted (Nararajarathinam et al., 2009). Poor relationship and lack of information sharing among supply chain members can also result in crisis. Supplier bankruptcy and external causes such as natural disasters, human interactions and accident or loss in transit are typical supply chain crisis (Hittle & Leonard, 2011). It is suggested that companies should first identify the potential source of crisis, can then solve them through diverse capacity, back-up equipment, or alternative manufacturing locations (Hittle & Leonard, 2011).

DISCUSSION AND CONCLUSION

From literature review of the most influential SN studies, structural and infrastructural components were identified. As manufacturing systems have developed from single factory level towards inter-firm network, a comparison was made between the decision areas of factory and SN, both from structural and infrastructural perspectives. From the above analysis, a conceptual framework for the architecture of SN was proposed here which was then developed and explained in detail.

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The framework contains four elements: role/function, relationship/alliance, configuration/reconfiguration and risk/crisis management. Role is a combination of process and function, as structural factors which differentiate SN from factory-based system. Relationship is the connection between different roles, which is the infrastructural support within the SN. Reconfiguration refers to the dynamic changing and mechanism both within the SN, and the influence of the external environment to the SN. Risk/crisis management refers to the understanding of both internal and external uncertainty.

Currently, role related studies are from perspectives of purchasing, manufacturing, transportation, however not adequate study is observed in service development. Relationship contains coordination, integration, power, trust, and commitment, all of which are inter-connected with one another; therefore the interaction among these factors requires further exploration. Reconfiguration mechanism includes NPD, CI, and cultural assessment. Risk/crisis management can be another research topic, especially to find out the stages companies should response in natural disasters and financial crisis.

In terms of managerial implementation, this chapter provides a new conceptual framework containing the important elements of SN; namely, role/function, relationship/alliance, configuration/reconfiguration, and risk/crisis. Business practitioners may use it to evaluate the critical decision making areas, identifying the current status, and make plans for both short-term and long-term. It can potentially be adapted to individual company strategy, to capture the changing trends with priorities, and to respond quickly to SN dynamics and crisis. It can also be a guide to managers who would like to know how SN is constructed, developed and improved in the existing academic literature.

In areas of SN, quantitative methods are most frequently adopted; however, not many qualitative approaches have been seen recently to the model the process and dimensions. This can be one of the areas for future research. Additionally, more work is required to develop the procedure to validate this framework in business practice.

REFERENCES

- Andersen, B. (1999). *Business improvement toolbox*. Milwaukee, WI: ASQ Quality Press.
- Arnold, U. (1999). Organisation of global sourcing: Ways towards an optimal degree of centralization. *European Journal of Purchasing and Supply Management*, 5(3-4), 167–174. doi:10.1016/S0969-7012(99)00023-4
- Ayers, J. B. (2001). *Handbook of Supply Chain Management*. London: St. Lucie Press.
- Barney, J. B. (1999, Spring). How a firm's capabilities affect boundary decisions. *Sloan Management Review*.
- Bowerson, D. J., & Closs, D. J. (1996). *Logistical management: the integrated supply chain process*. New York: MacGraw Hill.
- Bozarth, C. C., & Handfield, R. B. (2006). *Introduction to operations and supply chain management*. New York: Pearson Prentice Hall.
- Brewer, A. M. (2001). *Handbook of Logistics and Supply-chain Management*. Amsterdam: Elsevier Science Ltd.

Structuring and Managing Supply Network

Burt, D. N., & Soukup, W. R. (1985). Purchasing's new role in new product development. *Harvard Business Review*, 63(5), 90–97.

Choy, K. L., Lee, W. B., Lau, H. C., Lu, W. D., & Lo, V. (2004, December). Design of an intelligent supplier relationship management system for new product development. *International Journal of Computer Integrated Manufacturing*, 17(8), 692–715. doi:10.1080/0951192042000237483

Christopher, M. (2005). *Logistics and supply chain management: creating value-adding networks*. Harlow: Financial Times Prentice Hall.

Cordeau, J., Pasin, F., & Solomon, M.M. (2006). An integrated model for logistics network design. *Ann Oper Res* (2006).

Crujssen, F., Dullaert, W., & Fleuren, H. (2007, Summer). Horizontal cooperation in transport and logistics: a literature review. *Transportation Journal*.

Fisher, M. L. (1997, March-April). What is the right supply chain for your product. *Harvard Business Review*, 75(2).

Golda, J., & Philippi, C. (2007). Managing new technology risk in the supply chain. *Intel Technology Journal*, 11(2).

Govil, M., & Proth, J. (2002). *Supply chain design and management: strategic and tactical perspectives*. San Diego, CA: Academic.

Graves, S. C., & Willems, S. P. (2005, August). Optimizing the supply chain configuration for new products. *Management Science*, 51(8), 1165–1180. doi:10.1287/mnsc.1050.0367

Griffith, D.A., Myers, M.B., & Harvey, M.G. (2006). An investigation of national culture's influence on relationship and knowledge resources in interorganisational relationships between Japan and US. *Journal of International Marketing*, 14(3).

Handfield, R. B., & Nichols, E. L. (2002). *Supply chain redesign*. Upper Saddle River, NJ: Financial Times Prentice Hall.

Harland, C. M. (1996). Supply chain management: Relationships, chains and networks. *British Journal of Management*, 7(S1), S63–S80. doi:10.1111/j.1467-8551.1996.tb00148.x

Harland, C.M., Lamming, R. C., & Cousins, P.D. (1999). Developing the concept of supply strategy. *International Journal of Operations & Production Management*, 19(7), 650–674. doi:10.1108/01443579910278910

Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: competing through manufacturing*. New York: John Wiley.

Hill, T.J. (1993). *Manufacturing Strategy* (2nd ed.). London: Macmillan. doi:10.1007/978-1-349-22664-1

Hittle, B., & Moustafa Leonard, K. (2011). Decision making in advance of a supply chain crisis. *Management Decision*, 49(7), 1182–1193. doi:10.1108/00251741111151208

Hofstede, G. (1991). *Cultures and Organisations: Software of the Mind*. London: McGraw-Hill.

Structuring and Managing Supply Network

- Kouvelis, P., Chambers, C., & Wang, H. (2006, Fall). Supply chain management research and production and operations management: Review, trends, and opportunities. *Production and Operations Management*, 15(3), 449-469.
- Kraljic, P. (1983, September-October). (. Purchasing must become supply management. *Harvard Business Review*. Lamming, R. (1996). Squaring lean supply with supply chain management. *International Journal of Operations & Production Management*, 16(2), 183-196.
- Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, 44(3), 105-119. doi:10.2307/41166135
- Li, L. (2002, September). Information sharing in a supply chain with horizontal competition. *Management Science*, 48(9), 1196-1212. doi:10.1287/mnsc.48.9.1196.177
- Locke, D. (1996). *Global supply management: a guide to international purchasing*. Chicago, IL: Irwin Professional Publishing.
- Mentzer, J. T. (2001). *Supply chain management*. Thousand Oaks, CA: Sage Publications.
- Miemczyk, J., Johnsen, T.E., & Macquet, M. (2012). Sustainable purchasing and supply management: a structured literature review of definitions and measures at the dyad, chain and network levels, *Supply Chain Management: an international journal*, 17(5), 478-496.
- Mills, J. F., Schmitz, J., & Frizelle, G. D. M. (2004). A strategic review of supply networks. *International Journal of Operations & Production Management*, 24(10), 1012-1036. doi:10.1108/01443570410558058
- Morgan, R. M., & Hunt, S. D. (1994, July). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20-38. doi:10.2307/1252308
- Natarajarathinam, M., Capar, I., & Narayanan, A. (2009). Managing supply chain in times of crisis: A review of literature and insights. *International Journal of Physical Distribution & Logistics Management*, 39(7), 535-573. doi:10.1108/09600030910996251
- New, S. J., & Payne, P. (1995). Research frameworks in logistics – three models, seven dinners and a survey. *International Journal of Physical Distribution & Logistics Management*, 25(10), 60-77. doi:10.1108/09600039510147663
- Noori, H. (2004, February). Collaborative continuous improvement programs in supply chain. *Problems and Perspectives in Management*.
- Pilbeam, C., Alvarez, G., & Wilson, H. (2012). The governance of supply network: a systematic literature review. *Supply Chain Management: an international journal*, 17(4), 358-376.
- Porter, M. E. (1985). *Competitive Advantage*. New York: The Free Press.
- Ross, D. F. (1997). *Competing through supply chain management: creating market-winning strategies through supply chain partnerships*. London: Chapman & Hall.
- Salvador, F., Rungtusanatham, M., & Forza, C. (2004, June). Supply-chain configurations for mass customization. *Production Planning and Control*, 15(4), 381-397. doi:10.1080/0953728042000238818

Structuring and Managing Supply Network

- Saunders, M. (1994). *Strategic purchasing and supply chain management*. London: Pitman Publishing.
- Shi, Y., & Gregory, M. (1998). International manufacturing networks – to develop global competitive capabilities. *Journal of Operations Management*, 16(2), 195-214.
- Singh Srari, J., & Gregory, M. (2008). A supply network configuration perspective on international supply chain development. *International Journal of Operations & Production Management*, 28(5), 386–411. doi:10.1108/01443570810867178
- Skinner, W. (1969). Manufacturing – missing link in corporate strategy. *Harvard Business Review*, 47, 136–145.
- Slack, N., Chambers, S., & Johnson, R. (2007). *Operations management*. Harlow: FT/Prentice Hall.
- Slone, R. E., Dittman, J. P., & Mentzer, J. T. (2010). *The New Supply Chain Agenda: the five steps that drive real value*. Boston, MA: Harvard Business Press.
- Soni, G., & Kodali, R. (2011). A critical review of supply chain management frameworks: proposed framework. *Benchmarking: an international journal*, 20(2), 263-298.
- Taylor, T. A., & Plambeck, E. L. (2007, October). Supply chain relationships and contracts: The impact of repeated interaction on capacity investment and procurement. *Management Science*, 53(10), 1577–1593. doi:10.1287/mnsc.1070.0708
- Waller, D. L. (2003). *Operations management: a supply chain approach*. London: International Thomson Business Press.
- Weele, A. J. (2000). *Purchasing and supply chain management: analysis, planning and practice*. London: Business Press.
- Welch, J. A., & Ranganathan Nayak, P. (1992). Strategic sourcing: A progressive approach to the make-or-buy decision. *The Academy of Management Executive*, 6(1), 23–31. doi:10.5465/AME.1992.4274302

Chapter 20

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges: Case of Tanzania

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ABSTRACT

In absence of effective state institutions, informal and private sector operations tend to govern the market. This problem is evident in the petroleum industry in Tanzania. However, little is known about how players in petroleum industry operate in those business environments. The purpose of this chapter is to explore establishment of a relationship between supplier-logistic firms in a post planned economy. The study employed case study interview with two petroleum products distributors in Tanzania to achieve its objective. Data were analyzed by thematic analytical techniques. Three major findings regarding buyer-suppliers relationships in developing economies are presented: actors do not prefer to enforce contract that they sign, discretionary relationships exist in petroleum business among actors and 'undugunization' is the strongest criteria in selection of actors. Study implies that for a supplier-logistic relationship to exist government has a great role to play in enforcement of laws.

INTRODUCTION

Since 2000 when the petroleum business was liberalized in Tanzania, competition has increased upstream and downstream (Ernst & Young, 2013). It is estimated that there are 60 petroleum distributing companies and 1,074 retailing filling stations in the country. Most retailing filling stations are independently owned. This fact reduces the ability of distributors to dictate petroleum business in the country. Demand

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for total fuel consumption increased in Tanzania for 10 per cent from 2.6 billion litres in 2013 to 2.9 in 2014 (The Guardian, 2014). On the other hand, downstream petroleum and related product business became more competitive by more filling stations to be free to buy from any distributors. Which mean distributors have to improve their services to maintain and attract new customers (Ernst & Young, 2013).

Previous studies of supplier-retailer relationship in Africa focused on satisfaction of channel members (Bonsu & Sigure, 2012), the effects of conflicts on supplier-retailer relationship in brewery industry in Cameroon (Biboum & Sigure, 2014), the lack of trust and its effects on supplier-retailer relationship in Uganda (Ahimbisibwe, 2014). Furthermore, these studies employed quantitative analytical techniques. With the emergence of the private sector in Africa, it is very important to understand how distributors operate in the fragile yet growing business environment on the continent. Kuada (2008) studied the effects of power on establishment of the relationship in Ghana between local and foreign companies. He found that local companies, due to lack of power, have no chance to influence on the clauses of contracts which results in greater potential losses to them. Another study by Boampong (2009) examined how Ghana's exporters operate in market imperfections. The current study is on local actors and how they establish relationship.

Deshpande (1983) argues that for new phenomena qualitative measures are encouraged in order to understand various dimensions that prevail in business. Because this is a new phenomenon in most of African countries, and in particular Tanzania, the use of qualitative method is very appropriate to understand how actors select other players. In Tanzania studies on the fuel value chain focused on competition and price margin (Ernst & Young, 2013). Another study identified that native entrepreneurs in Tanzania were not trustworthy and committed to contracts (Stein, 2004). However, this study focused on the role of networks and business success.

Given the lucrative nature of the industry and the opportunities for cheating, it is very important to investigate how actors in value chain operate in this kind of environment in fuel sector. Furthermore, most of these studies were commissioned jobs by government agencies for instance Ernst and Young (2013) which reduce credibility of the influence of the third party on the reports. Despite the importance of the petroleum sector in the Tanzania's economy, most of previous value chain studies conducted in the country focused on agriculture commodities supply chain, neglecting the petroleum industry. Additionally, existing studies heavily relied on Gereffi et al's (2005) governance perspective supply chain. This chapter intends to fill that gap by examining the petroleum sector by using relational perspective of Supply Chain Management (SCM) as proposed by Dyer and Singh (1998). The marketing relationship with perspectives of distributors is explored. In particular, this chapter intends to answer the following questions:

- How actors establish relationships in petroleum retailing industry in Tanzania?
- What criteria do they use to choose a logistic firm?
- How long do these relationships last?

Since the emergence of the private sector in mid-1985 in Tanzania, private firms have been prominent for importing and retailing of petroleum products. Some companies acted as suppliers with retailing filling stations and others concentrated on importations as suppliers alone. The distribution of petroleum products involves partnerships between retailing firms and logistic companies.

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RELATIONSHIP, TRANSACTION COST ANALYSIS, AND NETWORK THEORY

The past two decades have witnessed a significant paradigm shift of modern business management from competition between individual businesses to competition between network of businesses and relationships, for the purpose of creating sustained competitive advantage (Dyer & Singh, 1998; Lambert & Cooper, 2000). This paradigm shift is an international one that is also evident in Tanzania and Africa. As firms seek to establish efficient business relationships and networks, Reutterer and Kotzab (2000) put forward that relationship establishment is an interplay of certain variables such as: 1) concentration of the core activities of the business; 2) consolidation of supply chain activities to realize economies of scale; 3) integration of all supply chain activities by using the same organizational and information technology (IT) standards at every echelon in the system; and 4) performance measurement to achieve better service levels and lower costs. According to Dyer and Singh (1998), business relationships and networks allow firms to procure assets, competences, or capabilities not readily available in competitive factor markets, particularly specialized expertise and intangible assets, such as reputation.

While Collins and Burt (2006) contend that any business relationship provides reduced excess costs, increased flexibility, reduced uncertainty and/or improved profitability by increasing sales and gross margins, and developing the right type of business relationships which is very challenging for supply chain partners which are associated with several challenges. These can include cheating, lack of mutual goals and expectations, and lack of proper basis for determining which members are critical to the success of the company and the supply chain (Arshinder, 2011; Lambert, 2008). We agree with the previous research that, the success or failure of any business relationship is based on: incentive design (i.e., how resources, risks and reward are shared between firms) (Wathne & Heide, 2004); trust (i.e., willingness to rely on an exchange partner in whom one has confidence) (Schulze, 2006); commitment (i.e., the desire by a party to a business relationship to maintain and strengthen that relationship) (Subramani, 2003); information and knowledge sharing (Sheu, 2006); institutional forces (i.e., certain external circumstances that influence formation and functioning of business relationship) (Kotelnikova, 2013) and the extent to which compatibility of organizational culture, value and beliefs between firms exist (Tepic, Omta, Trienekens, & Fortuin, 2011).

However, in this chapter, we use a broader definition of relational perspective as proposed by Dyer and Singh (1998) because it provides us with an increased understanding of critical factors contributing to relationship establishments. The authors propose two classes of relationship establishments: third-party enforced of agreements (e.g., legal contracts), and self-enforced agreements in which 'no third party intervenes to determine whether a violation has taken place'. Relationships based on transaction cost analysis fall primarily within the first class as they suggest that relationship establishments and dispute resolution requires access to a third party enforcer, whether it be the state (e.g., through contracts) or legitimate organization authority. In contrast, self-enforcing agreements involve safeguards that allow for self-enforcement.

EMPIRICAL LITERATURE REVIEWS

Previous studies in value chain activities of actors have yielded three major perspectives of the concept which are governance, relational, and structural (Hoenen & Omta, 2012). This study focus on relational governance which emerges from values and agreed processes generated through interactions and exchanges

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in social relationships (Granoveter, 1985). The emergence of such relationship depends greatly on how actors in the value perceive each other. The focus and interest of each actor is to benefit each member in the future through their actions over time. Zenger et al., (2002) emphasized that relational governance involves rules based on implicit understanding which are usually socially derived and, therefore, not immediately accessible through written documents or sanctions through a formal positions.

A key concept in the relational view of governance is trust (Fortuin *et al.*, 2011; Dwyer et al., 1987). Furthermore, Dwyer et al., (1987) argue that trust is a new concept that was introduced in the buyer-seller relationship. Trust involves confidence or positive expectation about another's behavior and willingness to expose oneself to vulnerability under conditions of risk and interdependence (Bhattacharya, et al., 1998; Das & Teng, 1998; Schurr, & Ozane, 1985). Lack of trust suggests that most traders do not invest much in social relationships with the expectation of long term benefit. Heide and John (1992) identified three dimensions inherent in inter-firm relations: flexibility or willingness to make adaptations, proactive information exchange, and solidarity or high value placed on the relationship. Information exchange is very important for buyer-seller relationships because through this exchange each part will be aware of the business environments as well as having information on the reputations of other's actors in the chain. This suggests that social capital is most influential in the decision to engage in business or not.

Dwyer et al., (1987) noted the higher the information flow the more aware actors become. Hence, information flow can influence relationship development among actors. However, flow of information in many African countries is very low making it difficult for it to be a factor in decision making. Therefore, information asymmetry induced actors in the chain to decisions of their means to survive in this business environment. Furthermore, most value chain actors are not members of any business association and thereby do not have access to the greater range of information that business associations could provide. Whether this lack of membership in business associations is due to the absence of business association or negligence of actors themselves still handicaps the value chain actors.

In these business environments, contractual agreements between actors are important for protecting the rights of individuals in the value chain. Some of the challenges facing petroleum industry and particularly in Tanzania are petroleum adulteration and payment delay. Structural perspectives presume that the efficacy of inter-organizational cooperation is highly influenced by the initial design of the cooperative arrangement (Poppo & Zenger, 2002; Williamson, 1985). This assumption promotes the designing and formalization of buying procedures among actors and in most cases signing of contract is preferred. Contractual formalization involves externally (i.e., legally) enforceable contract, while extra-contractual agreements such as job descriptions, rules and procedures, are internally enforceable documents (Grandori & Furlotti, 2010).

However, previous study conducted in Ghana indicates that actors in the value chain do not prefer to sign contracts and enforcement of it (Amoako & Lyon, 2014). This influenced many factors such as uncertainty which caused a lack of supply and delayed justice in most of courts in African countries. Rational commitment is one of the very important factors which are based on the interest based reasoning of the structural perspective (Fortuin *et al.*, 2011). The concept assumes that an individual would prefer to invest in a particular relationship with expectation to be rewarded in future. Furthermore, the relational commitment is not documented or formalized.

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges**METHODOLOGY**

Data were collected from two leading petroleum distributing companies: Tanzania Oil Company Limited (Oil Com) and Camel Oil Company (Camel). As indicated in Table 1, both companies control 17 per cent of the market share. The selection of the case is very important for the case study method (Gibbert, et al., 2008). The selection was based on the companies found in top ten lists of best performers, must be a distributor of petroleum products, and must be owned by indigenous entrepreneurs over 50%. These companies were found in the commercial city of Dar-Es-Salaam and they are owned by indigenous entrepreneurs. Originally, five companies were selected by researchers to participate in the study based on their performance as Table 1 shows, but three distributors declined the invitation to participate. Researchers visited the head offices of the two accepted companies by introducing themselves and explaining the purpose of the study.

Flyvberg (2006) argues that to use multiple cases or single case depends on the problem at hand and the circumstances. The petroleum business has been largely secret due to its importance, so there is strong control on price and measurements by government agencies. This situation limits most distributors to participate in open conversations such as research. For convenience, the contact person was asked for his or her easiest means of communication which was by mobile phone in most cases. After a telephone follow up for the selected contact person in each of the companies, three respondents declined our invitation with the reasons such as they are preoccupied; hence, they could not participate in the study. Interviews were conducted at the participants' offices and took an average of one hour. Respondents were comprised of general marketing manager, supplies manager and petroleum marketing consultant. All of the respondents from participated companies were male.

Respondents had working experience of an average of 15 years in the petroleum industry with different countries including Kenya, Uganda, South Africa, and India. Two researchers participated in the interview. One had guided the interview and the other was the scribe, taking notes during the interview. For data collection during interviews, participants were asked for their permission for researchers to use tape recorder and their willingness to accept the use of it during data collection. Both Kiswahili and English languages were used during the interviews.

Table 1. Petroleum and related product market share in 2013 (in %)

| Name of the Company | 2012 | 2013 |
|---------------------|------|------|
| Puma | 12.2 | 12.7 |
| ORXY | 11.1 | 11.5 |
| Oil Com | 05.9 | 11.5 |
| Gapco | 12.1 | 08.6 |
| Total | 7.5 | 7.3 |
| Mogas | 5.1 | 6.6 |
| Camel | 6.3 | 5.5 |
| Engen | 5.3 | 5.5 |
| Others | 34.5 | 30.8 |
| Total | 100 | 100 |

Source: Ernst and Young, (2013)

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Semi-structured questions were used to allow researchers to inquire about related issues for various important dimensions of the study. On-going questions and provocative questions were employed also implemented. Agee (2009) argues that ongoing qualitative research questions are very important to understanding unfold part and perspective of others. A thematic analysis technique was used for data analysis. Braun and Clarke (2006) argue that thematic analysis is flexible in that it can allow changes while the research is in process. The technique allows researcher to set dimensions and identify patterns emerge in the documents.

Attride-Stirling (2001) argues that for the thematic analysis to be of meaningful, it is of important to define and elaborate the means of connections between dimensions. Dimensions which were established based on the previous discussions of the theories and empirical findings included: trust and commitment (reputations, payment period, fulfillment of promises, signing of contract, period of relationship), social and network (family members, where do they meet, frequency of meeting or telephone call). Data were transcribed and manually coded for identifications of emerged patterns. Basit (2003) defines codes or categories as labels assigned to the units of words to allocate a particular meaning from gathered data. Furthermore, data were corroborated with newspapers reports and research reports.

FINDINGS

Criteria for Selection of a Partner

One of the crucial issues in the supply chain is the selection of a partner either downstream or upstream. Empirical evidence shows that each partner has a great role to play in the success of other members. However, in practice most actors are opportunistic resulting in a decline in profit for the affected members; hence, deterioration of the trust in most cases. A major challenge in developing economies is the enforcement of laws. As a result, actors do not prefer to go to court to settle disputes; instead, they use some activities or techniques to reduce anticipated problems. Therefore, selection of the partner in the value chain is very important.

Respondents were asked how they choose a partner. In general, this study indicates that partners are selected based on presentation of legal certificates such as business license, physical address of the company and long term relationship. Furthermore, this study identified that ‘undugunization’ is very important elements for a company to be selected. *Undugunization* is a blending of Swahili and English word whereby ‘Undugu’ can be translated as relative or next of kin. ‘Undugunization’ is similar with ‘guanxi’ in the Chinese business environment, but the difference is in the parameters that form each other. While ‘Guanxi’ is formed by the characters that depict pride, respect and trust, ‘undugunization’ characterized with ‘respect, family relationship, and trust’. Pride is not part of that. One of the participants said:

To minimize risk some time we choose people whom we know to work with such as next of kin.

Previous study by Alan *et al.*, (2009) on entrepreneurship and gender found a network is likely to be established among next of kin entrepreneurs in Tanzania. In some cases there were specific skills that were considered important. For example, the ability of a carrier to transport huge quantities of a products

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is a criteria used for the selection of a logistic firm. Reputation of the firm also emerged to be a strong factor as well. In these cases, the interest is in legality of the company such as certifications, and the bank's recently financial position.

We ask for certifications such as trucks registrations and insurance certificates. We also cross if the company has a good record in paying its employees especially drivers.

Governance Formalization

Interview data show there there is mix of conduct among actors in the petroleum value chain in Tanzania. First, distributors are used both as system contracts and no contract to operate in the oil business. However, contract signing has been the most preferred for a long time.

Petroleum business is business that involves huge sum of money just on one truck. Therefore when we rare engaging in a deal that assumes more than four Lories for one company we would like to have contract with a buyer.

The agreements between actors are on delivery, quality, and price and payment mode. When further asked if they enforce contract once there is a breach, both indicated they are not in favor of court divisions for their business operations.

We don't prefer to settle our problems in court. Because once you are attending court hearings that is the end of your future business and for us we like to have long time relationship with our buyers.

Because resolution of conflicts in a court of law is limited by delays in court decisions which, in turn, affects business operations, most trade partners prefer to settle their problems out of court. Similar findings by Amoako and Lyon (2014) for the Ghana's entrepreneurs deal with foreign business. Mkan-dawire (2009) referred to this as the focus of institutions to 'stabilize' business environments with less interest on 'development'.

Contract Signing

Most firms tend to reduce risks associated with working with untrustworthy logistic firms by signing a contract. However, it has been observed that for less complex business decisions, distributors do not sign contracts with the logistic firms, preferring instead to work with a company with which it has had an extended relationship. Similar to the findings by Stein (2004), the current study finds lack of trust and commitment among actors in the petroleum value chain in Tanzania. Trust, one of the important dimensions in business, is evident when parts fulfill their promises and continue doing business for a long time and solve their problem outside the court room. Participants said:

Retailers don't pay us on time. This causes problems with our partners such as logistic firms. Therefore, if we have a long term relationship with retailers and we know it for sure with the previous history he will pay. The company can pay a logistic firm in advance to secure the relationship.

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Enforcement of Contracts

One of the challenges in suppliers-retailers relationship is problem of enforcement of law when the contract has been breached. However, our findings suggest that suppliers do not prefer to take their problems to court as mentioned earlier. This is very interesting because the theory of power indicates that they can exercise their power to punish or even threatening companies that breach the contract (Kuada, 2008). When asked why the other party does not abide by the contract as stipulated, managers who were interviewed explained three major reasons:

One possibility of any of your enemy to be your best allies is high. Therefore, in most cases actors don't prefer to solve their problem by presenting their matter to the court of law. The other reason is delay of judgment, that company has to use its scarce resources on follow-up of the court decisions and during the time possibly most of the fund can be frozen by the decision of the court. When funds are frozen a particular firm is one that is facing challenges if faced with budget constraints. The last reason seems to be human and on the fact that most of the employees expected at any time to join one of the companies, this results in not enforcing the contract.

However, we suspect that an important factor is that actors in the petroleum value chain choose their relatives as we have seen in the issue of 'undugunaization'. It is likely that when problems occur, neither of the parties would like to cause trouble because they will potentially be disruptive at the family level. Thus, there are strong family values that limit parties taking matters to court when a contract is breached. Furthermore, this suggests that Tanzania's business environment is changing faster than the country's policies. The finding is similar with previous findings by Nkya (2002), Ferrali, (2012) on the mismatch between policy reforms and entrepreneurial spirits in Africa.

CONCLUSION

Most African countries are witnessing the growth of transport sector which accelerates the growth of petroleum business on the continent. One of the major challenges faced by the petroleum sector is development of positive relationship between actors in the value chain. Currently, the petroleum business can be characterized as a discrete relational model. MacNeil (1980) defined discrete relationships as formed of the basis of money on one side and measured by commodity on the other. As has been articulated, parties prefer not to adhere to contracts. However, the current study demonstrates that despite the form of relationships that prevail in the Tanzanian business environment as one focused primarily on material benefit, firms in the petroleum industry are trying to establish a long time relationship through franchising one by one.

The growth of the economy indicates that there is stiff competition in many sectors including petroleum retailing. For firms to survive either at downstream or upstream, collaboration with other members is very important. However, the study indicates that collaboration is facilitated by the enforcement of a particular country's laws and regulations. Future research can be conducted on outcome of the relationship among the actors with focus on the performance of key indicators such as sales, profit and margin among actors in the value chain. There are many challenges of having access to financial matters in developing countries like Tanzania where most of the companies do not have audited financial reports and few who

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do are not ready to share with outsiders. Maintaining proper records is also a challenge to most firms in developing countries. However, we propose a qualitative survey with questions on estimated figures as part of the questions instead of relying on them to provide figures.

Understandably the weakness of this approach is that will be highly influenced by the researchers but could lead to reduce the problem of accurate data and biasness. Further study is proposed to include other actors in the value chain such as logistic companies, government officials and business associations. Undugunization studies in Africa have contradictory findings. For example, a study in Madagascar by Minten and Fafchamps (2000) found it reduces a firm's efficiency. Hart (1988) found that kinship is very strong in enabling marginalized people in community in raising capital in African community. But more studies are needed across varied industries including services and petroleum in order to understand impact of working with next of kin (Undugunization) on firms' performance in developing economies.

Competing by collaborating with the members in the supply chain is becoming increasing necessary but, at the same time, collaboration is prone to conflicts. Hence, supply chain managers need to diagnose and understand the impact of their decisions in supply chain collaborative. Our findings provide several guidelines as to how managers can manage their relationship. First, to minimize risk of loss, managers must seek information from other actors in the value chain or work with consumers with good social capital. One way to accomplish this is to work very closely with other members who can share information on partners when necessary. Second, attention must be given to the circumstance of collaborations to avoid much loss and delay of payment from petroleum retailers. In this manner, managers can avoid loss by working companies that have a long relationship with and next of kin with some of their member of staff.

The current study has a number of weaknesses: (1) recruitment of respondents based on convenience sampling which was caused by the availability and acceptance of the participants. This caused us to have only among of the best performer and lacked information from below the line; (2) the study concentrated only with distributors which limit the ability to compare with the views of other actors in the chain such as retailers.

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REFERENCES

- Agee, J. (2009). Developing qualitative research questions: A reflective process. *International Journal of Qualitative Studies in Education*, 22(4), 431–447. doi:10.1080/09518390902736512
- Ahimbisibwe, A. (2014). The influence of contractual governance mechanisms, buyer-supplier opportunistic behavior on supplier performance. *Journal of African Business*, 15(2), 85–99. doi:10.1080/15228916.2014.920610
- Alan, I. S., Nilson, K., & Rutashobya, L. K. (2006). Gender, network and entrepreneurial outcomes in Tanzania. *Journal of African Business*, 10(1), 67–83.

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges

- Amoako, I. O., & Lyon, F. (2014, March 01). 'We don't deal with courts': Cooperation and alternative institutions shaping exporting relationships of small and medium sized enterprises in Ghana. *International Small Business Journal*, 32(2), 117–139. doi:10.1177/0266242613484778
- Arshinder, K., Kanda, A., & Deshmukh, S. G. (2011). A review on supply chain coordination: Coordination mechanisms, managing uncertainty and research directions. In T.M. Choi, & T.C. Edwin Cheng (Eds.), *Supply Chain Coordination under Uncertainty* (pp. 39-82).
- Attride-Stirling, J. (2001). Thematic network: An analytical tool for the qualitative research. *Qualitative Research*, 1(3), 385–405. doi:10.1177/146879410100100307
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45(2), 143–154. doi:10.1080/0013188032000133548
- Bhattacharya, R., Devinney, T. M., & Pillutla, M. M. (1998). A formal model of trust based on outcomes. *Academy of Management Review*, 23, 456–476.
- Biboum, A. D., & Sigure, S. P. (2014). Conflict in supplier-retailer relationships in the Brewery Industry in Cameroon. *Journal of African Business*, 15(2), 75–84. doi:10.1080/15228916.2014.925361
- Boampong, O. (2009). Market imperfections and the effectiveness of subcontracting and institutions in export market transactions in Ghana [Unpublished PhD Thesis]. University of Birmingham.
- Braun, V., & Clarke, V. (2006). Using thematic analysis in Psychology. *Qualitative Research in Psychology*, 3(2), 77–101. doi:10.1191/1478088706qp063oa
- Collins, A., & Burt, S. (2006). Private brands, governance, and relational exchange within retailer-manufacturer relationships: Evidence from Irish food manufacturer supplying the Irish and British grocery markets. *Agribusiness*, 22(1), 1–20. doi:10.1002/agr.20068
- Das, T. K., & Teng, B. S. (1998). Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of Management Review*, 23, 491–512.
- Deshpande, R. (1983). Paradigms lost: On theory method in research in marketing. *Journal of Marketing*, 47(4), 101–110. doi:10.2307/1251403
- Dwyer, F. R., Schurr, P. H., & Oh, S. (1987). Developing buyer-seller relationships. *Journal of Marketing*, 51(2), 11–27. doi:10.2307/1251126
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and source of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- Ernst and Young (2013). Review of petroleum wholesalers and retailers margins.
- Ferrali, R. (2012). The Maghribi industrialists: Contract enforcement in the Moroccan industry 1956-1982. Working Papers No.162/12, Department of Economic History, London School of Economics.
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. doi:10.1177/1077800405284363

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges

- Gereffi, G. Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of Political Economy*, 128(1), 78-104.
- Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study. *Strategic Management Journal*, 29(13), 1465–1474. doi:10.1002/smj.722
- Grandori, A., & Furlotti, M. (2010, June 17-19). Flexible formalization: a study on the components of contractual and extra formal organization. Proceedings of the 14th Annual Conference of the International Society for New Institutional Economics at the University of Stirling, Scotland, UK.
- Granoveter, M. S. (1985). Economic action and social structure: The problem of embeddedness. *Journal of Sociology (Melbourne, Vic.)*, 91, 481–510.
- Hart, (1988). Kinship, contract and trust: The economic organisation of migrants in an African city slum. In D. Gambeta (Ed.), *Trust: Making and Breaking Cooperative Relations* (pp. 176-193). Oxford: Blackwell.
- Heide, J. B., & John, G. (1992). Do norms matter in marketing relationships? *Journal of Marketing*, 56(2), 32–44. doi:10.2307/1252040
- Hoenen, S. J., & Omta, S. W. F. (2012). Fundamental perspectives on supply chain management. *Journal on Chain and Network Science*, 12(2), 199–214.
- Kotelnikova, Z. (2013). Structural embeddedness and contractual relationships of chain stores and their suppliers in Russian emerging markets (Working Paper). Basic Research Program.
- Kristiansen, S. (2004). Social networks and business success. The role of subculture on business success. *American Journal of Economics and Sociology*, 63(5), 1149–1171. doi:10.1111/j.1536-7150.2004.00339.x
- Kuada, J. (2008). Power asymmetries and relationships between MNCs and local firms in Africa. *African Journal of Business and Economic Research*, 3(2-3), 92–105.
- Lambert, D. M. (2008). *Supply chain management: Processes, partnerships, performance*. Sarasota, Florida. London: Supply Chain Management Institute.
- Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29(1), 65–83. doi:10.1016/S0019-8501(99)00113-3
- MacNeil, I. R. (1980). Contracts: Adjustment of long-term economic relations under classical, neoclassical and relational contract law. *Northwestern University Law Review*, 72, 854–902.
- Minten, B., & Fafchamps, A. (2000). Returns to social capital among traders, University of Oxford, Queen Elizabeth House (Working Paper No. 145). Development Studies.
- Mkandawire, T. (2009). *Institutional monocropping and monotasking in Africa. Democracy, Governance and Well Being Programme, Paper Number 1*. Geneva: United Nations Research for Social Development.
- Nkya, E. J. (2002). *Entrepreneurial response to the reform of institutional framework: The case of small scale enterprises in Tanzania*. Mzumbe University Adger Collaboration Research.

Relationship Establishment in SCM in a Market with Enforcement and Regulation Challenges

- Poppo, I., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8), 707–725. doi:10.1002/smj.249
- Reutterer, T., & Kotzab, H. W. (2000). The use of conjoint-analysis for measuring preferences in supply chain design. *Industrial Marketing Management*, 29(1), 27–35. doi:10.1016/S0019-8501(99)00109-1
- Schulze, B., Spiller, A., & Wocken, C. (2006). Supplier relationship quality in German pork and dairy sector: Theoretical considerations and empirical evidence. Paper Presented at the 16th Annual.
- Schurr, P. H., & Ozanne, J. L. (1985). Influence on exchange processes: Buyers' preconceptions of a seller's truth worthiness and bargaining toughness. *The Journal of Consumer Research*, 11(4), 939–953. doi:10.1086/209028
- Sheu, C., Rebecca Yen, H. J., & Chae, B. (2006). Determinants of supplier-retailer collaboration: Evidence from an international study. *International Journal of Operations & Production Management*, 26(1), 24–49. doi:10.1108/01443570610637003
- Sigué, S. P., & Bonsu, S. K. (2012). Influence strategies and channel member satisfaction in Cameroon. *Journal of African Business*, 13(3), 200–208. doi:10.1080/15228916.2012.727747
- Subramani, M. R. (2003). How do suppliers benefit from IT use in supply chain relationships? Working Paper no. 02-14, Management Information Systems Research Centre.
- Tepic, M., Omta, O., Trienekens, J., & Fortuin, F. (2011). The role of structural and relational governance in creating stable innovation networks: Insights from sustainability-oriented Dutch innovation networks. *Journal of Chain and Network Science*, 11(3), 197–211. doi:10.3920/JCNS2011.x206
- Tepic, M., Omta, O. S. W. F., Trienekens, J. H., & Fortuin, F. T. J. M. (2011). The role of structural and relational governance in creating stable innovation networks: Insights from sustainability-oriented Dutch innovation networks. *Journal on Chain and Network Science*, 11(3), 197–211. doi:10.3920/JCNS2011.x206
- The Guardian. (2014, October 17). *EWURA: Demand for petroleum up by 10 percent*.
- Wathne, K. H., & Heide, J. B. (2004). Relationship governance in a supply chain network. *Journal of Marketing*, 68(1), 73–89. doi:10.1509/jmkg.68.1.73.24037
- Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.
- Zenger, T. D., Lazzarini, S. G., & Poppo, L. (2002). Informal and formal organization in new institutional economics. *Advances in Strategic Management*, 19, 277–306. doi:10.1016/S0742-3322(02)19009-7

Chapter 21

Supply Chain Management Practices in Retail–The Trends and Future Perspective

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ABSTRACT

Retailing is amongst the leading industries that derive demand in the world. There is severe competition among retailers regarding supply chain management (SCM) practices used in this industry. Hence, this chapter mainly aims to address the supply chain management (SCM) practices (quick response, efficient consumer response, category management, continuous replenishment planning, continuous planning forecasting and replenishment, postponement, vendor managed inventory) and future trends in retailing. Moreover, this chapter provides insight for the retail practices preferred in emerging and developed markets. The chapter presents important implications for scholars, business executives, scholar-practitioners and university students who are interested in any part of retailing and supply chain management.

INTRODUCTION

Retailing covers the business processes comprised of selling goods and services to consumers for their personal, family or household use (Berman & Evans, 2004). While the scope of retailing is wide, and it is a key driver of global economy, in which aggregate sales of the top 250 retailers reached US\$4.29 trillion in 2012 (Deloitte, 2014). As retailing is among the most diverse and dynamic sectors, offering an ever increasing range of goods and services (Jones et al., 2005; George et al., 2013), achieving sustainable competitive advantage in this sector can be challenging.

The impact of globalization has changed the retail environment as retailers have become the active designers and controllers of supply and demand management which needs to be managed according to customer requirements. Retail success is obtained when high gross margins and desired customer ser-

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vice is provided with minimum inventory level (Mattila et al., 2002). Regarding these issues, retailing research can be grouped into different research categories such as pricing, promotion, product/branding, services, loyalty, consumer behavior, channels, organizations, internet and other (Grewal & Levy, 2007). In addition to these categories, emerging research issues in retailing have been identified as growth of the internet and e-commerce, branding and customer loyalty, service success strategies, and behavioral issues in pricing and patronage (Grewal & Levy, 2009).

As competition today mainly occurs at the supply chain rather than at the company level (Christopher, 1992), supply chain management (SCM) practices have become significant for the retail supply chain members. Supply chain management practices have been defined as a set of activities which organizations carry out in order to enhance the efficiency and effectiveness along the supply chain (Li et al., 2006). In the extant literature, there are a number of studies that discuss the SCM practices from a variety of different perspectives (e.g., Donlon, 1996; Tan et al., 1998; Alvarado & Kotzab, 2001; Li et al., 2006). The major themes of these studies are mainly examine supplier partnership, customer relationship, information sharing, postponement, customer service management, purchasing, quality, and outsourcing for representing SCM practices.

In all areas of retailing, retail information systems play an increasingly important role in effective information sharing among the chain members. The typical tasks of a retail information system are merchandise planning, order management, order receipts, invoice control, sales, payment, and inventory control (Kotzab, 2005). Through the use of information technology (IT), operational strategies such as Continuous Replenishment Planning (CRP), Collaborative Planning Forecasting and Replenishment (CPFR), Quick Response (QR), Efficient Consumer Response (ECR) and Vendor Managed Inventory (VMI) have become essential tools for all types of retailers (Lowson, 2001).

Future trends in retailing will be based on changing consumer demographics, increasing needs of consumers, the reduced amount of time spent searching for and purchasing products, fluctuations in the cost of food products consumed home and away from home, technological trends, and multiple retailing channels (Peterson & Balasubramanian, 2002). Moreover, the major supply chain trends that lead to transformations in the retailing are global sourcing practices, multichannel routes to market and relationship-based innovation (Ganesan et al., 2009). From the practitioners' perspective (Deloitte, 2014), there exists a myriad of supply chain challenges such as same day delivery, free shipping, inventory availability, and "buy online/pick-up in store service".

In addition, there is a need to consider emerging trends in retailing such as the advances in 3D printing applications and the increasing use of digital and social media, as well as the international expansion of the retailers especially into emerging markets. This chapter mainly aims to address the following questions:

- A. What are the main supply chain management practices in retailing?
- B. Do the supply chain management practices vary according to retailers?
- C. What are the trends that will shape the future perspective in retailing?
- D. What are the leading retail SCM practices in developed and emerging markets?

The contribution of this chapter is three-fold. Firstly, it provides a deeper understanding of SCM practices in retail from different perspectives. Secondly, it aims to highlight the trends and provide projection for future perspective in retail. Furthermore, we also provide some evidence for the differences and similarities in emerging and developed retail markets.

*Supply Chain Management Practices in Retail-The Trends and Future Perspective***SUPPLY CHAIN PRACTICES IN RETAILING**

Retailing is not a business in which “one size fits all” strategy is applicable. SCM strategies performed by retailers differ according to the retailer’s model (Randall et al., 2011). The world’s largest retailers, such as Wal-Mart, Carrefour, Metro, and Tesco or smaller in scale but more specialized ones such as Sephora and Douglas, H&M, and the GAP need the support of well-established supply chain structures and efficiently managed SCM practices (Swoboda et al., 2005, 2008). The SCM practices serve to the retail supply chain members including customers. The retail supply chain is comprised of several different, independent members, each with different goals, objectives and benefits (Stock et al., 2010).

The encouragement to found a long-term strategic partnership increases when there is a high level of interdependence (Kent & Mentzer, 2003). For instance, Walmart has founded partnerships with manufacturers such as Procter & Gamble and 3M to reduce the logistics costs both for the manufacturer and the retailer (Mentzer et al., 2000). From retailers’ point of view, there are a number of critical success factors in sourcing products, particularly forecast accuracy, process lead time, offshore/local sourcing mix and up-front/replenishment buying mix (Mattila et al., 2002). In all the critical success factors, the key role of data accuracy is evident. In order to enhance the data accuracy and integration, Quick Response (QR), Efficient Consumer Response (ECR), Category Management (CM), Continuous Replenishment Planning (CRP), Collaborative Planning, Forecasting, and Replenishment (CPFR), postponement and Vendor Managed Inventory (VMI) are used in the retailing industry. Each of these is explained below.

- **Quick Response (QR) and Efficient Consumer Response (ECR):** The role of responsiveness is significant both for click and mortar stores and click stores as well as brick and mortar ones (Ferne et al., 2010). The need for more efficient and more responsive supply chains to is significant to deal with changing trends and consumer demand characteristics especially in fashion retailers (Barnes & Greenwood, 2010). In this sense, quick response is a synonymous practice with the textile and apparel supply chain (Christopher et al., 2004; Barnes & Greenwood, 2010; Ferne et al., 2010).

Quick Response (QR) is a demand driven strategy which bases on information sharing between parties by utilizing information technologies and tools such as Electronic Data Interchange (EDI), point of sales (POS), QR codes, Computer Aided Design (CAD), and Computer Aided Manufacturing (CAM) in order to be more responsive and flexible (Ferne, 1994; Lowson et al., 1999; Birtwistle et al., 2006). In QR programs, due to the extensive need of integration and collaboration, partnerships act as one of the major components (McMichael et al., 2000). QR enables to have reductions in lead times, inventory levels and forecasting errors.

Furthermore, application of this time-based strategy contributes in creating better product assortments and variety that will result in better space allocation. In quick response, cross-docking and floor-ready merchandise (e.g., as pre-labeled and pre-hanged) are also crucial for speeding up the time-to-market and responding to the requirements of fast fashion (Lowson et al., 1999; Birtwistle et al., 2003). Moreover, although response to complaint management changes according to retailer types (Hansen et al., 2010), quick response is a general and common strategic practice for ensuring and managing product-harm crisis and product returns (Standop & Grunwald, 2009).

As a response to the QR emerged between suppliers and fashion retailer in the mid-1980s, ECR was initiated by the US grocery retailers in 1992 (Corsten & Kumar, 2005). ECR is still mainly used by

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grocery retailers (Aaastруп et al., 2008) and has been a driver for CPFR practices regarding the advances in internet technologies (Fernie et al., 2010). The United Kingdom pioneers the way in European ECR practices regarding the fact that ECR in UK is integrated with and promoted by the UK's IGD, formerly the Institute of Grocery Distribution (Aaastруп et al., 2008). QR and ECR are demand driven, time-based strategies and similar in nature. However, food supply chains differ from fashion supply chains in terms of volatility, complexity and gross margins (Fernie, 1994; Birtwistle et al., 2003).

Through the implementation of QR and ECR, efficiency in replenishment and inventory management can be achieved. Additionally, by lowering down the lead times and order cycles, time to market advantage can be obtained (Birtwistle et al., 2003) which may lead to better customer service levels.

- **Postponement:** This strategy refers to the postponement of final manufacturing to the last possible point for mitigating risk (Pagh & Cooper, 1998). This is the implementation of lean strategies up to the decoupling point (forecast driven) and agile strategies after this point (demand-driven) (Christopher, 2000). Up to that decoupling point, production is conducted in mass logic. At the de-coupling point, the manufactured semi-finished inventory is held for customization. As real demand information is received through Point of Sales (POS) data, customization starts (Lehtonen et al., 1999). Thus, demand meets the production. Besides customization, postponing final manufacturing provides efficiency in inventory management and reductions in logistics costs (Van Hoek, 1999). Some very famous fashion brands like Benetton and Zara are implementing this hybrid strategy in their operations (Christopher, 2000).
- **Category Management (CM):** Around the 1990s, category performance and management became one of the most prominent supply chain practices among retailers and manufacturers (Dhar et al., 2001). By focusing on product categories category management deals with product assortment planning and determines the variety, depth of merchandise and service level for each stock keeping unit (Berman & Evans, 2004; Mantrala et al., 2009).

Category management is designed to provide the combination of right mix of products, price, and promotions at the right time to the right place (Gruen & Shah, 2000). This strategy approaches product categories as main business units and analyses the category store-by-store basis in light of the category goals defined (Dussart, 1998; Dhar et al., 2001). Even within a store chain and format (e.g., grocery retailers), store size impacts the performance of category management with regard to store margins (Haans & Gijbrecchts, 2011). Specialty retailers such as Barnes & Noble (books), Best Buy (electronics), Staples (office supplies) follow huge assortment strategy while retailers such as Costco present relatively few SKUs (Mantrala et al., 2009).

In category management (CM), a preferred supplier takes the planning responsibility for the demand and supply of a specific category (with various brands) and acts as a category captain with the aim of maximizing sales (Gruen & Shah, 2000; Hingley, 2005). Based on entire category sales information provided by retailer, the channel captain is developing a category plan for the assortments, pricing, promotion and placement of each stock keeping units in the product category (Gruen & Shah, 2000). Obviously, CM leads to better assortments, more sales and more efficiency (Gruen & Shah, 2000; Dhar et al., 2001).

- **Continuous Replenishment Planning (CRP) and Collaborative Planning, Forecasting, and Replenishment (CPFR):** Continuous replenishment planning (CRP) is the link established be-

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tween supply chain players for generating orders and managing inventory with EDI technology and supporting software programs (Andraski, 1994). Collaborative planning, forecasting, and replenishment (CPFR) is a sequential approach that defines key actions for performing integrated efforts among supply chain members in the scope of single business plan (Smaros, 2003; Cassivi, 2006). CPFR is a comprehensive process that involves joint sales and order forecasting/generation for replenishment (VICS, 1998). Different metrics such as retail in-store service levels, order fill-rates, forecast accuracy, shipment variability, delivery punctuality are evaluated and measured in CPFR processes (VICS, 1999). CPFR outreaches VMI and CRP in facilitating information exchange in multi-echelon supply chains (Cassivi, 2006).

Since its first pilot testing around 1990s between Wal-Mart and one of its suppliers, it has been receiving a considerable amount of attention from the practitioners and academics. However, the adoption rate of CPFR is slower than expected due to lack of forecasting processes/resources and lack of technological compability among the participant companies (Smaros, 2003).

- **Vendor Managed Inventory (VMI):** Vendor Managed Inventory (VMI) is an effective partnering initiative that refers to and also named as supplier managed inventory systems which gained popularity with retail giants' (e.g. Walmart and P&G) applications in late 1980's (Waller et al., 1999). In VMI, the buyer's (retailer) inventory levels are monitored by the vendor (supplier, usually the manufacturer, reseller or distributor), who uses information in inventory replenishment decisions. In this model, with the delegation of resupply decisions, the supplier company monitors the buying company's inventory levels and acts as a decision maker in inventory replenishment decisions for amount determination and scheduling of shipments (Waller et al., 1999). Thus, long-term, trust based relationships is a prominent concern in this partnership model (Angulo et al., 2004).

VMI is a kind of partnership that heavily relies on information sharing and integration through the use of technologies such as EDI or ERP (Waller et al., 1999; Disney & Towill, 2003; Angulo et al., 2004). As for the benefits, VMI provides reduction in logistics and production costs, improvement in logistics customer service levels such as reduced lead times, inventory levels and better control of bullwhip effect (distortion in demand and information flow) (Angulo et al., 2004). Leading global retailers such as Tesco (Watson, 2005) and Wal-Mart use VMI for cost reduction and service improvement (Waller et al., 1999).

FUTURE TRENDS IN RETAILING

Over the next decade, retail industry will continue to evolve and change. A set of new technologies and new adaptation of the existing ones will shape the future of retailing.

- **Radio Frequency Identification (RFID):** RFID consists of a smart-tag and a reader that generates radio frequency waves for identification without requiring a line of sight (Roussos, 2006; Boeck & Wamba, 2008). When its cost saving and product monitoring capabilities considered, it is obvious that it has the ability of transforming the way business done in the area of retailing. By

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enabling automated item level tracking, RFID can provide high levels of visibility in supply chain processes and create efficiency (Gaukler et al., 2007). RFID in retail stores can alter the whole shopping experience by reshaping check-out transactions, loyalty programs, and promotional offers (Roussos, 2006). Unfortunately, high costs of item-level deployment in tagging and privacy concerns prevent the wider expansion of RFID in the area of retailing (Roussos, 2006; Gaukler et al., 2007).

- **Use of Big Data:** Through the emergence of advanced technological tools and increasing influence of social media, data sources are increasing in amount. Accessibility to that massive quantities of data generated by and about people, things and their interactions are becoming more and more possible (Boyd & Crawford, 2012). Big data is a socio-technical phenomenon that refers to the use of technology via computers and algorithms for gathering, analyzing, linking and comparing very large data sets with the aim of identifying more accurate and objective patterns (Boyd & Crawford, 2012).

More commonly and frequently than in the past, big retailers start to utilize and analyze huge variety of data about sales, demographics, social media entries, economics and even weather to generate their product, pricing and promotion strategies. However, based on industry reports and Big Data Value Potential Index (which evaluates sectors' potential value creation through Big Data and ease-of-capturing big data), retail industry could not go far beyond the utilization of localized analytics and small data over the last decade except those big players (Brown et al., 2011; Deloitte, 2013). In the near future with the development of advanced technological tools, more retailers will have the opportunity to gather and analyze big data.

- **Content Rich Retail Experience and Digitalization:** Enhancing the online and in-store experience is crucial due to the fact that sensory, emotional, cognitive, behavioral, and relational values derived from experiences have the potential to alter the perceptions and replace functional values (Schmitt, 1999). As customers spend more time entertaining in indoor facilities such as, kinder gardens, music and gaming areas, their moods are impacted positively and they tend to spend more and show higher repurchase intentions (Spies et al., 1997).

In near future, the retailers that try to enrich the social experience for customers will benefit more from digitalization and thus, digitalizing will amend the physical and on-line retail stores dramatically. Increase in the number of omni-channel retailers that benefit both from online and physical store environments will trigger the use of digital tools. Based on the researches, consumers have already started to engage in digital activities for comparing prices, finding coupons, getting product information and planning for grocery trips (Deloitte, 2014). Thus, consumers' in-store digitalization should be supported by launching more mobile applications and providing wireless internet technologies in retail stores.

Disney is using interactive digital displays in its retail stores that serve to all family members in order to enrich the content of the retail experience and extend the time spend inside. Apart from this, various other digital tools have started to be used in retailing industry such as in-room cameras with 360 degree views, mobile checkout, QR code ordering, and virtual product demonstrations through mobile technologies (Rigby, 2011). Moreover, since GPS started to be deployed with smart phones and computers, retailers have found the chance to develop location based strategies. With the help of GPS and

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new technological tools, retailers can detect the active mobile devices in their stores and transmit their promotion offers (e.g., discounts) (Deloitte, 2014). Apart from the promotional efforts, these technologies may enable to create better store layouts based on the detected in-store traffic.

- **3D Printing:** 3D printing is a technique in which products are being built layer by layer out of plastic, metal or other materials by utilization of Computer-Aided Design CAD (NASA, 2014). By the time that the household use of 3D printers increases, any kind of customized product will be easily provided within the given design specifications. 3D will diminish the need of keeping inventory and time-to-market in new product development in a dramatic way. Hence, this technology will reshape whole supply chains by changing the ways of distribution and sourcing. Moreover, this technology will broaden the amount of customization and personalization at ease by enabling the perfect fit (Deloitte, 2014).

EMERGING MARKETS

Currently, the retailing industry is growing not only in emerging economies, but also in developed economies, creating an increasing demand for logistics and supply chain activities, and the need for a more comprehensive focus for managerial issues. Recently, the combination of economic growth and population growth in emerging markets and less developed markets has accelerated the progression of globalization of retailing and globalization by retailers (Reinartz, et al., 2011). SCM practices in developed and emerging retailing markets are likely to be figured out in accordance with consumer choices and retailing trends.

The retail markets can be grouped into three different market types; mature markets such as in Western Europe and North America, emerging markets such as Asia, Central and South America, and Eastern Europe, less developed markets such as in Africa, some parts of Asia and South America (Reinartz et al., 2011). The other emerging markets category is identified in Deloitte Global Powers in Retailing report (2014) as Brazil and Russia while other promising markets are Columbia, Mexico, Turkey and much of Sub-Saharan Africa. The consumer choices are different in countries. For instance, in mature markets such as UK, the store loyalty is high regarding the retail product brand penetration, where in USA, Germany and France price and promotions are main factors to determine consumer choice (Ferne et al., 2010).

In the United Kingdom, retailers act as the focal company in their supply chain regarding their success in SCM practices to compete in retailing industry (Ferne et al., 2010). Moreover, grocery retailers in United Kingdom restructured their supply chains to increase competitive power, leading to the creation of one of the most efficient retail supply chains in the world during the 1990s and early 2000s (Ferne & Sparks, 2004). Emerging markets encompass the countries and regions having accelerated economic growth and industrialization that are likely to proceed to mature markets in the future (Gielens & De-kimpe, 2007). Emerging markets include Mexico, Poland, South Africa, South Korea, Turkey and BRIC countries (Brazil, Russia, India and China). According to AT Kearney's 2014 Global Retail Development Index, the top 10 emerging markets for retail are Chile, China, Uruguay, United Arab Emirates, Brazil, Armenia, Georgia, Kuwait, Malaysia, and Kazakhstan.

For international retailers, there exists an increasing need for adaptation in diversified and culturally different markets (Watson et al., 2005) especially in emerging markets. Regarding the fact that understanding the cultural differences comprehensively is a challenge, franchising stands as an important retail

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type of operation in some markets such as Middle East and Russia (Uras 2002; Watson et al., 2005). But in some cases even franchising might not be a solution. One of the recent examples is the decision of Target exiting from Canadian retail market. Even though, U.S. and Canada are neighbor countries, the product assortment, regulations, supply chain structures and practices are entirely different from each other which lead to a failure of a retailer such as Target in Canadian retail market (Gustafson, 2014). Therefore, pioneering SCM practices change according to type of retailers in different emerging markets.

FUTURE RESEARCH DIRECTIONS AND CONCLUSION

Dynamics on competition has not changed dramatically. According to Alt (1949), the competition in retailing takes place regarding the variety of overhead or common costs; interrelatedness of demand among various products; alteration of consumer shopping habits; and development of new products while advancing and standardizing the old ones. Today, the real competition takes place between supply chains rather than companies. Herein, the different SCM practices conducted by different types of retailers was discussed. Throughout the chapter, it is mentioned that “one size fits all” approach is not suitable for retailing. Regarding the fact that SCM practices implemented by retailers should be adapted in accordance with the retailer’s type (Randall et al., 2011), different SCM practices are presented.

However, providing evidence from different retailers which use different SCM practices is a challenge, due to limited research. The limited research on this topic is due to the lack of willingness of parties (supply chain members) to share data (e.g., research on ECR by Corsten & Kumar, 2005). Certain inference for leading SCM practices can be provided through case study, survey, and interview research methods as for future research. Consequently, this chapter provides an understanding of SCM practices in retailing by highlighting the trends and future perspectives. However, SCM practices used today are likely to change in the near future.

The future challenges for retailers can be named as efficiency, transparency, flexibility and sustainability (Fernie et al., 2010). Moreover, understanding consumer behavior in detail in light of acquisition, consumption, disposition of goods, services, time, and ideas by the human decision maker will maintain its significance in retailing industry as a challenge (Puccinelli et al., 2009). Thus, revealing the future challenges and understanding changing consumer habits in different retail markets are promising research topics in this field.

REFERENCES

- Aastrup, J., Kotzab, H., Grant, D. B., Teller, C., & Bjerre, M. (2008). A model for structuring efficient consumer response. *International Journal of Retail & Distribution Management*, 36(8), 590–606. doi:10.1108/09590550810883450
- Alt, R. M. (1949). Competition among types of retailers in selling the same commodity. *Journal of Marketing*, 14(3), 441–447. doi:10.2307/1248197
- Alvarado, U. Y., & Kotzab, H. (2001). Supply chain management: The integration of logistics in marketing. *Industrial Marketing Management*, 30(2), 183–198. doi:10.1016/S0019-8501(00)00142-5

Supply Chain Management Practices in Retail-The Trends and Future Perspective

- Andraski, J. C. (1994). Foundations for successful continuous replenishment programs. *The International Journal of Logistics Management*, 5(1), 1–8. doi:10.1108/09574099410805036
- Angulo, A., Nachtmann, H., & Waller, M. A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of Business Logistics*, 25(1), 101–120. doi:10.1002/j.2158-1592.2004.tb00171.x
- ATKearney. (2014). *Global retail development index*. Retrieved from <http://www.atkearney.com/documents/10192/4600212/Full+Steam+Ahead+for+Global+Retailers--+2014+Global+Retail+Development+In....pdf/6f55a59b-e855-4236-96cb-464c2ca01e91>
- Barnes, L., & Lea-Greenwood, G. (2010). Fast fashion in the retail store environment. *International Journal of Retail & Distribution Management*, 38(10), 760–772. doi:10.1108/09590551011076533
- Berman, B., & Evans, J. R. (2004). *Retail management-A strategic approach* (9th ed.). New York: Pearson Prentice Hall.
- Birtwistle, G., Fiorito, S. S., & Moore, C. M. (2006). Supplier perceptions of quick response systems. *Journal of Enterprise Information Management*, 19(3), 334–345. doi:10.1108/17410390610658504
- Birtwistle, G., Siddiqui, N., & Fiorito, S. S. (2003). Quick response: Perceptions of UK fashion retailers. *International Journal of Retail & Distribution Management*, 31(2), 118–128. doi:10.1108/09590550310462010
- Boeck, H., & Fosso Wamba, S. (2008). RFID and buyer-seller relationships in the retail supply chain. *International Journal of Retail & Distribution Management*, 36(6), 433–460. doi:10.1108/09590550810873929
- Boyd, D., & Crawford, K. (2012). Critical questions for big data. *Information Communication and Society*, 15(5), 662–679. doi:10.1080/1369118X.2012.678878
- Brown, B., Chui, M., & Manyika, J. (2011). Are you ready for the era of 'big data'? *The McKinsey Quarterly*, October.
- Cassivi, L. (2006). Collaboration planning in a supply chain. *Supply Chain Management: An International Journal*, 11(3), 249–258. doi:10.1108/13598540610662158
- Choon Tan, K., Lyman, S. B., & Wisner, J. D. (2002). Supply chain management: A strategic perspective. *Journal of Operations and Production Management*, 22(6), 614–631. doi:10.1108/01443570210427659
- Christopher, M. (1992). *Logistics: The strategic issues*. London: Chapman and Hall.
- Christopher, M. (2000). The agile supply chain-competing in volatile markets. *Industrial Marketing Management*, 29(1), 37–44. doi:10.1016/S0019-8501(99)00110-8
- Christopher, M., Lowson, R., & Peck, H. (2004). Creating agile supply chains in the fashion industry. *International Journal of Retail & Distribution Management*, 32(8), 367–376. doi:10.1108/09590550410546188
- Corsten, D., & Kumar, M. (2005). Do suppliers benefit from collaborative relationships with large retailers? An empirical investigation of efficient consumer response adoption. *Journal of Marketing*, 69(3), 80–94. doi:10.1509/jmkg.69.3.80.66360

Supply Chain Management Practices in Retail-The Trends and Future Perspective

- Deloitte (2013). *Executive summary, formula for growth: Innovation – big data & analytics*. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-da-executivesummary_gma_big_data_041913.pdf
- Deloitte (2014). 2014 outlook on retail. Retrieved from http://www.deloitte.com/view/en_US/us/Industries/29ec5a5bdc5ea310VgnVCM2000003356f70aRCRD.htm
- Deloitte (2014). *Global powers of retailing - Retail beyond begins*. Retrieved from <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Consumer-Business/dttl-CB-GPR14STORES.pdf>
- Deloitte (2014). *The new digital divide*. Retrieved from <http://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-rd-thenewdigitaldivide-041814.pdf>
- Dhar, S. K., Hoch, S. J., & Kumar, N. (2001). Effective category management depends on the role of the category. *Journal of Retailing*, 77(2), 165–184. doi:10.1016/S0022-4359(01)00045-8
- Disney, S. M., & Towill, D. R. (2003). The effect of vendor managed inventory (VMI) dynamics on the bullwhip effect in supply chains. *International Journal of Production Economics*, 85(2), 199–215. doi:10.1016/S0925-5273(03)00110-5
- Donlon, J. P. (1996). Maximizing value in the supply chain. *Chief Executive*, 117, 54–63.
- Dussart, C. (1998). Category management: Strengths, limits and developments. *European Management Journal*, 16(1), 50–62. doi:10.1016/S0263-2373(97)00073-X
- Fernie, J. (1994). Quick response: An international perspective. *International Journal of Physical Distribution & Logistics Management*, 24(6), 38–46. doi:10.1108/09600039410066178
- Fernie, J., & Sparks, L. (2004). *Logistics and retail management: Insights into current practice and trends from leading experts*. London: Kogan Page.
- Fernie, J., Sparks, L., & McKinnon, A. C. (2010). Retail logistics in the UK: Past, present and future. *International Journal of Retail & Distribution Management*, 38(11/12), 894–914. doi:10.1108/09590551011085975
- Ganesan, S., George, M., Jap, S., Palmatier, R. W., & Weitz, B. (2009). Supply chain management and retailer performance: Emerging trends, issues, and implications for research and practice. *Journal of Retailing*, 85(1), 84–94. doi:10.1016/j.jretai.2008.12.001
- Gaukler, G. M., Seifert, R. W., & Hausman, W. H. (2007). Item-Level RFID in the retail supply chain. *Production and Operations Management*, 16(1), 65–76. doi:10.1111/j.1937-5956.2007.tb00166.x
- George, M., Kumar, V., & Grewal, D. (2013). Maximizing profits for a multi-category catalog retailer. *Journal of Retailing*, 89(4), 374–396. doi:10.1016/j.jretai.2013.05.001
- Gielens, K., & Dekimpe, M.G. (2007). The entry strategy of retail firms into transition economies. *Journal of Marketing*, April(71), 196–212.
- Grewal, D., & Levy, M. (2007). Retailing research: Past, present and future. *Journal of Retailing*, 83(4), 447–464. doi:10.1016/j.jretai.2007.09.003

Supply Chain Management Practices in Retail-The Trends and Future Perspective

- Grewal, D., & Levy, M. (2009). Emerging issues in retailing research. *Journal of Retailing*, 85(4), 522–526. doi:10.1016/j.jretai.2009.09.007
- Gruen, T. W., & Shah, R. H. (2000). Determinants and outcomes of plan objectivity and implementation in category management relationships. *Journal of Retailing*, 76(4), 483–510. doi:10.1016/S0022-4359(00)00041-5
- Gustafson, K. (2014). What Nordstrom can learn from Target's Canadian experiment. Retrieved from <http://www.cnn.com/id/101481503>
- Haans, H., & Gijsbrechts, E. (2011). One-deal-fits-all? On category sales promotion effectiveness in smaller versus larger supermarkets. *Journal of Retailing*, 87(4), 427–443. doi:10.1016/j.jretai.2011.05.001
- Hansen, T., Wilke, R., & Zaichkowsky, J. (2010). Managing customer complaints: Differences and similarities among heterogeneous retailers. *International Journal of Retail & Distribution Management*, 38(1), 6–23. doi:10.1108/09590551011016304
- Helman, D., & Chernatony, L. D. (1999). Exploring the development of lifestyle retail brands. *Service Industries Journal*, 19(2), 49–68. doi:10.1080/02642069900000018
- Hingley, M. K. (2005). Power imbalanced relationships: Cases from UK fresh food supply. *International Journal of Retail & Distribution Management*, 33(8), 551–569. doi:10.1108/09590550510608368
- Jones, P., Hillier, D., Comfort, D., & Eastwood, I. (2005). Sustainable retailing and consumerism. *Management Research News*, 28(1), 34–44. doi:10.1108/01409170510784760
- Kent, J. L., & Mentzer, J. T. (2003). The effect of investment in interorganizational information technology in a retail supply chain. *Journal of Business Logistics*, 24(2), 155–175. doi:10.1002/j.2158-1592.2003.tb00050.x
- Kotzab, H. (2005). Retailing in the context of IT and distribution. In H. Kotzab & M. Bjerre (Eds.), *Retailing in a scm-perspective*. Denmark: Copenhagen Business School Press.
- Lehtonen, J. M., Holmström, J., & Slotte, J. (1999). Constraints to quick response systems in the implosive industries. *Supply Chain Management: An International Journal*, 4(1), 51–57. doi:10.1108/13598549910255095
- Li, S., Nathan-Ragu, B., Nathan-Ragu, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *International Journal of Management Sciences*, 34, 107–124.
- Lowson, B., King, R., & Hunter, A. (1999). *Quick Response: Managing the supply chain to meet consumer demand*. New York: John Wiley & Sons.
- Lowson, R. H. (2001). Retail operational strategies in complex supply chains. *The International Journal of Logistics Management*, 12(1), 97–111. doi:10.1108/09574090110806253
- Mantrala, M. K., Levy, M., Kahn, B. E., Fox, E. J., Gaidarev, P., Dankworth, B., & Shah, D. (2009). Why is Assortment Planning so Difficult for Retailers? A Framework and Research Agenda. *Journal of Retailing*, 85(1), 71–83. doi:10.1016/j.jretai.2008.11.006

Supply Chain Management Practices in Retail-The Trends and Future Perspective

Mattila, H., King, R., & Ojala, N. (2002). Retail performance measures for seasonal fashion. *Journal of Fashion Marketing and Management*, 6(4), 340–351. doi:10.1108/13612020210448637

McMichael, H., Mackay, D., & Altmann, G. (2000). Quick response in the Australian TCF industry: A case study of supplier response. *International Journal of Physical Distribution & Logistics Management*, 30(7/8), 611–626. doi:10.1108/09600030010346288

Mentzer, J. T., Min, S., & Zacharia, Z. G. (2000). The nature of interfirm partnering in supply chain management. *Journal of Business Logistics*, 76(4), 549–568.

NASA. (2014). 3D-printing. Retrieved from <http://www.nasa.gov/3Dprinting/>

Pagh, J. D., & Cooper, M. C. (1998). Supply chain postponement and speculation strategies: How to choose the right strategy. *Journal of Business Logistics*, 19, 13–34.

Peterson, R. A., & Balasubramanian, S. (2002). Retailing in the 21st century: Reflections and prologue to research. *Journal of Retailing*, 78(1), 9–16. doi:10.1016/S0022-4359(01)00062-8

Puccinelli, N. M., Goodstein, R. C., Grewal, D., Price, R., Raghubir, P., & Stewart, D. (2009). Customer experience management in retailing: Understanding the buying process. *Journal of Retailing*, 85(1), 15–30. doi:10.1016/j.jretai.2008.11.003

Randall, W. S., Gibson, B. J., Clifford Defee, C., & Williams, B. D. (2011). Retail supply chain management: Key priorities and practices. *The International Journal of Logistics Management*, 22(3), 390–402. doi:10.1108/09574091111181381

Reinartz, W., Dellaert, B., Krafft, M., Kumar, V., & Varadarajan, R. (2011). Retailing innovations in a globalizing retail market environment. *Journal of Retailing*, 87, 53–66. doi:10.1016/j.jretai.2011.04.009

Rigby, D. (2011). The future of shopping. *Harvard Business Review*, December.

Roussos, G. (2006). Enabling RFID in retail. *Computer*, 39(3), 25–30. doi:10.1109/MC.2006.88

Schmitt, B. (1999). Experiential Marketing. *Journal of Marketing Management*, 15(1-3), 53–67. doi:10.1362/026725799784870496

Småros, J. (2003). Collaborative forecasting: A selection of practical approaches. *International Journal of Logistics: Research and Applications*, 6(4), 245–258. doi:10.1080/13675560310001626981

Spies, K., Hesse, F., & Loesch, K. (1997). Store atmosphere, mood and purchasing behavior. *International Journal of Research in Marketing*, 14(1), 1–17. doi:10.1016/S0167-8116(96)00015-8

Standop, D., & Grunwals, G. (2009). How to solve product-harm crises in retailing? *International Journal of Retail & Distribution Management*, 37(1), 915–932.

Stock, J. R., Boyer, S. L., & Harmon, T. (2010). Research opportunities in supply chain management. *Journal of the Academy of Marketing Science*, 38(1), 32–41. doi:10.1007/s11747-009-0136-2

Swoboda, B., Foscht, T., & Cliquet, G. (2008). International value chain processes by retailers and wholesalers- A general approach. *Journal of Retailing and Consumer Services*, 15(2), 63–77. doi:10.1016/j.jretconser.2007.05.005

Supply Chain Management Practices in Retail-The Trends and Future Perspective

Swoboda, B., Foscht, T., & Schwarz, S. (2005, Summer). Enormously dynamic and differing strategies in retailing internationalisation: A case study of the largest food retail firms. *European Retail Digest*, 46, 55–63.

Tan, K. C., Kannan, V. R., & Handfield, R. B. (1998). Supply chain management: Supplier performance and firm performance. *The International Journal of Purchasing and Materials Management*, 34(3), 2–9.

Uras, L. (2002). *An exploratory study of ownership redirection among leading luxury Italian firms* [Unpublished M.Sc. dissertation]. School of Management Studies for the Service Sector, University of Surrey, United Kingdom.

Van Hoek, R. I. (1999). From reversed logistics to green supply chains. *Supply Chain Management: An International Journal*, 4(3), 129–135.

VICS. (1998). Collaborative planning forecasting and replenishment voluntary guidelines. Retrieved from http://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=632&PortalId=0&TabId=785

VICS. (1999). Roadmap to CPFR: The case studies. Retrieved from http://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=632&PortalId=0&TabId=785

Waller, M., Johnson, M. E., & Davis, T. (1999). Vendor-managed inventory in the retail supply chain. *Journal of Business Logistics*, 20, 183–204.

Watson, A., Stanworth, J., Healeas, S., Purdy, D., & Stanworth, C. (2005). Retail franchising: An intellectual perspective. *Journal of Retailing and Consumer Services*, 12(1), 25–34. doi:10.1016/j.jretconser.2004.02.001

Watson, E. (2005). Nestle switches to vendor managed inventory with Tesco. *Food Manufacture*, 80(8), 20. Retrieved from <http://www.foodmanufacture.co.uk/Supply-Chain/Nestle-switches-to-vendor-managed-inventory-with-Tesco>

Chapter 22

The History and Development of Purchasing Management and Its Theoretical Framework: A Review of Transaction Cost Economics

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ABSTRACT

Purchasing as a management or academic field of study has seen a rise in its awareness. The strategic role it assumes in most organizations and businesses is as a result of the need for firms to reduce cost and to counter increased competition. However, this recognition evolved from ‘humble’ beginnings up to the strategic importance it assumes today in some organizations and as a major field of study in the academia. The historical development of purchasing is worth studying so as to better understand and appreciate the important role it now assumes. Much literature and many theoretical frameworks have been developed to help explain various phenomena in the purchasing field. Transaction cost economics is one of such theories that have been applied. The contribution of transaction cost economics to the growth of knowledge in the purchasing and channel studies has been enormous.

INTRODUCTION

The advent and the growth of purchasing as a research/academic field of study and the attendant strategic role it assumes in most organizations and businesses of today cannot be underemphasized. The importance and recognition of the purchasing function by senior management has become necessary as a result of the need for firms to reduce cost and to counter increased competition from both domestic and international firms (Heberling, 1993). Academic research and studies have also had a ‘ripple effect’ in the purchasing field as a whole as managerial implications and issues of relevance to public policy are considered. The growth of the purchasing field has seen some tremendous uplift both in the theoretical and policy/managerial domain. Therefore, this chapter seeks to trace the historical development of purchasing management and make a review of one of the key theoretical frameworks that is used in purchasing management literature and research – transaction cost economics (TCE).

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The History and Development of Purchasing Management and Its Theoretical Framework

This chapter consists of three main sections. Section One provides a general background on the development of the purchasing field with respect to historical development of industrial purchasing; the emergence of business-to-business/industrial marketing and the organization of industrial purchasing. This section also discusses purchasing's evolution from a clerical buying function into a strategic business function and highlights the role of the buyer, academic/research and professional associations. Section Two investigates the historical and recent development of TCE and some conceptual/empirical studies utilizing TCE. Transaction cost theory has seen a rise in its application not only in purchasing and supply chain management but has over the past two to three decades been used generally in inter-firm studies, buyer-seller relationships and marketing channels. Section Three contains the Conclusion.

HISTORICAL DEVELOPMENT OF INDUSTRIAL PURCHASING

The development of purchasing as a field of study and a profession all started with industrial purchasing with significant contribution from the field of marketing. Philip Kotler's (1967, 1972, 1976) very popular and one of the most frequently used marketing textbook: *Marketing Management: Analysis, Planning and Control* chapter on producers, resellers, and government markets sets the tone for the agenda on business marketing. Purchasing started with the emphasis on marketing philosophy where the product concept was very dominant during the 1850-1915, followed by the era of the selling concept (1916-1960) and the new concept of marketing after the 1960s.

The Period 1850-1915 (The Product Concept)

The product concept period was marked by production orientation. The expansion of mileage of railroads; the rapid development of the steel industry; the increase in population; developments in communication and transportation especially in the USA spurred the rapid expansion of markets and the use of mass production techniques. The availability of electric power coupled with the development of better machinery led to the mechanization of manufacturing processes and procedures, notable being the automobile industry (Weeks & Marks, 1969).

The era of the product concept was characterized by firms concentrating on how best to efficiently produce goods without much thought on how to sell or market those goods that were produced. Hence, the focus was on how to produce rather than how to solve the problem of selling the goods or providing some level of customer service. For example, the emphasis on efficient production and price typifies Ford's production technology such that "between 1909 and 1914, Ford's mass production method reduced the retail price of the Model T from US\$950 to US\$490 leading John D. Rockefeller to call Ford's Highland Park plant the industrial miracle of the age" (McIntyre, 2000, p. 269).

Despite the reduction in Model T's price as a result of the new production methods, mounting customer dissatisfaction with dealer service threatened to reduce the sale of the Model T automobiles. During this period, many firms expanded in size so as to control the emerging markets and to gain increasing economies of scale. Consequently, excesses began to show in the production capacity of these firms. This led to the ushering of a new era where sellers began seeking out new buyers. Advertising and personal selling, therefore, became of much importance to most of these firms (Weeks & Marks, 1969).

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The Period 1916-1960 (The Selling Concept)

The selling concept of the 1916-1960 timeframe is characterized by: firms' main objective was to create sales for existing products; the need for buyers to be stimulated to make purchases and significant efforts put into increasing sales of the company's products. World War I stimulated the tendency to emphasize problems relating to the production and manufacture of military products. Within this period, several attempts were made to make production more efficient so as to conserve manufacturing facilities (Weeks & Marks, 1969).

Following the war, business activities continued to high levels until 1920 as a result of high consumer buying power and exports from the USA to the rebuilding of Europe. However, a decline in government spending, the demobilization of the armed forces, and a slowdown in European spending for reconstruction led many manufacturing businesses to cut down on production and, in some instances, to cut down on prices of their products due to low demand. The depression was brief with an upswing by 1922 and a decade long expansion by businesses with notable industry such as the chemical, petroleum and the automobile industries. For example, the automobile which was previously a luxurious product, become a necessity for most families such that the impact of the automobile on the economic and social life of the USA was enormous (Weeks & Marks, 1969, p. 26).

The USA was again plunged into a recession in October, 1929 when the stock market collapsed with its attendant loss in jobs, Gross National Product (GNP) declined, and about 50% of all businesses failed between 1929 and 1932. World War II was another period during which the US economy begun to right itself as the production of military hardware sought to fill the rising demands for arms by European allies. Production was said to increase when the USA entered the war in 1941 and by 1944, military demand had caused a significant increase in total production and, hence, Gross Domestic Product (GDP) (Weeks & Marks, 1969).

Though the emphasis during this period was again on production, the selling concept gained ground. The continued development of new and better products to serve the needs of customers ushered in a new exciting era of business management that begun to evolve with a focus on the consumer post-World War II. Therefore, the marketing concept evolved to better serve the needs of customers and consumers.

The Period after 1960 (The Marketing Concept)

The new concept of marketing started around 1960 with firms focusing on meeting the specific needs of customers, use of market research to better understand the needs of customers in terms of product development and sales, and the use of marketing principles such as segmentation, targeting and positioning, and the fulfillment of specific requirements in the market to create loyal customers. "The marketing concept of management is a unifying approach marshalling and directing the total resources of a business firm toward the determination and satisfaction of customer and consumer wants and needs in a way planned to enhance the firm's overall profit position" (Weeks & Marks, 1969, p. 25).

The marketing concept posited that marketing was the principal function of the firm since the main objective of any business was to create a satisfied customer. Profit was therefore not the objective, but rather the reward for creating a satisfied customer (Drucker, 1954 as cited in Webster, 1992). Firms created marketing departments which were usually an extension of the old sales department. The task

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of the marketing function during this era was first to develop a thorough understanding of the market place to ensure that the firm was producing goods and services required and desired by the customer (Webster, 1992, p. 4).

EMERGENCE OF BUSINESS-TO-BUSINESS/INDUSTRIAL MARKETING AND THE ORGANIZATION OF INDUSTRIAL PURCHASING

Early textbooks in industrial marketing appeared in the 1930s. Copeland (1930) published a case book while Frederick (1934) published a textbook on industrial marketing. According to Vargo and Lusch (2011), business-to-business (B2B) teaching and scholarship was given a boost when the first course in industrial marketing was developed by Ray Corey at Harvard Business School and the subsequent publication of *Industrial Marketing: Cases and Concepts* (Corey, 1962). In 1972, *Industrial Marketing Management* was launched as an outlet for the publication of academic and research works in the B2B sub discipline. The initial task within the academic B2B was the attempt to identify the key distinguishing differences between business-to-business (B2B) and business-to-consumer (B2C) such as derived demand, professional buyers, small number of customers, etc. (Vargo & Lusch, 2011). According to Cova and Salle (2008), consumer marketing has been criticized for its universalistic claims of encompassing all situations of exchange irrespective of the object of exchange and the nature of the actors.

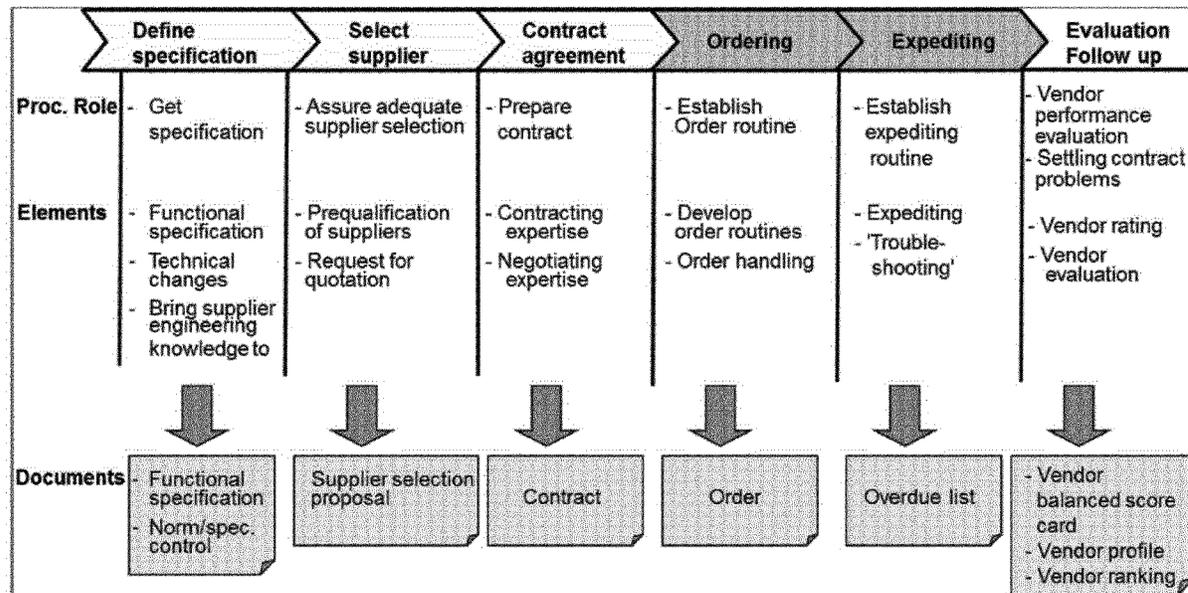
It must be noted that a series of controversies during the beginning of the 1970s and the 1980s occurred concerning the specifics of industrial marketing with the major question: "Are the marketing situations encountered for industrial goods and for consumer goods really so different that different approaches must be used?" (Cova & Salle, 2008, p. 4). Bonoma and Johnson (1978), Corey (1976) and Webster (1979) among others alluded to the fact that industrial marketing situations show unique characteristics that are distinguishable from consumer marketing. These are said to be historically important in view of the many efforts that culminated in making industrial marketing an autonomous and distinct field despite the fact that the dominant framework has remained that of marketing management (Cova & Salle, 2008).

A careful survey of the extant marketing literature shows that a relatively small proportion of it is devoted to the problems and techniques of marketing industrial products (Buvik, 2011). The objective has been on how to reach industrial or organizational customers. The suppliers, therefore, need information on what the customers' need and how they buy. The suppliers are most concerned about the key objectives in industrial purchasing – how industrial buyers organize their purchasing and how decision-making in organizational buying is conducted. This culminated in several studies, common among them being the industrial/organizational buying behavior model by Robinson and Faris (1967), Sheth (1973), and Webster and Wind (1972). These three conceptual models that were published in the 1960s and 1970s generated a lot of influence and interest in organizational buying behavior studies. For example, the industrial buying process model shows the six important activities of specification, supplier selection, contracting, ordering, expediting and evaluation/follow-up (See Figure 1).

According to Sheth (1996), the concepts of make-buy, modified rebuy, the buying center, and the behavioral aspects of decision-making led to significant research and the development of other streams such as buyer-seller interaction by the Industrial Marketing and Purchasing (IMP) group (Ford, 1982; Håkansson, 1982) and buyer-seller relationships especially in the area of channels as customers. This stream of research is said to be heavily influenced by El-Ansary and Stern's (1972) work on power, dependence, and conflict and later by Williamson's Transaction Cost theory.

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Figure 1. The Industrial buying process model. Source: Van Weele (2009)



Purchasing Evolvement from a Clerical Buying Function into a Strategic Business Function

It is generally agreed that purchasing has evolved from a clerical buying activity into a strategic business function that makes significant contribution to the competitive position of companies (Ellram & Carr, 1994; Carter & Narasimhan, 1996; Gelderman & Van Weele, 2005). Initially, purchasing's role in strategy was reactive rather than proactive. Thus, the movement of the purchasing function from a "passive" or reactive role to a strategic role is a widely discussed aspect of purchasing strategy (Ellram & Carr, 1994). Kraljic (1983)'s seminal paper, *Purchasing Must Become Supply Management*, published in *Harvard Business Review* provided a comprehensive purchasing portfolio approach (see Figure 2). It provides a matrix that classifies a firm's purchased items into four categories on the basis of their profit impact and supply risk (Kraljic, 1983; Gelderman & Van Weele, 2005).

The publication by Kraljic in 1983 set the tone for the strategic role and the dominant approach to what the profession regards as "operational professionalism" (Cox, 1997; Lamming & Harrison, 2001; Gelderman, 2003). The strategic role that purchasing plays in the firm's competitive positioning is also emphasized by the "Strategic Triangle" (see Figure 3) (Kenichi, 1991).

A "strategic triangle" highlights the factors needed for success by a business or organization. This model is useful in strategy development in relation to: (1) the firm's customers (the organization's value creation activities provides satisfaction to its customers through the provision of quality product, at the lowest cost and at the right time); (2) Suppliers (the planning for and acquiring the firm's current and future needs through effectively managing the supply base); and (3) competitors (how the organization leverage its competitive advantage within the industry). It is only by integrating these factors in terms of the interconnections between them that a business can achieve sustained competitive advantage.

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Figure 2. The Kraljic matrix: Categories and recommendations. Modified from Kraljic (1983)

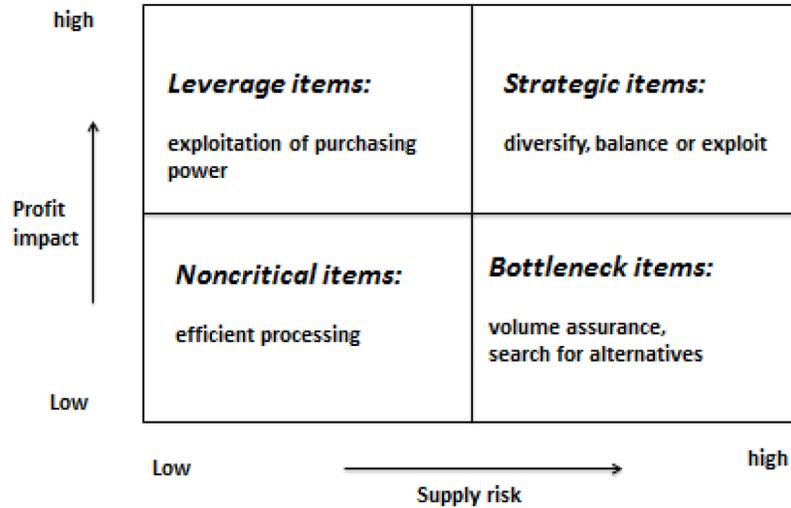
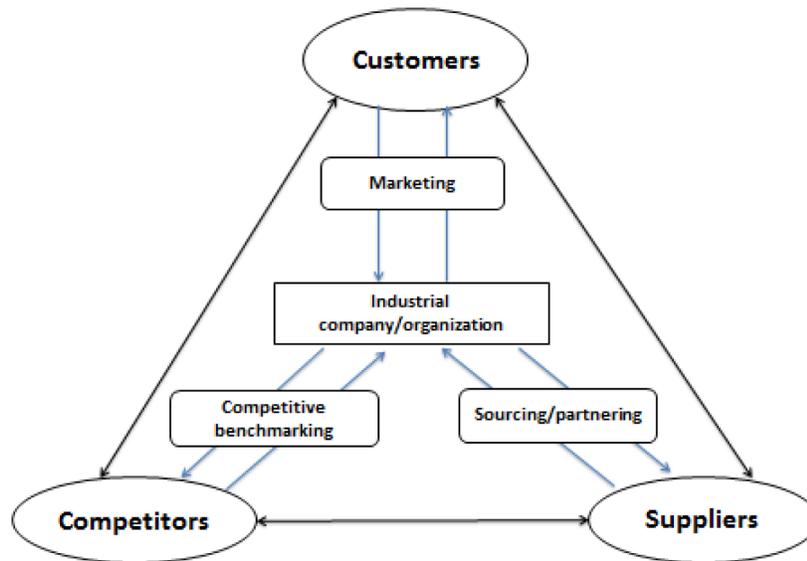


Figure 3. The Strategic triangle for an industrial company/organization with respect to its customers, competitors and suppliers. Modified from Tesfay (2014)



The business or organization must formulate strategies aimed at maximizing its strengths relative to the competition. This is important especially in those functional areas that are critical to the achievement of success in the industry in which the business organization operates. Thus, purchasing role in achieving competitive advantage is unquestionable. Decisions on “make” or “buy”; cost reduction through sourcing strategies and supplier relationship management and the focus of the firm in serving the needs of its customers by being customer-centric are some of the key strategic issues that can make a difference in

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the competitive environment. Earlier, Reck and Long conducted case studies of 15 firms, addressing the issue of purchasing's contribution to competitive strategies of firms. The article introduces four stages of development that the purchasing function passes through to become "a competitive weapon in the battle for markets": passive, independent, supportive, and integrative (Ellram & Car, 1994) (see Table 1).

Thus, from a passive and reactive stage in which many of purchasing's legitimate activities are handled by other functions outside purchasing, through to an independent stage involving the professionalization of the purchasing function to the supportive stage where purchasing's role in supporting and strengthening the competitive advantage of the firm is emphasized with support from top management. The final, fourth stage is where the purchasing functions become more integrative throughout the whole firm. At this stage, in order to sustain a competitive advantage, the firm's purchasing responsibility rests on the expertise and capability of the procurement professionals. This brings to mind the important role of purchasing and supply chain management capabilities in achieving competitive advantage for the firm.

Thus, "resource based theory suggests that purchasing and supply chain management will often have the attributes that can enable them to be sources of sustained competitive advantage" (Barney, 2012, p. 3). This capability enables the procurement function to play a very strategic role not only within the firm but also outside the firm where its influence is felt within the whole supply chain. See Table 2 for contributions from the extant literature on purchasing development.

Recent frameworks based on TCE (Williamson, 1975) applied to the analysis of purchasing portfolio models by Luzzini, Caniato, Ronchi, and Spina (2012) is worth mention. TCE suggests minimizing transaction costs to distribute resources according to the level of risk/reward (Carter & Hodgson, 2006) typical of portfolio models. Williamson explored possible exchanges between transaction cost economics and supply chain management (Williamson, 2008).

The Role of the Buyer, Academic/Research and Professional Associations

In view of the improvement in procurement knowledge and practice across most private and public sector organizations, the role of the buyer has developed from managing or dealing with transactions to a more strategic and professional level. This development can also be largely attributed to the efforts of the various professional bodies, notably the Chartered Institute of Procurement and Supply (CIPS) in the United Kingdom (UK), the Institute for Supply Management (ISM), and the National Institute of Governmental Purchasing (NIGP), the last two being in North America where the idea of procurement

Table 1. Four stages of purchasing development. Source: Reck and Long (1988).

| | |
|-----------|--|
| Stage I | In the passive stage, purchasing normally begins as a reactor to requests from other departments. Many of purchasing's legitimate activities are handled by other functions outside of purchasing. |
| Stage II | In the independent stage, purchasing departments spend considerable time attempting to professionalize the purchasing function by introducing such things as computerized information systems (e.g. enterprise resource planning ERP, electronic data interchange EDI), formalized supplier programs and communication links with the technical functions. |
| Stage III | In the supportive stage, purchasing departments are viewed by top management as essential business functions. Purchasing is expected to support and strengthen the firm's competitive advantage by providing timely information to all departments in the firm about potential changes in the price and availability of materials, which may impact the firm's strategic role. |
| Stage IV | In the integrative state, the firm's competitive success rests significantly on the capabilities of the purchasing department's personnel. Purchasing's role within the firm changes from facilitator to functional peer. This development process must be implemented and guided by management over a period of time. |

The History and Development of Purchasing Management and Its Theoretical Framework*Table 2. Contributions from literature on purchasing development. Modified from Van Weele, Rozemeijer and Rietveld (2010)*

| Author | Stage 1 | Stage 2 | Stage 3 | Stage 4 | Stage 5 | Stage 6 |
|---|-----------------------------------|------------------------------------|---------------------------------------|--|--|-------------------------|
| Reck and Long (1988) | Passive | Independent | Supportive | Integrative | --- | --- |
| Bhote (1989) | Confrontation | Arm's Length | Goal congruence | Full partnership | --- | --- |
| Cavinato (1991) | Buying (at low prices) | Purchasing | Procurement | Supply acquisition | Facilitate networks | --- |
| Burt and Doyle (1993) | Reactive | Mechanical | Proactive | Strategic apply management | --- | --- |
| Keough (1993) | Serve the factory | Lowest unit cost | Co-ordinated purchasing | Cross functional purchasing | World class supply management | --- |
| Syson (1994) | Clerical (Transactional) | Commercial | Strategic (proactive focus) | --- | --- | --- |
| Barry, Cavinato, Green and Young (1996) | Basic MRO* purchasing processing | Enhanced MRO procurement practices | World-class MRO procurement practices | --- | --- | --- |
| Rajagopal and Chadwick (1997) | Clerical | Commercial | Supportive | Strategic | --- | --- |
| Van Weele, Rozemeijer and Rietveld (2010) | Transactional (Serve the factory) | Commercial (lowest unit cost) | Coordinating purchasing | Internal integration cross functional purchasing | External integration (Supply chain management) | Value chain orientation |

*MRO Maintenance, repair and operating

as a profession has been promoted vigorously. These professional associations have been involved in the development of vocational qualification and competence standards which have become highly desirable in terms of employability and career progression.

Most businesses have realized the strategic role that procurement can play in competitive positioning and consequently appoint a Chief Procurement Officer (CPO) who represents procurement issues at senior or executive levels within a business or organization. This is important when procurement decisions can be complex and of high value and relate to the bottom line or fundamental success of a business. For example, in terms of procuring assets or resources and services required to deliver the business own products or services.

This is also significant in terms of the governance process for an organization where visibility and transparency relating to the procurement of goods and services can benefit from the skills and expertise of an experienced procurement colleague rather than a more traditional financial view. Hence, due to the competitive environment that most businesses and organizations find themselves, the role of the procurement manager is to appropriately manage the level of risk and value that the business faces when sourcing or procuring goods, services or works (Magan, Lalwani, Butcher, & Javadpour, 2012, p. 173).

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Academic and research associations have also been at the forefront of knowledge creation and dissemination within the purchasing and supply chain management field. These associations have devoted most of their activities to the promotion of academic knowledge and research within purchasing and supply chain management. The International Purchasing and Supply Education and Research Association (IPSEERA) is a multi-disciplinary network of academics and practitioners dedicated to the development of knowledge concerning purchasing and supply management. The Nordic Logistics Research Network (NOFOMA) is a network of Nordic researchers within the field of logistics and supply chain management.

Attendance at the annual conferences of these associations offers participants exposure to some of the most recent developments in the field of logistics, supply chain, and purchasing management. These associations act as reference platform not only for academics but also for practitioners to exchange ideas, have stimulating discussions and to reflect on concepts, theories and educational forms and methods in an open and friendly atmosphere. The topics discussed and issues raised at these conferences are expected to help improve the professional quality of those active in the field of purchasing and supply management. The next section discusses historical and recent developments of TCE.

THE HISTORICAL AND RECENT DEVELOPMENTS OF TRANSACTION COST ECONOMICS (TCE)

TCE has more recently become one of the key theoretical/conceptual underpinning of most research works within the purchasing management field within the past two to three decades, especially with special reference to buyer-seller relationships, inter-organizational, and channel relationship studies. This section, therefore, discusses the historical and recent developments within this very important theoretical field. Despite having a long past, TCE became a very popular research framework within a short period of time with the work of Oliver Williamson in the 1970s. Transaction costs as a term have been present in economic discourse for centuries. The assertion that transaction is the basic unit of economic analysis was proposed by John R. Commons in 1934.

The past of TCE has rich metaphoric themes that describes the idea of what transaction cost is. For example, some of that metaphor is strongly connected to the further metaphor of the market as a machine whose deviations from ideal functioning is characterized by frictions (Walras, 1893 as cited in Hardt, 2009, p. 29). Transaction cost for centuries has been conceptualized as just “costs of transportation” and then in the nineteenth century conceptualized metaphorically as “friction” where it denotes the difficulties in the process of price formation. John Hicks is said to have disagreed with the general friction based explanations: “The most obvious sort of friction, and undoubtedly one of the most important, is the cost of transferring assets from one form to another” (Hicks, 1935, p. 6 as cited in Hardt, 2009, p. 30).

The term “transaction cost” was subsequently introduced in 1940 in the economics vocabulary by Tibor Scitovsky (Hardt, 2006; 2009). Ronald Coase published a paper in 1937 attributing the “existence of the firm to the cost of using the price mechanism” (Coase, 1937, p. 390 in Hardt, 2009). Hence, the “Nature of the Firm” by Coase (1937), sought to find answers to the question, “What is it that determines when a firm decides to integrate and when instead it relies on the market?” (Williamson, 1981, p. 550). It is therefore noteworthy to emphasize that TCE as the economic consequences of “costly exchange” had long been in existence. However, Oliver Williamson’s 1979 article titled, *Transaction Cost Economics: The Governance of Contractual Relations* in the *Journal of Law and Economics* was a turning point in the study of the economics of organizations.

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The Origin of Williamson's TCE

According to Hardt (2009), the neoclassical theory of the firm was widely criticized for its unrealistic assumptions during the 1950s and 1960s, most importantly the assumption of profit maximization and a firm's perfect information about market conditions. For example, Katona (1951) claims that firms do not maximize profits but, rather, act in order to satisfy managers various ambitions while others argued that firms are interested in maximizing the so-called "general preference function" which aggregates the individual aspirations of members of an organization. Others argued that a firm's reason or justification of existence is just to survive while others did not reject the objective of firms in making profit but rather prefer to talk of satisfactory profit instead of the pure profit maximization objective of firms (Hardt, 2009).

In view of those criticisms two important streams of theories emerged: designing an incentive structure within the firm to help maximize the survivability of the firm within the market (Simon, Smithburg, & Thompson, 1950) and decision making within organizations with its origin from cognitive psychology (Simon, 1957a). Hence, there was a departure from the perfect rationality assumption and the recognition that individuals are characterized by bounded rationality. Individuals, "are intentionally rational, but only to a limited extent" (Simon 1957b, p. 24). Economic man is, therefore, substituted for organizational man having limited cognitive and computational capacity (Simon, 1978). Herbert Simon was a very distinguished Professor and was awarded the Nobel Prize in Economics in 1978 for his work on rational decision-making in business organizations.

A closer look at Williamson's works including, for example, his PhD dissertation entitled, "The economics of discretionary behavior: managerial objectives in a theory of the firm" shows the borrowing of behavioral assumptions from the organization literature and its combination with analytical frameworks from neoclassical economics. Secondly, the problem of opportunistic behavior combined with that of bounded rationality arising from small number situations (bilateral monopoly) and uncertainty became the defining feature of his analytical framework (Hardt, 2009). Hence, TCE joins economics with organization theory and some aspect of law, especially contract law (Williamson, 2007). Williamson, therefore, used ideas from the organization literature which are translated into concepts observable in firms and markets (e.g., Simon's bounded rationality) which help in the theoretical conceptualization of incomplete contracts and opportunism. The use of Cyert and March's (1964) search theories (e.g., myopic search and or local search etc.) to develop the concept of "feasible foresight", and combination of that conceptual framework with the "classical" assumption prevalent in neoclassical economics as in cost minimization (Hardt, 2009).

Williamson's interdisciplinary training at Carnegie-Mellon University and his one year stint as special economic assistant to the head of the Antitrust Division at the US Department of Justice coupled with his motivation to study sources of market failure contributed to his successful work on "Transaction Cost Economics". To quote Williamson (1988, p. 16): "I was especially dismayed by the inadequacy of the theory that informed antitrust enforcement in the areas of vertical integration and vertical market restrictions". The teaching of organization theory (which he offered under the title, *Theories of Institutions*) in 1969 also gave him the added opportunity to join economics and organization theory in a more concerted effort. According to Williamson (1988), this led to the efforts to make an explicit choice of

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behavioral assumptions and the examination of the micro analytic attributes of transaction. His efforts to pool this approach together was in an earlier article published in the *American Economic Review* in 1971 followed by the publication of *Markets and Hierarchies* in 1975 by the Free Press (Williamson, 1988) and subsequent publications.

The Tenets of Williamson's TCE

The key question about why firms exist was addressed by Williamson with the principle that firms emerge when making transactions internally within the firm as this is less costly than externally on the market. This is seen to be similar to Coase's famous statement that "the main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism (Coase, 1937, p. 390 as cited in Hardt, 2009, p. 38). Coase (1937) further writes about the "the cost of discovering what the relevant prices are" and "costs of negotiating and concluding a separate contract" informs Williamson's work on TCE.

Hence, the costs of running the system includes such ex ante costs such as drafting and negotiating contracts and ex post costs such as monitoring and enforcing agreements (Rindfleisch & Heide, 1997). According to Williamson (1998, p. 23), "a key conceptual move for both [new institutional economics and new economics of organization] was to push beyond the theory of the firm as a production function (which is a technological construction) into a theory of the firm as a governance structure (which is an organizational construction)". Transaction cost theory perspectives on the theory of the firm and market organization can therefore be said to be partially complementary and partly rival. In that it helps in explaining the mechanisms that the theory purports to explain concerning firms and market organization.

TCE is an ex post governance construction with emphasis on transactions which R. A Commons refers to as "attention" such that continuity or breakdown of the exchange relation is of special importance. The characteristic feature of such transaction differs from simple market transactions where no such continuity is featured (Williamson, 2010). The TCE logic is that in a complex world, contracts are typically incomplete. This may be because agents are boundedly rational or that certain outcomes or qualities of the transaction are not observable or may not be verifiable to third parties such as the courts such that contracts cannot be made contingent on these variables or outcomes (Shelanski & Klein, 1995, p. 336). Due to this incompleteness, parties investing in relationship-specific assets are therefore exposed to some form of hazards.

One surest way to safeguard these investments is for the parties to merge through integration so as to avoid adversarial interests (such as opportunistic behaviors). Transaction specific investment or relationship-specific assets according to Williamson (1983) are distinguished into four categories: site specificity; physical asset specificity; human asset specificity and dedicated assets. Additional categories include brand name capital and temporal specificity. Several strategies exist to avoid this problem of safeguarding investments, some of which involve "hostage taking" and partial ownership agreements.

Generally, a variety of such governance structure may be used depending on peculiar characteristics of the relationship (Shelanski & Klein, 1995). TCE, therefore, tries to basically explain how partners choose from a set of feasible institutional alternative arrangements that offer protection for relationship-specific investments at the lowest total cost. Key characteristics of TCE include: extent to which relationship-specific assets are involved; uncertainty (environmental and/or behavioral); the complexity of

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the trading arrangement and the frequency with which the transaction occurs. The primary consequence of environmental uncertainty is an adaptation problem due to the difficulty of modifying agreements as a result of changing circumstances while the effect of behavioral uncertainty is the performance evaluation problem (i.e. the difficulty of verifying if compliance with established agreement has occurred (Rindfleisch & Heide, 1997).

Opportunism is the assumption that parties to an exchange process may unscrupulously seek to serve their own interest and therefore very difficult to know beforehand (a priori) who is trustworthy and who is not. According to Williamson (1985, p. 47), Opportunism is defined as “self-interest seeking with guile” which involves such behaviors as cheating, lying as well as more subtle forms of deceit such as violating contractual agreements. Opportunism poses a problem when a relationship is supported by specific assets whose value is limited outside the focal relationship (John, 1984; Rindfleisch & Heide, 1997). It is the need to curb such behaviors that requires the need to shift from market exchanges to organizational or vertically integrated exchanges (Buvik & John, 2000; John, 1984; Williamson, 1985).

The basic logic of TCE is that if adaptation, performance evaluation, and safeguarding costs are low or absent, market governance will be favored by economic actors while if these costs are high such that they exceed production cost advantages then firms are likely to favor internal organization. Organizations are noted to have more powerful control and monitoring mechanisms compared to the market system because of their ability to evaluate and reward behavior and as well as output (Oliver & Anderson, 1987; Rindfleisch & Heide, 1997). In view of this advantage possessed by firms over the market system, the ability of firms to detect opportunism and structure adaptation systems is enhanced.

Organizations are also able to provide incentive schemes and rewards as a way to reduce payoff from opportunistic behavior and tendencies (Rindfleisch & Heide, 1997). The governance systems and approaches posited by TCE can be described along a continuum from market to hierarchies. Thus, at one end of the spectrum lies the pure anonymous spot market and at the other end lies the fully integrated firm where trading parties have a unified ownership and control. TCE posits that such hierarchies offer greater protection for relationship-specific investments and also provide relatively more efficient mechanism for responding to change when coordinated adaptation is needed. Between the two poles of market and hierarchy lies a variety of “hybrid” modes such as partial contracts, alliances, and strategic partnerships, equity arrangements, to more informal mechanisms such as joint planning and information sharing (Rindfleisch & Heide, 1997; Shelanski & Klein, 1995; Williamson, 1985).

Some Conceptual/Empirical Studies Utilizing TCE

The application of TCE in empirical studies started in the USA in the 1980s and has since grown exponentially as the number of published articles has exceeded 400 involving researchers in Europe, New Zealand, and South America, among others (Williamson, 1998). A search using the key word “transaction cost economics” in Google produces over seven million results in a fraction of a second while a basic search in ProQuest and ScienceDirect produces a result of 51,497 and 56,263 peer reviewed and scholarly journal articles in just few seconds. This shows the depth of work in terms of the application and the use of TCE following its emergence since the 1970s. It is worthy to note that surveys of empirical TCE have been conducted in the past (e.g., Shelanski & Klein, 1995; Lyons, 1996; Crocker & Masten, 1996; Rindfleisch & Heide 1997; Geyskens, Steenkamp & Kumar, 2006) shows the growing application of the theory in various studies cutting across several different fields and disciplines.

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Most empirical works of TCE can be considered a basic variation of the following model: the efficient form in which a given economic activity is organized is a function of asset specificity, uncertainty, complexity and frequency. Organizational form is the dependent variable while asset specificity, uncertainty, complexity and frequency are the independent variable. Organizational form is usually conceptualized as “make” or “buy” which is binary though sometimes as a continuous variable.

Most empirical TCE studies use a variety of methodological options such as qualitative studies involving case studies and quantitative studies using longitudinal or cross-sectional data (Shelanski & Klein, 1995). Qualitative case studies (e.g., Williamson’s 1976 study of cable TV franchising) and quantitative cross-sectional studies using econometric analytics are common. A summary of a few empirical studies are discussed. It is not within the scope of this chapter to provide an extensive review of the empirical studies utilizing TCE. A brief overview of some studies in order to appreciate the level of development of this very important theory is summarized in Appendix 1 and 2.

The decision to “make” or “buy” has been one of the dominant decision making paradigm in the application of TCE. The decision to “make” or “buy” is a strategic decision which is pertinent to the competitiveness of the firm. Monteverde and Teece’s (1982ab) application of TCE in the “make” or “buy” decision problem is one of such example. Monteverde and Teece (1982a) using a sample of 133 firms; independent variable: asset specificity and dependent variable internal versus external procurement of components finds that asset specificity is positively related to automobile manufacturer’s internal production of components (see Appendix 1). Noordewier, John, and Nevin (1990) used a cross-sectional sample of 140 manufacturing firms which purchase ball and roller bearings, items that are repetitively used by the manufacturing firms to empirically examine the relationship between the organization of the buyer-supplier interface and performance in the procurement of such items.

On the basis of TCE reasoning, Noordewier, John, and Nevin (1990) proposed from the buyers’ perspective a model of purchasing arrangements for repetitively used items. Acquisition costs stems from the need to originate requisitions, interview sales people, expedite deliveries, and follow up on inaccurate deliveries among other activities. Using lateness of deliveries and the extent of unacceptable items as observable indicators of acquisition costs, Noordewier, John, and Nevin’s (1990) findings indicate that acquisition costs are lowered under conditions of uncertainty when buyers and sellers share high levels of relational governance.

Stump and Heide (1996) study of 165 chemical manufacturers also suggest that buyers protect specific investment through partner selection; high levels of uncertainty are negatively related to supplier specific investment while more extension supplier qualification reduces buyer monitoring significantly. Buvik and John’s (2000) study of 161 industrial buyers using TCE as the theoretical framework conclude that when specific investments are modest, greater vertical coordination increases transaction difficulties in adapting to high environmental uncertainty. Conversely, vertical coordination increases transaction difficulties when firms adapt to high environmental uncertainty and when specific investments are substantial (Buvik & John, 2000). See Appendix 2.

Subsequently, numerous studies have been conducted within the purchasing and channel studies utilizing the TCE framework. It is important to note that most of these studies cut across various fields and subject areas. However, in most purchasing, marketing and channel studies, TCE empirical studies have look at vertical integration, complex contracting and hybrids, informal agreements, and franchising among others. The linkage of TCE and supply chain management by Williamson himself is also worth mention. Williamson’s article titled, *Outsourcing: Transaction Cost Economics and Supply Chain Management*, examined outsourcing from TCE perspectives using transaction as the basic unit of analy-

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sis and procurement decision, as between “make” or “buy” with reference to transaction cost as the economizing objective. The ease of contracting varies with the attributes of the transaction, with special emphasis on whether preserving continuity between a particular buyer-seller pair is source of added value.

As bilateral dependency develops, the efficient governance of contractual relation gradually moves from simple market exchange to hybrid contracting to hierarchy. This last corresponds to the “make” decision which as viewed from TCE perspective is seen as the organization form of last resort (Williamson, 2008, p.5).

CONCLUSION

Purchasing is an important driver of firm competitiveness. On average, industrial firms spend more than half of every sales dollar on purchased products. Because each dollar saved in procurement is equal to a dollar of new profit, purchasing influence can easily make the difference in leadership in an industry and an untenable competitive position (Noordewier, John, & Nevin, 1990, p. 80). The development of purchasing as a field of study and a profession all started with industrial purchasing with significant contribution from the field of marketing. Purchasing started with the emphasis on marketing philosophy where the product concept was very dominant during 1850-1915, followed by the era of the selling concept (1916-1960) and the new concept of marketing after the 1960s. Early textbooks in industrial marketing appeared in the 1930s. Copeland's (1930) publication of a case book and Frederick's (1934) publication of a textbook on industrial marketing gave it the needed attention for growth.

Purchasing's importance in the business organization has been highly elevated. The role of the buyer has developed from a clerical function to a more strategic and professional status. This development has also been largely attributed to the efforts of the various professional bodies, academic and research associations. These associations have been involved in the development and promotion of purchasing as a profession of much repute and an academic field which is very important to the development of the field of purchasing and supply management.

Though a careful survey of the marketing literature shows that previously a relatively small proportion of it was devoted to the problems and techniques of marketing industrial products (Buvik, 2011), much attention is now been devoted to purchasing because of its impact on the bottom line of most businesses. A lot of literature and theoretical frameworks have been developed to help explain various phenomena in the purchasing field. TCE is one of such notable theories that have been applied.

Ronald Coase's (1937) classic paper titled, *The Nature of the Firm*, was the first to highlight the concept of transaction costs on the study of firm and market organization. Coase uncovered a serious lapse in the commonly accepted textbook theory of the firm and market organization. Upon the realization that the firm and market can be considered as “alternative methods of coordinating production” (1937, p.388), Coase observed that the decision to use one mode rather than the other should not be taken as a given (as a prevailing practice) but should be derived (Williamson, 2010, p. 216). The implicit assumption of zero transaction cost went unchallenged for over two decades during that era. The key question about why firms exist was addressed by Williamson with the principle that firms emerge when making transactions internally within the firm, as this is less costly than externally on the market.

Transaction cost has been criticized for various reasons, including: (1) neglecting the social (Granovetter, 1985; Uzzi, 1996) and institutional (North, 1986); (2) failing to take into account the relation between company characteristics and contract choices (Liebein, 2003); (3) inability to examine the relation

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between different types of transaction risk (Geysken et al., 2006); (4) even though Williamson (2000) may explicitly conceptualize TCE as a dynamic framework, most studies examine the process of reducing exposure to transaction risks as a static process (Dyer, 1977; Wever, Wognum, Trienekens & Omta, 2012). Williamson (2010, p. 686) aware of some of these criticisms states:

Transaction cost economics is sometimes criticized because it has not been fully formalized, to which I have three responses: transaction cost economics, like many other theories, has undergone a natural progression; full formalization is work in progress; and premature formalization runs the risk of a disconnection with the phenomena. Theories commonly progress from informal to preformal to semiformal to fully formal stages of development—broadly in the spirit of Thomas S. Kuhn (1970). The informal stage of transaction cost economics was the literature from the 1930s (especially Commons and Coase) where errors or omissions in the neoclassical set-up were described. Preformal work got underway in the 1970s, where new concepts for interpreting vertical integration, vertical market restrictions, labor market organizations, franchise bidding for natural monopoly, and the like were forged and the conditions for efficient alignment were worked out. Semiformal work in the 1980s and since deal with credible contracting, hybrid modes, the dimensionalization of transactions and governance structures, a multiplicity of applications within business and economics and the contiguous social science (to include public policy), and the extensive empirical testing. Full formalization also got under way in the 1980s and is still in progress.

The formalization of TCE remains ongoing as its application in the purchasing field and other fields has contributed to so much knowledge creation and growth in these fields. Therefore, TCE will continue to be of useful application now and in the future.

REFERENCES

- Anderson, E., & Oliver, R. L. (1987). Perspectives on behavior-based versus outcome-based sales control systems. *Journal of Marketing*, 51(4), 76–88. doi:10.2307/1251249
- Barney, J. B. (2012). Purchasing, supply chain management and sustained competitive advantage: The relevance of resource-based theory. *Journal of Supply Chain Management*, 48(2), 3–6. doi:10.1111/j.1745-493X.2012.03265.x
- Barry, J., Cavinato, J. L., Green, A., & Young, R. R. (1996). A development model for effective MRO procurement. *International Journal of Purchasing and Materials Management*, 32(2), 35–44. doi:10.1111/j.1745-493X.1996.tb00284.x
- Bhote, K. R. (1989). *Strategic supply management: A blueprint for revitalizing the manufacturer-supplier partnership*. New York: AMACOM.
- Bonoma, T. V., & Johnston, W. J. (1978). The social psychology of industrial buying and selling. *Industrial Marketing Management*, 7(4), 213–224. doi:10.1016/0019-8501(78)90038-X
- Burt, D. N., & Doyle, M. F. (1993). *The American Keiretsu: A strategic weapon for global competitiveness*. New York: McGraw-Hill.

The History and Development of Purchasing Management and Its Theoretical Framework

- Buvik, A. (2002). Hybrid governance and governance performance in industrial purchasing relationships. *Scandinavian Journal of Management*, 18(4), 567–587. doi:10.1016/S0956-5221(01)00030-6
- Buvik, A. (2011, May 2-6). Industrial Purchasing: It all started with marketing (PhD course). Molde University College, Molde, Norway.
- Buvik, A., & John, G. (2000). When does vertical coordination improve industrial purchasing relationships? *Journal of Marketing*, 64(4), 52–64. doi:10.1509/jmkg.64.4.52.18075
- Buvik, A., & Reve, T. (2001). Asymmetrical deployment of specific assets and contractual safeguarding in industrial purchasing relationships. *Journal of Business Research*, 51(2), 101–113. doi:10.1016/S0148-2963(99)00056-9
- Carter, J. R., & Narasimhan, R. (1996). Is purchasing really strategic? *International Journal of Purchasing and Materials Management*, 32(4), 20–28. doi:10.1111/j.1745-493X.1996.tb00216.x
- Carter, R., & Hodgson, G. M. (2006). The impact of empirical tests of transaction costs economics on the debate on the nature of the firm. *Strategic Journal Management*, 27(5), 461–476. doi:10.1002/smj.531
- Cavinato, J. L. (1991). Evolving procurement organizations: Logistics implications. *Journal of Business Logistics*, 13(1), 27–45.
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386–405. doi:10.1111/j.1468-0335.1937.tb00002.x
- Commons, J. R. (1934). *Institutional Economics*. Madison: University of Wisconsin Press.
- Copeland, M. A. (1930). Psychology and the natural science point of view. In M.A. Copeland (Ed.), *Psychological Review* (461-487). Westpoint, CN: Greenwood Press. doi:10.1037/h0072054
- Corey, E. R. (1962). *Industrial marketing: cases and concepts*. Englewood Cliffs, NJ: Prentice-Hall.
- Corey, E. R. (1976). *Industrial Marketing*. Englewood Cliffs, NJ: Prentice-Hall.
- Cova, B., & Salle, R. (2007). The industrial /consumer marketing dichotomy revisited: A case of outdated justification? *Journal of Business and Industrial Marketing*, 23(1), 3–11. doi:10.1108/08858620810841443
- Cox, A. (1997). *Business success – a way of thinking about strategic, critical supply chain assets and operational best practice*. London: Earlsgate Press.
- Crocker, K. J., & Masten, S. E. (1996). Regulation and administered contracts revisited: Lessons from transaction cost economics for public utility regulation. *Journal of Regulatory Economics*, 9(1), 5–39. doi:10.1007/BF00134817
- Cyert, R., & March, J. (1964). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice Hall.
- Drucker, P. F. (1954). *The practice of management*. New York: Harper & Row Publishers, Inc.
- Dyer, J. H. (1997). Effective Interfirm collaboration: How firms minimize Transaction Cost and maximize transaction value. *Strategic Management Journal*, 18(7), 535–556. doi:10.1002/(SICI)1097-0266(199708)18:7<535::AID-SMJ885>3.0.CO;2-Z

The History and Development of Purchasing Management and Its Theoretical Framework

- El-Ansary, A. I., & Stern, L. W. (1972). Power measurement in the distribution channel. *JMR, Journal of Marketing Research*, 9(1), 47–52. doi:10.2307/3149605
- Ellram, L. M., & Carr, A. (1994). Strategic purchasing: A history and review of the literature. *International Journal of Purchasing and Materials Management*, 30(2), 10–18.
- Ford, I. D. (1982). The development of buyer-seller relationships in industrial markets. In H. Håkansson (Ed.), *International Marketing and Purchasing of Industrial Goods: An Interaction Approach* (pp. 288–304). New York: John Wiley.
- Frederick, J. H. (1934). *Industrial Marketing*. New York: Prentice Hall.
- Gelderman, C. J. (2003). *A portfolio approach to the development of differentiated purchasing strategies* [Doctoral dissertation]. Eindhoven University of Technology.
- Gelderman, C. J., & Van Weele, A. J. (2005). Purchasing portfolio models: A critique and update. *The Journal of Supply Chain Management*, 41(3), 19–28. doi:10.1111/j.1055-6001.2005.04103003.x
- Geyskens, I., Steenkamp, J.-B. E. M., & Kumar, N. (2006). Make, buy, or ally: A transaction cost meta-analysis. *Academy of Management Journal*, 49(3), 519–543. doi:10.5465/AMJ.2006.21794670
- Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, 91(3), 481–510. doi:10.1086/228311
- Håkansson, H. (1982). *International Marketing and Purchasing of Industrial Goods*. Chichester, UK: Wiley.
- Hardt, L. (2006). Transaction cost economics as a three dimensional externally driven research program. *Studia Ekonomiczne*, 1(2), 7–31.
- Hardt, L. (2009). The history of transaction cost economics and its recent developments. *Erasmus Journal of Philosophy and Economics*, 2(1), 29–51.
- Heberling, M. E. (1993). The rediscovery of modern purchasing. *International Journal of Purchasing and Material Management*, 29(4), 48–53.
- Hicks, J. (1935). A suggestion for simplifying the theory of money. *Economica*, 2(5), 1–19. doi:10.2307/2549103
- John, G. (1984). An empirical investigation of some antecedents of opportunism in a marketing channel. *JMR, Journal of Marketing Research*, 21(3), 278–289. doi:10.2307/3151604
- John, G., & Weitz, B. A. (1988). Forward integration into distribution: An empirical test of transaction cost analysis. *Journal of Law Economics and Organization*, 4, 121–139.
- Katona, G. (1951). *Psychological analysis of economic behavior*. New York: McGraw-Hill.
- Kenichi, O. (1991). *The Mind of the Strategist: The Art of Japanese Business*. New York: McGraw-Hill.
- Keough, M. (1993). Buying your way to the top. *The McKinsey Quarterly*, 2, 41–62.
- Kotler, P. (1967). *Marketing management*. Englewood Cliffs, NJ: Prentice-Hall.

The History and Development of Purchasing Management and Its Theoretical Framework

- Kotler, P. (1972). *Marketing management: analysis, planning and control*. Englewood Cliffs, NJ: Prentice-Hall.
- Kotler, P. (1976). *Marketing management: analysis, planning and control* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review*, 61(5), 109–117.
- Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago: University of Chicago Press.
- Lamming, R. C., & Harrison, D. (2001). Smaller customers and larger suppliers: the potential for strategic purchasing approach: A case study. Paper presented at the 10th International IPSERA Conference, Jonkoping, Sweden.
- Leiblein, M. J. (2003). The choice of organizational governance form and performance: Predictions from Transaction Cost, Resource-Based, and Real Options Theories. *Journal of Management*, 29(6), 937–961. doi:10.1016/S0149-2063(03)00085-0
- Lieberman, M. B. (1991). Determinants of vertical integration: An empirical test. *The Journal of Industrial Economics*, 39(5), 451–466. doi:10.2307/2098455
- Luzzini, D., Caniato, F., Ronchi, S., & Spina, G. (2012). A transaction costs approach to purchasing portfolio management. *International Journal of Operations & Production Management*, 32(9), 1015–1042. doi:10.1108/01443571211265684
- Lyons, B. R. (1996). Empirical relevance of efficient contract theory: Interfirm contracts. *Oxford Review of Economic Policies*, 12(4), 27–52. doi:10.1093/oxrep/12.4.27
- Magan, J., Lalwani, C., Butcher, T., & Javadpour, R. (2012). *Global logistics and supply chain management*. Chichester, West Sussex: John Wiley & Sons Ltd.
- McIntyre, S. L. (2000). The failure of Fordism. *Technology and Culture*, 41(2), 269–299. doi:10.1353/tech.2000.0075
- Monteverde, K., & Teece, D. J. (1982a). Supplier switching costs and vertical integration in the automotive industry. *The Bell Journal of Economics*, 13(1), 206–213. doi:10.2307/3003441
- Monteverde, K., & Teece, D. J. (1982b). Appropriate rent and quasi vertical integration. *The Journal of Law & Economics*, 25(2), 321–328. doi:10.1086/467018
- Noordewier, T. G., John, G., & Nevin, J. R. (1990). Performance outcomes of purchasing arrangements in industrial buyer-vendor relationships. *Journal of Marketing*, 54(4), 80–93. doi:10.2307/1251761
- North, D. C. (1986). The new institutional economics. *Journal of Institutional and Theoretical Economics*, 142(1), 230–237.
- Pilling, B. K., Crosby, L. A., & Jackson, D. W. Jr. (1994). Relational bonds in industrial exchange: An experimental test of the transaction cost economic framework. *Journal of Business Research*, 30(3), 237–251. doi:10.1016/0148-2963(94)90054-X

The History and Development of Purchasing Management and Its Theoretical Framework

- Rajagopal, S., & Chadwick, T. (1997). *Strategic supply management: An implementation toolkit*. Oxford: Butterworth-Heinemann.
- Reck, R. F., & Long, B. C. (1988). Purchasing: A competitive weapon. *Journal of Purchasing and Material Management*, 24(3), 2–8.
- Rindfleisch, A., Antia, K., Bercovitz, J., Brown, J. R., Cannon, J., Carson, S. J., & Wathne, K. H. et al. (2010). Transaction cost, opportunism, and governance: Contextual considerations and future research opportunities. *Marketing Letters*, 21(3), 211–222. doi:10.1007/s11002-010-9104-3
- Rindfleisch, A., & Heide, J. B. (1997). Transaction cost analysis: Past, present and future applications. *Journal of Marketing*, 61(4), 30–54. doi:10.2307/1252085
- Robinson, P. J., & Faris, C. W. (1967). *Industrial Buying and Creative Marketing*. Boston: Allyn & Bacon.
- Shelanski, H., & Klein, P. (1995). Empirical research in transaction cost economics: A review and assessment. *Journal of Law Economics and Organization*, 11, 335–361.
- Sheth, J. N. (1973). A model of industrial buyer behavior. *Journal of Marketing*, 37(4), 50–56. doi:10.2307/1250358
- Sheth, J. N. (1996). Organizational buying behavior: Past performances and future expectations. *Journal of Business and Industrial Marketing*, 11(3/4), 7–24. doi:10.1108/08858629610125441
- Simon, H. (1957a). *Models of Man*. New York: John Wiley and Sons.
- Simon, H. (1957b). *Administrative Behavior*. New York: Macmillan.
- Simon, H. (1978). Rationality as process of and as product of thought. *The American Economic Review*, 68(2), 1–16.
- Simon, H., Smithburg, D., & Thompson, V. (1950). *Public Administration*. New York: Knopf.
- Stump, R. L., & Heide, J. B. (1996). Controlling supplier opportunism in industrial relationships. *JMR, Journal of Marketing Research*, 33(4), 431–441. doi:10.2307/3152214
- Syson, R. (1994). Purchasing for the nineties. Retrieved from <http://www.littoralis.info/iom/assets/1994020135.pdf>
- Tesfay, Y. Y. (2014). Environmentally friendly cost efficient and effective sea transport outsourcing: The case of Statoil. *Transportation Research Part D, Transport and Environment*, 31, 135–147. doi:10.1016/j.trd.2014.05.019
- Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review*, 61(4), 674–698. doi:10.2307/2096399
- Van Weele, A. J. (2009). *Purchasing and supply chain management: Analysis, strategy, planning and practice*. Cengage Learning EMEA.
- Van Weele, A. J., Rozemeijer, F. A., & Rietveld, G. (2010). Professionalizing purchasing in organizations: towards a purchasing development model. Retrieved from <http://www.gercorietveld.nl/wp-content/uploads/2010/10/Purchasing-Development-Model.pdf>

The History and Development of Purchasing Management and Its Theoretical Framework

- Vargo, S. L., & Lusch, R. F. (2011). It's all B2B...and beyond: Toward a systems perspective of the market. *Industrial Marketing Management*, 40(2), 181–187. doi:10.1016/j.indmarman.2010.06.026
- Walras, L. (1893). To Johan Gustave Knut Wicksell (Letter no. 1170). In W. Jaffe (Ed.), *Correspondence of Leon Walras and related papers* (Vol. 2). Amsterdam: Royal Netherland Academy of Sciences and Letters.
- Webster, F. E. Jr. (1979). *Industrial Marketing Management*. New York: John Wiley & Sons.
- Webster, F. E. Jr. (1992). The changing role of marketing in the corporation. *Journal of Marketing*, 56(4), 1–17. doi:10.2307/1251983
- Webster, F. E. Jr, & Wind, Y. (1972). A general model for understanding organizational buying behavior. *Journal of Marketing*, 36(2), 12–19. doi:10.2307/1250972
- Weeks, R. R., & Marks, W. J. (1969). The marketing concept in historical perspective. *Business & Society*, 9(2), 24–32. doi:10.1177/000765036900900203
- Wever, M., Wognum, P. M., Trienekens, J. H., & Omta, S. W. F. (2012). Supply chain-wide consequences of transaction risks and other contractual solutions: Towards an extended transaction cost economics framework. *Journal of Supply Chain Management*, 48(1), 73–91. doi:10.1111/j.1745-493X.2011.03253.x
- Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and anti-trust implications*. New York: The Free Press.
- Williamson, O. E. (1976). Franchise bidding for natural monopolies-in general and with respect to CATV. *The Bell Journal of Economics*, 7(1), 73–104. doi:10.2307/3003191
- Williamson, O. E. (1979). Transaction cost economics: The governance of contractual relations. *The Journal of Law & Economics*, 22(2), 233–261. doi:10.1086/466942
- Williamson, O. E. (1981). The economics of organizations: The transaction cost approach. *American Journal of Sociology*, 87(3), 548–577. doi:10.1086/227496
- Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review*, 73(4), 519–540.
- Williamson, O. E. (1985). *The economic institutions of capitalism: firms, markets, relational contracting*. New York: The Free Press.
- Williamson, O. E. (1988, March 7). Markets and hierarchies: analysis and antitrust implications, *This Weeks Citation Classic*, CC/No. 10. Retrieved from <http://garfield.library.upenn.edu/classics1988/A1988M191900001.pdf>
- Williamson, O. E. (1998). Transaction cost economics: How it works; where it is headed? *De Economist*, 146(1), 23–58. doi:10.1023/A:1003263908567
- Williamson, O. E. (2007, March 1). Transaction cost economics: An introduction (Discussion paper 2007-3). *The Open Access Open Assessment E-Journal*, Retrieved from <http://www.economics-ejournal.org/economics/discussionpapers/2007-3>

The History and Development of Purchasing Management and Its Theoretical Framework

Williamson, O. E. (2008). Outsourcing: Transaction cost economics and supply chain management. *The Journal of Supply Chain Management*, 44(2), 5–16. doi:10.1111/j.1745-493X.2008.00051.x

Williamson, O. E. (2010). Transaction cost economics: The natural progression. *The American Economic Review*, 100(3), 673–690. doi:10.1257/aer.100.3.673

Williamson, O. E. (2010). Transaction cost economics: The natural progression. *Journal of Retailing*, 86(3), 215–226. doi:10.1016/j.jretai.2010.07.005

KEY TERMS AND DEFINITIONS

Bounded Rationality: Individuals are limited by the information they have in order to make a decision in the decision-making process due to the limitation of rationality of individuals.

Kraljic Matrix: This is a matrix introduced by Kraljic in his 1983 Harvard Business Review publication. Kraljic provided a classification of items that firms procure into four different categories based on their profit impact and supply risk.

Marketing Concept: This is the period after 1960 where the emphasis shifted to meeting the needs of customers and firms began to place more attention to being customer centric.

Opportunism: This is the assumption that parties in an exchange relationship may take advantage of the other to unscrupulously seek their own self interests.

Product Concept: This refers to the period from 1850 to 1915 which was characterized by production orientation where the emphasis was more on how to efficiently produce goods.

Selling Concept: This refers to the period from 1916 to 1960 which was characterized by firms' concentration on increasing sales.

Strategic Triangle: This is a model which is useful for strategy development and showcase how firms relate to their customers, suppliers, and competitors.

Transaction Cost: This is the cost incurred in making an economic exchange such as search and information cost.

Transaction-Specific Assets: This is the extent to which investments made to support a particular transaction or relationship have a higher value to that transaction or relationship than they would have if deployed for any other purpose.

The History and Development of Purchasing Management and Its Theoretical Framework**APPENDIX 1***Table 3. Some selected studies utilizing TCE. Source: Modified from Rindfleisch and Heide (1997).*

| Author(s) | Sample | Independent Variable(s) | Dependent Variable(s) | Key Findings |
|------------------------------------|--|---|---|---|
| Monteverde and Teece (1982a) | 133 Automotive components | Asset specificity | Internal versus external procurement of components | Asset specificity is positively related to automobile manufacturer's internal production of components |
| Monteverde and Teece (1982b) | 28 components of a major US automotive supplier | Value of appropriable quasi rents | Presence of absence of quasi-vertical integration | The value of appropriable quasi rents is positively related to quasi-vertical integration. |
| John and Weitz (1988) | 88 Manufacturers of industrial products | Asset specificity; Environmental uncertainty; Behavioral uncertainty | Percentage of manufacturer's sales through direct distribution channels | Asset specificity, environmental and behavioral uncertainty are positively related to manufacturer's degree of forward vertical integration into distribution. |
| Noordewier, John and Nevin (1990) | 140 Manufacturing firms who purchase ball and roller bearings | Environmental uncertainty and acquisition cost | Level of possession and acquisition cost | Acquisition cost is lowered under conditions of uncertainty when buyers and sellers share high levels of relational governance |
| Pilling, Crosby and Jackson (1994) | 229 Purchasing personnel from aerospace, electronics and defense firms | Asset specificity; Environmental uncertainty; Transaction frequency Level of ex ante and ex post transaction costs | Level of ex ante and ex post costs Relational closeness | Asset specificity is positively related to both ex ante and ex post costs, environmental uncertainty is related to ex ante costs, and frequency is related to neither cost. Transaction costs appear to mediate the relationship between TCA dimensions and relational closeness. |

The History and Development of Purchasing Management and Its Theoretical Framework**APPENDIX 2***Table 4. Some selected studies utilizing TCE. Source: Modified from Rindfleisch and Heide (1997).*

| Author(s) | Sample | Independent Variable(s) | Dependent Variable(s) | Key Findings |
|------------------------|---------------------------------------|---|--|---|
| Lieberman (1991) | 203 US producers of chemical products | Supplier concentration; Asset specificity; Cost of an upstream input | Backward integration versus contractual arrangements for obtaining chemical products | Firms seek downstream integration to avoid lock-in due to specific assets; the higher the cost input, the higher the probability of backward integration. |
| Stump and Heide (1996) | 165 Chemical manufacturers | Asset specificity | Partner qualification, incentive design, and monitoring | Buyers protect specific investments through partner selection and supplier-specific investments. |
| | | Technological uncertainty | Level of supplier specific investments | Higher levels of uncertainty are negatively related to supplier specific investments. |
| | | Partner qualification | Degree of monitoring | More extensive supplier qualification reduces buyer monitoring |
| Buvik and John (2000) | 161 Industrial buyers | Uncertainty; Supply specific investments; Buyer specific investments; Vertical coordination | Transaction cost | When specific investments are modest, greater vertical coordination increases transaction difficulties in adapting to high environmental uncertainty. Conversely vertical coordination increases transaction difficulties when firms adapt to high environmental uncertainty and specific investments are substantial |

Chapter 23

Implementation of Green Supply Chain Management in a Globalized Economy

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ABSTRACT

Green supply chain management (GSCM) practices help a firm to become eco-friendly, socially responsible, meet customer expectations, deal with industry peer-pressure and comply with government regulations (Luthra, 2014). GSCM refers to the management of all activities involved in sourcing, purchasing, manufacturing, transportation and distribution of products and services to customers in an eco-friendly way (Sharma, 2013). A conceptual framework of GSCM is presented that consists of eco-friendly organizational culture, collaborative relationships, innovative products and eco-friendly processes (Mutingi, 2013). A SWOT analysis for context specific implementation strategies for global GSCM is presented (Lee and Chen, 2010). The contribution of GSCM practices to a firm's performance is discussed (Laisirihongthong et al., 2013). The critical success factors required to achieve GSCM include top management commitment, government regulations, environment protection literacy and compliance among the supply chain partners, and ISO14001 certification (Jain and Sharma, 2014).

INTRODUCTION

The conventional "Supply Chain Management (SCM)" includes the firm's strategies to efficiently integrate suppliers, manufacturers, warehouses and stores so that merchandise is produced and distributed in the right quantity, to the right location, and at the right time, in order to minimize system wide costs while satisfying service-level requirements (Simchi-Levi et al., 1999). SCM's goal is to achieve downstream integration and upstream collaboration of firm's partners and customers in an effective and efficient manner. SCM includes manufacturing operations, purchasing, transportation, and distribution and is a key component of organizational competitiveness and effectiveness (Womack & Jones, 2005). The practices, concerns, competencies, and performance criteria of conventional supply chain are different from those for green supply chain management (GSCM).

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GSCM adds the ‘green’ component to conventional supply chain management by sourcing, purchasing, designing, manufacturing, operations, transportation, and distribution of products to customers in an eco-friendly way. GSCM uses reverse logistics and waste management for scheduling, applying and monitoring the well-organized, economical drift of raw materials, in-process catalog, finished goods and associated information from the point of ingesting to the point of recollecting value or proper discarding (Srivastava, 2007; Green et al., 2013; Ghobakhloo et al., 2013).

The green supply chain is defined as the chain of touch points for a product or service from the manufacturer to the customer where each link in the chain integrates the concerns for environment along with economic and social concerns into all their processes. The term “green” refers to the environment and is one of the three pillars of the concept of sustainability – environmental, social, and economic. The links in the supply chain include the raw materials suppliers, components, finished product/service, and wholesale and retail distributors. GSCM applies to each of the links in the supply chain acting in an environment-friendly way and involves ensuring that all the partners in the supply chain share the same concern for the environment (Rahimifard & Clegg, 2007). The overall strength of the whole green supply chain is limited by the weakest link.

The stakeholders’ demands and government regulations continue to push businesses to be more and more sustainable (Ashby et al., 2012). Motivated by the need for companies to move towards ecologically sustainable business practices including the practices of ISO14000 and ISO 26000, there is a growing need for integrating environmentally sound choices into supply chain management practices. A number of operational guidelines, standards, and legislative frameworks have been put in place to minimize environmental impact of manufacturing, distribution and retailing (Baines et al., 2012). Corporations, consumers and governments are becoming more aware of protecting the environment and adopting strategies for renewable resources (Sharma, 2013). Corporations are upgrading their supply chain management from a purely functional role to a strategic role to comply with current environmental legislations and maintain an enduring competitive advantage, through technological innovation and improved eco-efficiency (Mutingi, 2013).

The strategy of implementing GSCM can be risk-based and/or innovation based (Lee & Chen, 2010). A green supply chain strategy directly impacts the overall environmental, economic and operations performance. The economic benefits are derived from increased efficiency through reduced waste, competitive advantage through innovation, improved product quality, consistent corporate environmental goals and improved public image (Sharma, 2013). In today’s globalized economy, corporations are increasingly demonstrating a convergence of supply chains and sustainability (Mollenkopf et al., 2010). The firms’ ability to implement green supply chains is becoming a powerful novel source of competitive advantage and good economic performance (Rao & Holt, 2005; Green et al., 2012).

This chapter focuses on the role of the various factors that contribute to a firm’s green supply chain management. A conceptual framework of GSCM is presented that consists of eco-friendly organizational culture, collaborative relationships, innovative products and eco-friendly processes. Environmental Performance Index (EPI) and International Environmental and Social standards like ISO 14000 and 26000 are discussed. A SWOT analysis of GSCM is presented to enable a firm to select its context-specific GSCM strategy. The drivers of the implementation strategies for GSCM are described. Finally, the role of GSCM to firm’s business performance is presented.

*Implementation of Green Supply Chain Management in a Globalized Economy***GREEN SUPPLY CHAIN MANAGEMENT: CONCEPTUAL FRAMEWORK**

GSCM practices include green design, green purchasing, reduction in energy consumption, reuse/recycling, packaging, environmental collaboration in the supply chain, cleaner production, internal service quality, just-in-time inventory, environmental auditing, and green innovation. The goals of GSCM are to minimize waste, minimize energy consumption and optimize resource usage. The elements of the green supply chain include green procurement, production, packaging, marketing, logistics and recycling (Emmet & Sood, 2010; Cervera & Flores, 2012). There are two types of GSCM practices – proactive and reactive. Proactive practices include eco-design, green purchasing and reverse logistics while reactive practices include compliance with the legislation and regulation. GSCM performance is influenced by the organizational culture, collaboration with supply chain partners, and the product and process design.

A conceptual framework of GSCM strategy consists of *eco-friendly organizational culture, collaborative relationships with supply chain partners, innovative and eco-friendly products and processes* (see Figure 1). GSCM focuses on the green design, green operations, green manufacturing, reverse logistics and waste management (Srivastava, 2007), and must be context specific due to local, national and international environmental regulations. The critical areas of GSCM focus include environmental performance standards, eco-efficiency, green technology innovations, and collaborative supply chain with reduced waste and recycling (Mutingi, 2013).

Organizations are beginning to prioritize the importance of the environmental and social aspects in addition to the economic aspect. The eco-friendly organizational culture and GSCM originates in the boardroom as top management commitment sets the tone and policies for the entire organization. However, when the top management of an organization decides to implement an environmental vision and goals, the employees may resist the change. The same methods that are used for changing the organizational culture can also be used for making the organization more eco-friendly. Communicating the information about the need to become eco-friendly and involving all employees in the process of becoming eco-friendly is essential. Ongoing evaluation of the progress and celebrating successes is crucial since environmental work is an ongoing process.

To implement GSCM effectively, firms must possess both internal environmental management and external collaboration with suppliers and customers in their supply chain to ensure eco-friendly strategy.

Figure 1. Determinants of green supply chain management strategy



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Firms must collaborate with the first and second tier suppliers to comply with environmental regulations in creating products and services. Green purchasing involves conducting an environmental audit of the supplier and requiring an external international environmental system certification like ISO 14000 (Hsu & Hu, 2008). In global GSCM, the suppliers may not be aware of the environmental regulations in foreign countries so buyers must make their suppliers aware of such regulations (Lee, 2008).

Two main practices of GSCM include green design and green processes. A green product can be an innovative product that may have an unpredictable demand and may have a short life cycle. The innovative product focuses on green efficiency using innovative technology and should be innovative and designed with environment in mind. The manufacturing processes need to be eco-efficient or green-efficient (Paulraj et al., 2008). Green design involves environmentally conscious design (ECD) and life cycle assessment (LCA). Green operations include green manufacturing, reuse, recycle, reverse logistics, and network design.

In a green supply chain of a manufacturer and retailer of a consumer product, one has to determine the effect of the package size and shelf space on profit. Reducing the package size of its product reduces environmentally costly transportation cost, reduces product packaging cost, and cost savings (Swami & Shah, 2011, 2013). Green performance metrics need to be put in place for assessing the impact on business performance. Performance measurement for GSCM includes intra-organizational, inter-organizational and environmental issues that affect all the members in the green supply chain (Hervani et al., 2005). Implementation of GSCM is governed by institutional theory (IT), ecological modernization theory (EMT), and total environmental quality management (TQM) (Muslan, 2013; Li, 2011). Risk theory has been applied to GSCM (Khan & Burnes, 2007).

COLLABORATIVE RELATIONSHIPS BETWEEN GLOBAL GREEN SUPPLY CHAIN MEMBERS

With increased globalization, the supply chain often involves partners across continents. Globalization enables new markets for products and access to suppliers who can provide materials and inputs more efficiently than domestic sources. The globalization of supply chains involves off shoring production, inventories, suppliers and customers. It also represents differences in economies, infrastructures, cultures, and politics in the competitive environment (Manuj & Mentzer, 2008). The green, global and lean supply chain strategies need to be considered in an integrated life cycle management framework (Mollenkopf, Stolze, Tate, & Ueltschy, 2010).

The buyer-supplier quality management facilitates cooperative learning and improves inter-organizational learning processes leading to enhancement of supply chain satisfaction and performance. The interaction of the firm level and supply chain-level quality practices influence buyer-seller performance and lead to buyer-supplier satisfaction. The firm-level quality practices involve top management support, information systems, employee involvement, process improvement, product/service design and customer satisfaction. The supply chain level quality practices involve trust, governance, information integration, process integration, and cooperative learning (Mellat-Parast, 2012).

The relationships between all the links of the supply chain need to be collaborative and based on trust. The collaborative relationship involves enhanced mutual involvement and high degree of information sharing between the stakeholders. A collaborative supply chain is agile, flexible, and responds quickly

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to dynamic demand using innovation and dynamic technology evolution (Liker & Choi, 2004). Product life-cycle costs and overall supply chain costs are minimized through collaborative relationships (Zhu & Sarkis, 2007).

Corporations have to take environmental initiatives in inbound logistics, production or the internal supply chain, outbound logistics and, in some cases, reverse logistics which include materials suppliers, service contractors, vendors, distributors and end users working together to reduce or eliminate adverse environmental impact of their business activities (Rao & Holt, 2005).

Trust among the partners in all the links in the green supply chain ensures proper coordination and functioning of the entire supply chain. The geographically distributed supply chain stakeholders represent virtual organizations connected by the trust and information communication technologies (ICT). Trust is a significant factor in achieving supply chain integration. Cooperation of the stakeholders in the supply chain determines their exposure to business and market risk. As the number of links in the supply chain increases, the trust relationships can get more complex. Some partners rely on trust based on direct interactions (e.g., A-B). Other business interactions rely on derivative trust, which affect A through B's interaction with C.

Successful SCM offers all the stakeholder firms a competitive edge. Among medical equipment suppliers, communication, behavioral certainty, asset specificity, partner reputation and perceived benefits contributed to positive trust. The relationship tenure did not have a significant effect on trust (Chao et al., 2013). Trust is a key factor inter-organizational knowledge sharing. Participation and communication which enhance trust, positively influence knowledge –sharing. Opportunistic behaviors, which reduce trust, negatively influence knowledge sharing (Cheng, et al., 2008).

In a study of the supply chain for metallurgical enterprises, stakeholders depended on the direct trust and derivative trust for smooth functioning of the entire supply chain (Gajdzik & Grzybowska, 2012). Trust is a key factor inter-organizational knowledge sharing. Participation and communication which enhance trust, positively influence knowledge –sharing. Opportunistic behaviors, which reduce trust, negatively influence knowledge sharing (Cheng, et al., 2008).

To enhance inter-organizational coordination, manufacturing firms often insist with their partners in supply chain management such as suppliers and subcontractors to establish common processes. This requires sharing process and inter-organization knowledge. It enhances the competitive advantage of the supply chain as a whole (Luthra et al., 2013; Spekman et al., 2002). Knowledge management in supply chain relationships is crucial to firm performance. The three dimensions of strategic orientation (i.e., alliance, leadership and learning and two dimensions of inter-organizational knowledge management (i.e., knowledge creation and acquisition are related and are positively related to firm's performance) (Gupta, 2006). The coercive relationship between supply chain stakeholders has low information sharing, legal contracts -driven and is focused on supply for the predictable demand at the lowest possible cost (Pagell et al., 2007).

A sustainable green supply chain requires proactive relationship management including organizational learning and transfer of knowledge and capabilities from the large players in the supply chain (Mellat-Parast, 2012; Cheung & Rowlinson, 2011). GSCM ensures that each of the links in the supply chain (i.e., all the suppliers, subcontractors and retailers), act in an environment-friendly way (Muslan et al., 2013; Rahimifard & Clegg, 2007).

Supply chain coordination improves performance by aligning the objectives of the links in the chain. The focus is on inventory management and ordering decisions. Some of the channel coordination models include multi-echelon inventory theory, multiple decision makers, asymmetric information,

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mass customization, outsourcing, short product life cycles and delayed differentiation. To enhance inter-organizational coordination, manufacturing firms often insist with their partners in supply chain management such as suppliers and subcontractors to establish common processes. This requires sharing process and inter-organization knowledge. It enhances the competitive advantage of the supply chain as a whole (Spekman et al., 2002).

GSCM is challenging because different countries involved in the supply chain may not have uniform “green” local regulations and standards and is an improvement over conventional supply chains. It includes green design, green operations, green manufacturing, reverse logistics, and waste management (Srivastava, 2007). Firms should prioritize the relative importance of the four dimensions of GSCM: supplier management, product recycling, organizational involvement and life-cycle management (Hu & Hsu, 2010).

INNOVATIVE ECO-FRIENDLY PRODUCTS AND PROCESSES

There are two main practices towards GSCM: Green design and green operations. Green design is in the direction of systematic environmental consideration in the product design and green operations are related to all aspects of supply chain management operations. Green design involves environmentally conscious design (ECD) and life cycle assessment (LCA). Environmentally conscious design is the process of understanding the ways and means to develop concern over of how design decisions affect a product’s environmental compatibility. The life-cycle assessment/analysis (LCA) is to analyze, assess and evaluate the conservational, professional health and resource-related concerns of a product through all the stages of its life cycle. Green operations include manufacturing and remanufacturing, reverse logistics, and network design. Green manufacturing is about using appropriate material and technologies and thereby saving most of the resources which are on the verge of being exhausted.

Remanufacturing is to utilize the waste products in the process of manufacturing to re-use them for manufacturing new valuable products. Recycling is done to regain the material content of used and non-functioning goods. Reverse logistics is the process of scheduling, applying and monitoring the well-organized, economical drift of raw materials, in-process catalogue, finished goods and associated information from the point of ingesting to the point of source for the purpose of recollecting value or proper discarding. The collection is the first stage in the retrieval process is followed by sorting of used products (Ghobakhloo et al., 2013). In a green supply chain of a manufacturer and retailer of a consumer product, one has to determine the effect of the package size and shelf space on profit. Reducing the package size of its product reduces environmentally costly transportation cost, reduces product packaging cost, cost savings. It helps the manufacturer to achieve ‘green manufacturer’ status (Swami & Shah, 2011).

Innovative eco-friendly processes aim to reduce waste, emissions to the environment, energy usage and increase recycling at the end-of-life for the product. Innovative products and processes go hand-in-hand. The green process is centered on eco-efficiency or green efficiency. Four main areas of focus for environmental performance standards include eco-efficiency, green technology innovations, remanufacturing and recycling. The comprehensive boundaries and flow framework can be valuable for identifying barriers to implementing GSCM (Sarkis, 2012). Fisher’s perspective of efficient versus responsive

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supply chains can be a stepping-stone to the development of two green supply chains-eco efficient and eco-responsive (Youn et al., 2012). The critical success factors required to achieve GSCM include top management commitment, government regulations, environment protection literacy and compliance among the supply chain partners, and ISO 14001 certification (Jain & Sharma, 2014).

INTERNATIONAL STANDARDS FOR ENVIRONMENTAL MANAGEMENT AND SOCIAL RESPONSIBILITY

Environmental and social responsibility performance is increasingly being used as additional measures for the overall performance of firms. The ISO 14000 standard addresses various aspects of environmental management and ISO 26000 addresses social responsibility management. The ISO 14000 family provides practical tools for companies and organizations to identify and control their environmental impact and constantly improve their environmental performance. ISO 14001:2004 and ISO 14004:2004 focus on environmental management systems. The other standards in the family focus on specific environmental aspects such as life cycle analysis, communication, and auditing.

ISO 14001:2004 sets out the criteria for an environmental management system and can be certified. It does not state requirements for environmental performance, but maps out a framework that a company or organization can follow to set up an effective environmental management system. It can be used by any organization regardless of its activity or sector. The ISO 14001:2004 can provide assurance to company management and employees as well as external stakeholders that environmental impact is being measured and improved. The benefits of using ISO 14001:2004 can include reduced cost of waste management, savings in consumption of energy and materials, lower distribution costs and improved corporate image among regulators, customers and the public. Small and medium sized enterprises (SMEs) can also benefit from ISO 14001:2004. The publication, ISO 14001 Environmental Management Systems, provide an easy to use checklist for SMEs (ISO, 2014).

Corporate social responsibility is covered by ISO 26000. Social responsibility means acting in an ethical and transparent way that contributes to the health and welfare of society. ISO 26000:2010 provides guidance rather than requirements, so it cannot be certified to unlike some ISO 14001. Instead, ISO 26000:2010 helps clarify the meaning of social responsibility and helps businesses and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location. The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, non-government organizations (NGOs), industry, consumer groups and labor organizations around the world were involved in its development, thus meaning it represents an international consensus (ISO, 2014).

Other international occupational health and safety management standards include Occupational Health and Safety Assessment Series (OHSAS 18000), and the Restriction of Hazardous Substances (RoHS). The Waste Electrical and Electronic Equipment (WEEE) enforces compliance with the relevant laws relating to product recycling and prohibit the use of hazardous substances in products for sale in the market (Mutungi, 2013).

*Implementation of Green Supply Chain Management in a Globalized Economy***ENVIRONMENTAL PERFORMANCE INDEX (EPI), INTERNATIONAL AGREEMENTS, LEGISLATION AND NGOS**

The 2014 EPI Framework includes nine issues and 20 indicators. The nine issues cover the areas of environmental health and Ecosystem vitality (EPI, 2014). The three issues in environmental health include health impacts, air quality, water, and sanitation. The ecosystem vitality issues include six issues- water resources, agriculture, forests, fisheries, biodiversity and habitat, and climate and energy. The Environmental Performance Index (EPI) is constructed through the calculation and aggregation of 20 indicators reflecting national-level environmental data. These indicators are combined into nine issue categories, each of which fits under one of the two primary objectives. Table 1 lists 2014 EPI values for various economies out of a total of 178 countries.

The international organizations formulate various acts and reach agreements that affect the countries and corporations (Andressen & Boasson, eds., 2012; Yu & Hui, 2008). International environmental agreements such as the United Nations Multilateral Environmental Agreement Negotiator's Handbook (2007), Negotiator's Handbook for Pacific Region (2013), ASEAN agreement on Trans boundary and Haze Pollution, Framework convention on climate change (UNFCCC, 1992), the Kyoto Protocol, the Climate Change Treaty and the Montreal Protocol influence the local and national governments to create environmental legislation. This guides and forces the firms to practice GSCM (Chien & Shih, 2007).

CONTEXT SPECIFIC GSCM IMPLEMENTATION STRATEGIES

Implementation of GSCM should be context-specific to the industry sector, country, and firm. Global GSCM presents new challenges since the environmental regulation standards and their enforcement varies significantly from country to country. ISO 14001 certification of all the suppliers helps with managing global suppliers. The Twelve Steps to a Greener Supply Chain include redesign of the product, reconfiguration of manufacturing, shifting to green suppliers, shortening the distances, altering service-level settlements, shrinkage in packaging, plan for inverse supply chain activity, consolidation of shipments, planning for shorter routes, coordination with partners, taking a holistic lifecycle view, starting early

Table 1. Environmental performance index, EPI and rank of selected countries

| COUNTRY | ENVIRONMENTAL PERFORMANCE INDEX, EPI, % | RANK OUT OF 178 COUNTRIES |
|-------------|---|---------------------------|
| Switzerland | 87.67 | 1 |
| USA | 67.52 | 33 |
| Russia | 53.45 | 73 |
| Brazil | 52.97 | 77 |
| China | 43 | 118 |
| India | 31.23 | 155 |
| Somalia | 15.47 | 178 |

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and if required starting now (Sharma, 2013). A structural model of natural resource based green supply chain management can provide managers with validated measurement scales to evaluate their strengths and weaknesses in implementing GSCM (Shi et al., 2012).

The SWOT analysis of GSCM helps a firm to see beyond the legislative, social, and peer pressures to create an effective strategy. The strengths, weaknesses, opportunities, and threats for implementing GSCM are listed in Table 2. Using the SWOT analysis, a firm has to create a context-specific strategy by maximizing the strengths, minimizing the weaknesses, taking advantage of the opportunities and guarding against the potential threats. A more critical POWER SWOT may be more helpful as it includes **P**ersonal experience, **r**ank **O**rder, assigning **W**eights, **E**mphasize detail and **R**ank order (Power SWOT, 2014). Using a Balanced Score card and Key Performance Indicators can make additional enhancements.

A firm in a given industry sector should identify relevant goals for implementing GSCM and specifying long-term plans to achieve these goals (Mudgal, Shankar, Talib, & Raj, 2010). Firms have to select a suitable strategy in accordance with stipulated regulations and customer requirements. For each industry sector in a given geographical context, one has to identify and rank the major strategies that help successful implementation of green supply chain management. Using fuzzy analytic hierarchy processes to prioritize the relative importance of supplier management, product recycling, organizational involvement and life cycle management, it was found that the organizations that place more emphasis on supplier management find it easy to implement GSCM successfully. (Hsu & Hu, 2008). Firms have to prioritize the relative importance of the four dimensions of GSCM – supplier management, product recycling, organizational involvement and life-cycle management (Hu & Hsu, 2010).

The strategy of implementing GSCM can be risk-based and/or innovation based. A risk-based strategy involves the inclusion of basic clauses towards purchasing contracts for suppliers to meet all pertinent

Table 2. SWOT Analysis for GSCM (adapted from Lee & Chen, 2010)

| | DETAILS |
|----------------------|--|
| STRENGTHS | Green design, materials, process, packaging and recycling, can reduce product-life-cycle costs by reducing waste clean up cost, lower production costs, minimize waste and lower price for consumers |
| | Enhance efficiency and profit through improvements in workplace settings for employees |
| | Upgrade corporate image and product reputation, increase market share, Earn the confidence of lenders |
| | Trust building in each link in the supply chain leading to efficient collaboration and reduced costs |
| WEAKNESSES | One or more links in the chain may practice superficial green practices |
| | Collaboration management challenges with all the links in the chain |
| | Require R&D expenditure for innovation to find green solutions |
| | Lack of mutual trust may cause opportunistic behavior for one or more links in the chain and undermine overall goals for the GSCM |
| OPPORTUNITIES | Increasing consumer demand for green products/services |
| | Take advantage of government incentives for manufacturing green products |
| | Awareness of environmental standards in the host country by each chain link |
| THREATS | In international markets, products may face import barriers and lose competitive edge by not practicing GSCM |
| | Additional inspection and certification costs to meet international market standards can raise price and lower market share |
| | Lack of international green certification system may encourage counterfeit green products |

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environment regulatory requirements. To implement green supply chain, there must be a set instructions and processes that should be well notified to enterprises to follow environment-friendly based methods for all company's operations. Innovation strategy involves more inclusive product life-cycle management deliberations for consumers of their products during the designing stages. Innovation at every step of supply chain structure is necessary in order to differentiate a company's unique selling from its competitors.

The GSCM strategy can be lean-based, innovation centered, compliance-driven or closed loop strategies. Efficiency-based GSCM practice creates an environment of being generous towards the environment by minimal waste generation. This type of strategy involves in meeting operational efficiency objectives like quality standards. Companies should adhere to proper quality control measures in order to meet up to tackle environmental ill effects. Closed-loop strategy is significant in implementing green initiatives. This type of a strategy involves product designing through artifact take-back and reverse logistics implemented in the supply chain components for waste reduction (Lee & Chen, 2010). A taxonomic scheme for developing green strategies involves analyzing the green supply chain activities and identifying key dimensions that influence green supply chain management (Mutingi, 2013). The biggest challenge for firms in practicing GSCM is to select suitable strategies in accordance with the stipulated regulations in a given context and customer requirements (Hu & Hsu, 2010).

The organizational factors that influence GSCM are explained by the institutional theory, which includes coercion or external pressure, normative (compliance) and mimetic (imitation). Innovation and technological development to make GSCM effective is explained by the ecological modernization theory. Using Total Environmental Quality Management (TQM) in implementing GSCM helps one to focus on effectiveness and efficiency (Muslan, 2013). Risk theory has been applied to GSCM (Khan & Burnes, 2007).

Another study identified four categories of GSCM implementation strategies in terms of supply chain touch points: non-members, downward stream, organization, and upward stream as shown in Table 3. The first dimension of the non-members of a supply chain includes the international environmental agree-

Table 3. Four dimensions of GSCM Implementation (Adapted from Luthra, Garg, & Haleem, 2013)

| | DIMENSIONS | DETAILS |
|----|---|---|
| 1. | Non-Members of Supply Chain | International environmental agreements Government legislation Non-government organizations (NGO's) |
| 2. | Downward Stream Supply Chain Members | Involvement of suppliers in green activities, Training programs, Technology transfer to suppliers Technology transfer to suppliers Environmental auditing of suppliers |
| 3. | Organizational Perspective | Top Management Perspective: Initiation and commitment, Proper company policies, Technology advancement, Information technology enablement Innovative Green Practices: Environmental management systems, ISO 14000 implementation, Green procurement strategies, green product development and design, eco friendly products and process optimization, eco-friendly packaging and labeling, eco friendly transportation and distribution. Employee Perspective: Human resources, Information quality and sharing, Training programs. Economic Interests Firm's Competitiveness Industrial Perspective: Waste management, Reuse and recycle, lean manufacturing, Proper workplace management |
| 4. | Upward Stream Perspective | Awareness level of customers End-of-life management Association with local recycling organizations |

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ments, government legislation and acts formulated by the non-government organizations. The second dimension of the downward stream supply chain management includes involvement of suppliers in green activities, training programs, technology transfer to suppliers and environmental auditing of suppliers.

It is still the firm's responsibility to the public even if an adverse event happens in any one of the links in the supply chain. Some examples are McDonald's recall of 12 million drinking glass gift sets and Mattel's Fisher Price recall of over 10 million lead-painted toys (Lee, Kim, & Choi, 2012).

The third dimension of the organizational perspective includes top management perspective, innovative green practices, employee perspective, economic interests, firm's competitiveness and industrial perspective. The top management perspective includes initiation and commitment, proper company policies, technology advancement and information technology enablement. The innovative green practices consist of adopting environmental management systems like ISO 14000, green procurement strategies, green product development and design practices, use of environmental friendly packaging and labeling of the products and use of environment friendly transportation and distribution. The environmental footprint is established at the product design stage when one decides the materials and processes to manufacture a product (Zhu & Sarkis, 2007).

The employee perspective includes human resources, information quality and sharing, and training programs. The economic interests include lower cost by reducing waste, recycling and lowering environmental compliance costs. The firm's competitiveness comes from first mover advantage of the green innovations. The industrial perspective includes waste management, reuse and recycle, lean manufacturing and proper workplace management. The fourth dimension of upward supply chain members includes awareness level of customers, end-of-life management, and association with local recycling organizations. These four dimensions play an important role in greening the supply chains and enable the firm to achieve enhanced operational performance (Luthra, Garg, & Haleem, 2013).

GREEN SUPPLY CHAIN MANAGEMENT PRACTICES AND BUSINESS PERFORMANCE

There are two types of GSCM practices: proactive and reactive. The proactive practices include eco-design, green purchasing, and reverse logistics. The reactive practices include legislation and regulation. GSCM practices include green design, green purchasing, reduction in energy consumption, reuse/recycling, packaging, environmental collaboration in the supply chain, cleaner production, internal service quality, just-in-time inventory, environmental auditing, and green innovation

Consumers are demanding eco-friendly products and services and corporations are reporting economic benefits from green practices (Bajdor & Grabara, 2011). Commonwealth Edison reported savings of US\$50 million annually from managing material and equipment with a life-cycle management approach. Pepsi saved US\$44 million by switching from corrugated to reusable plastic shipping containers. Mitigating environmental impact of production and services is a novel strategy to enhance organizational competitiveness. This includes improvements in their environmental performance to comply with environmental regulations and addressing the environmental concerns of their customers (Bacallan, 2000). GSCM implementation improves business performance when operational efficiency and relational efficiency are improved (Lee et al., 2012; Green et al., 2012). Performance measurement for GSCM includes inter-organizational environmental issues (Hervani et al., 2005).

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According to resource dependency theory, firms synergistically combine their own resources with those of other firms to create a resource bundle that is unique and hard to imitate (Harrison et al., 2001). Such interdependent relationship-specific capabilities are superior to what the individual firms possess on their own. This leads to sustainable competitive advantage and improved organizational performance (Paulraj & Chen, 2007; Lee, Kim, & Choi, 2012).

Most of the suppliers around the world are SMEs which often have inadequate proactive environmental strategy and can be a weak link in the green supply chain (Sarkis & Dijkshoorn, 2007). SMEs often lack knowledge workers with expertise on environmental management systems (Lee, 2009). In Europe, a total of 76% of all corporations are SMEs which are responsible for 60% to 70% of all industrial pollution, 40% to 45% of CO₂ emissions, 40% of water and energy consumption, and 70% of industrial waste production (Heras & Arama, 2010).

There is a direct link between GSCM practice implementation and business performance. Significant indirect relationships were found between GSCM practice implementation and business performance through mediating variables of operational efficiency and relational efficiency. The business performance is improved when GSCM enhances relational efficiency and operational efficiency, Figure 2 (Lee, Kim, & Choi, 2012). Firms need to leverage GSCM practices to facilitate both operational and relational efficiencies to gain greater competitiveness in the dynamic global market place Testa & Iraldo, 2010).

There is a lack of consensus on the impact of GSCM practices on business performance due to a lack of a unified framework for green practices and a variety of performance measures in use (Zhu et al., 2012; Laosirihongthong, Adebajo, & Tan, 2013)). Implementing different GSCM practices in different settings can result in different performance outcomes (Koh et al., 2012).

Based on empirical studies on GSCM drivers from the manufacturing industries in Germany, Malaysia, India, Taiwan, China, the United Kingdom, and South Korea, three main drivers to implement GSCM emerge that include government regulations (27%), customer pressure/requirements (16%), and competition (14%). Competition includes marketing, product differentiation, competitive advantage, and brand reputation. Other drivers include social responsibility/ethics (6%), business benefits, organizational commitment, awareness, experience (6%), environmental collaboration with suppliers (5%), collaboration with the customers (3%), certification of supplier's environmental management systems (3%), ISO 14001 certification (2%), sustainability of resources (2%), lowered costs (2%) and return on investment (2%) (Jain & Sharma, 2014).

Figure 2. Improvement in Business Performance through GSCM implementation (Adapted from Lee, Kim, & Choi, 2012)



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SUMMARY

GSCM has evolved to become a firm's competitive strategy to become eco-friendly, socially responsible and to achieve compliance with customer expectations, peer-pressure and government regulations. Corporate sustainability requires that the concerns for environment ("green") along with economic and social concerns be integrated into all the processes of a corporation including supply chain management (Luthra, 2014). The environmental NGOs, international environmental agreements, and environmental legislation at the local and national level play a significant role in providing motivation to the firms to comply with the regulations.

The implementation of GSCM is specific to the industry sector, firm, and the country, and presents new challenges since the environmental regulation standards and their enforcement varies significantly from country to country. In today's globalized economy, corporations are increasingly demonstrating a convergence of supply chains and sustainability (Mollenkopf et al., 2009). GSCM is challenging because different countries involved in the supply chain may not have uniform "green" local regulations and standards. ISO 14001 certification of suppliers helps with managing global suppliers.

The firms' ability to implement green supply chains is becoming a powerful novel source of competitive advantage and good economic performance (Green et al., 2012; Rao, & Holt, 2005). At the firm-level, greening the boardroom helps gather support for firm's international environmental management systems, establishing trust among members of the supply chain, environmental auditing of the suppliers, green product design and development through innovation, green manufacturing through technology improvements, environmental friendly packaging and labeling, environmental friendly product distribution, environment friendly organizational culture, employee training for green initiatives, and effective use of internet and communication technologies for knowledge management. Context specific strategies for green supply chain management have to be created to enhance the firm's competitive performance.

REFERENCES

- Andresen, S., & Boasson, E. L. (Eds.). (2012). *International Environmental Agreements: An Introduction (Environmental Politics)*. New York: Routledge Publishing.
- Ashby, A., Leat, M., & Hudson-Smith, M. (2012). Making Connections: A Review of Supply Chain Management and Sustainability Literature, Supply Chain Management –. *International Journal (Toronto, Ont.)*, 17(5), 497–516.
- Bacallan, J. J. (2000). Greening the Supply Chain. *Business and Environment*, 6(5), 11–12.
- Baines, T., Brown, S., Benedettini, O., & Ball, P. (2012). Examining Green Production and Its Role within the Competitive Strategy of Manufacturer. *Journal of Industrial Engineering and Management*, 5(1), 53–87. doi:10.3926/jiem.405
- Bajdor, P., & Grabara, J. K. (2011). Implementing Green Elements into the Supply Chain – The Literature Review and Examples. *Annales Universitatis Apulensis Series. Oeconomica*, 13(2), 584–589.
- Cervera, C. M., & Flores, J. L. M. (2012). A Conceptual Framework for a Green Supply Chain Strategy. *Proceedings of the Global Conference on Business and Finance Proceedings*, 7(2), 269-273.

Implementation of Green Supply Chain Management in a Globalized Economy

- Chao, C. M., Yu, C. T., Cheng, B. W., & Chuang, P.-C. (2013). Trust and Commitment in Relationships among Medical Equipment Suppliers: Transaction Cost and Social Exchange Theories. *Social Behavior and Personality*, 41(7), 1057–1069. doi:10.2224/sbp.2013.41.7.1057
- Cheng, F. H., Yeh, C. H., & Tu, C. W. (2008). Trust and Knowledge sharing in Green Supply Chains. *Supply Chain Management – International Journal (Toronto, Ont.)*, 13(4), 283–295.
- Chien, M. K., & Shih, L. H. (2007). Relationship between Management Practice and Organization Performance under European Directives such as ROHS – A Case Study of the Electrical and Electronics Industry in Taiwan. *African Journal of Environmental Science and Technology*, 1(3), 37–48.
- Emmett, S., & Sood, V. (2010). *Green Supply Chains: An Action Manifesto*. London: Wiley.
- Environmental Performance Index (EPI). (2014). Retrieved from <http://www.epi.yale.edu/epi>
- Gajdzik, B., & Grzybowska, K. (2012). Example Models of Building Trust in Supply Chains of Metallurgical Enterprises. *Metalurgija*, 51(4), 563–566.
- Ghobakhloo, M., Tang, S. H., Zulkifli, N., & Ariffin, M. K. A. (2013). An Integrated Framework of Green Supply Chain Management Implementation. *International Journal of Innovation, Management and Technology*, 4(1), 86.
- Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhaduria, V. S. (2012). Green Supply Chain Management Practices: Impact on Performance. *Supply Chain Management*, 17(3), 290–305. doi:10.1108/13598541211227126
- Guang Shi, V., Lenny Koh, S. C., Baldwin, J., & Cucchiella, F. (2012). Natural Resource-based Green Supply Chain Management. *Supply Chain Management*, 17(1), 54–67. doi:10.1108/13598541211212203
- Gupta, V. K. (2006). *Firm Strategy and Knowledge Management in Strategic Supply Chain Relationships: A Knowledge-Based View* [Dissertation]. University of Missouri-Columbia.
- Harrison, J., Hitt, M., Hoskisson, R., & Ireland, R. (2001). Resource Complementarity in Business Combinations: Extending the Logic to Organizational Alliances. *Journal of Management*, 27(6), 679–690. doi:10.1177/014920630102700605
- Heras, I., & Arana, G. (2010). Alternative Models for Environmental Management in SMEs: The Case of EcoScan vs. ISO 14001. *Journal of Cleaner Production*, 18(8), 726–735. doi:10.1016/j.jclepro.2010.01.005
- Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance Measurement for Green Supply Chain Management. *Benchmarking*, 12(4), 330–353. doi:10.1108/14635770510609015
- Hsu, C. W., & Hu, A. H. (2008). Green Supply Chain Management in the Electronic Industry. *International Journal of Science & Technology*, 5(2), 205–216. doi:10.1007/BF03326014
- Hu, A. H., & Hsu, C. W. (2010). Critical Factors for Implementing Green Supply Chain Management Practice – An Empirical Study of Electrical and Electronics Industries in Taiwan. *Management Research Review*, 33(6), 586–608. doi:10.1108/01409171011050208
- International Standards Organization (ISO). (2014). Environmental Management (ISO 14000) and Social Responsibility (ISO 26000). Retrieved from <http://www.iso.org/iso/home/standards.htm>

Implementation of Green Supply Chain Management in a Globalized Economy

- Isaksson, M., & Nikolausson, H. (2014). Establishing an Environmentally Friendly Organizational Culture.
- Jain, V. K., & Sharma, S. (2014). Drivers Affecting the Green Supply Chain Management Adaptation: A Review. *IUP Journal of Operations Management*, 13(1), 54–63.
- Khan, O., & Burnes, B. (2007). Risk and Supply Chain Management; Creating a Research Agenda. *International Journal of Logistics Management*, 18(2), 197–216. doi:10.1108/09574090710816931
- Ki Fiona Cheung, Y., & Rowlinson, S. (2011). Supply Chain Sustainability: A Relationship Management Approach. *International Journal of Managing Projects in Business*, 4(3), 480–497. doi:10.1108/17538371111144184
- Klassen, R., & Vachon, S. (2003). Collaboration and Evaluation in the Supply Chain: The Impact on Plant-Level Environmental Investment. *Production and Operations Management*, 12(3), 336–352. doi:10.1111/j.1937-5956.2003.tb00207.x
- Koh, S. C. L., Gunasekaran, A., & Tseng, C. S. (2012). Cross-Tier Ripple and Indirect Effects of Directives WEEE and RoHS on Greening a Supply Chain. *International Journal of Production Economics*, 140(1), 305–317. doi:10.1016/j.ijpe.2011.05.008
- Laosirihongthong, T., Adebajo, D., & Choon Tan, K. (2013). Green Supply Chain Management Practices and Performance. *Industrial Management & Data Systems*, 113(8), 1088–1109. doi:10.1108/IMDS-04-2013-0164
- Lee, C. K., & Chen, S. H. (2010). Selecting the Most Feasible Strategy for Green Supply Chain Management. *The Business Review, Cambridge*, 14(2), 141–146.
- Lee, K. (2009). Why and How to Adopt Green Management into Business Organizations? *Management Decision*, 47(7), 110–121.
- Lee, S. (2008). Drivers for the Participation of Small and Medium-Sized Suppliers in Green Supply Chain Initiatives. Supply Chain Management. *International Journal (Toronto, Ont.)*, 13(3), 185–198.
- Lee, S. M., Tae Kim, S., & Choi, D. (2012). Green Supply Chain Management and Organizational Performance. *Industrial Management & Data Systems*, 112(8), 1148–1180. doi:10.1108/02635571211264609
- Li, Y. (2011). Research on the Performance Measurement of Green Supply Management in China. *Journal of Sustainable Development*, 4(3), 101–107. doi:10.5539/jsd.v4n3p101
- Liker, J., & Choi, T. (2004). Building Deep Supplier relationships. *Harvard Business Review*, December.
- Luthra, S., Garg, D., & Haleem, A. (2013). Identifying and Ranking of Strategies to Implement Green Supply Chain Management in Indian Manufacturing Industry Using Analytical Hierarchy Process. *Journal of Industrial Engineering and Management*, 6(4), 930–962. doi:10.3926/jiem.693
- Luthra, S., Garg, D., & Haleem, A. (2014). Green Supply Chain Management: Implementation and Performance A Literature Review and Some Issues. *Journal of Advances in Management Research*, 11(1), 20–46. doi:10.1108/JAMR-07-2012-0027
- Manuj, I., & Mentzer, J. T. (2008). Global Supply Chain Risk Management. *Journal of Business Logistics*, 29(1), 133–155. doi:10.1002/j.2158-1592.2008.tb00072.x

Implementation of Green Supply Chain Management in a Globalized Economy

- Mellat-Parast, M. (2013). Supply Chain Quality Management – An Interorganizational Learning Perspective. *International Journal of Quality & Reliability Management*, 30(5), 511–529. doi:10.1108/02656711311315495
- Mollenkopf, D., Stolze, H., Tate, W. L., & Ueltschy, M. (2010). Green, Lean and Global Supply Chains. *International Journal of Physical Distribution & Logistics Management*, 40(1/2), 14–41. doi:10.1108/09600031011018028
- Mudgal, R. K., Shankar, R., Talib, P., & Raj, T. (2010). Modeling the Barriers of Green Supply Chain Practice: An Indian Perspective. *International Journal of Logistics Systems and Management*, 7(1), 81–107. doi:10.1504/IJLSM.2010.033891
- Muslan, N., Hamid, A. B. A., Tan, H., & Idris, H. (2013). Practices of Green Supply Chain Management (GSCM) Towards Manufacturing Sustainability. *International Proceedings of Economic Development and Research*, 66, 74–80.
- Mutingi, M. (2013). Developing Green Supply Chain Management Strategies: A Taxonomic Approach. *Journal of Industrial Engineering and Management*, 6(2), 525–546. doi:10.3926/jiem.475
- Pagell, M., Wu, Z., & Murthy, N. (2007). The Supply Chain Implications of Recycling. *Business Horizons*, 50(2), 133–143. doi:10.1016/j.bushor.2006.08.007
- Paulraj, A., & Chen, I. (2007). Environmental Uncertainty and Strategic Supply Management: A Resource Dependence Perspective and Performance Implications. *Journal of Supply Chain Management*, 43(3), 29–42. doi:10.1111/j.1745-493X.2007.00033.x
- Paulraj, A., Lado, A., & Chen, I. (2008). Inter-organizational Communication as a Relational Competency: Antecedents and Performance Outcomes in Collaborative Buyer-Supplier Relationships. *Journal of Operations Management*, 26(1), 45–64. doi:10.1016/j.jom.2007.04.001
- POWER SWOT. (2014). SWOT Analysis- POWER SWOT. Retrieved from <http://www.marketingteacher.com>
- Rahimifard, S., & Clegg, A. J. (2007). Aspects of Sustainable Design and Manufacture. *International Journal of Production Research*, 45(18-19), 4013–4019. doi:10.1080/00207540701608511
- Rao, P., & Holt, D. (2005). Do Green Supply Chains Lead to Competitiveness and Economic Performance? *International Journal of Operations & Production Management*, 25(9), 898–916. doi:10.1108/01443570510613956
- Sarkis, J. (2012). A Boundaries and Flow Perspective of Green supply Chain Management. *Supply Chain Management*, 17(2), 202–216. doi:10.1108/13598541211212924
- Sarkis, J., & Dijkshoorn, J. (2007). Relationship between Solid Waste Management Performance and Environmental Practice Adoption in Welsh Small and Medium Size Enterprises (SME's). *International Journal of Production Research*, 45(21), 4989–5015. doi:10.1080/00207540600690529
- Sharma, M. M. (2013). A Study on the Concept of Green Supply Chain Management. *Journal of Supply Chain Management Systems*, 2(1), 1–7.

Implementation of Green Supply Chain Management in a Globalized Economy

Simchi-Levi, D., Simchi-Levi, E., & Kaminsky, P. (1999). *Designing and Managing the Supply Chain: Concepts, Strategies and Case*. New York: McGraw-Hill.

Spekman, R. E., Spear, J., & Kamauff, J. (2002). Supply Chain Competency: Learning as a Key Component. *Supply Chain Management*, 7(1), 41–55. doi:10.1108/13598540210414373

Srivastava, S. (2007). Green Supply Chain Management – A State of the Art Literature Review. *International Journal of Management Reviews*, 9(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x

Swami, S., & Shah, J. (2011). Channel Coordination in Green Supply Chain Management: The Case of Package Size and Shelf-Space Allocation. *Technology Operation Management*, 2(1), 50–59. doi:10.1007/s13727-012-0005-y

Swami, S., & Shah, J. (2013). Channel Coordination in Green Supply Chain Management. *The Journal of the Operational Research Society*, 64(3), 336–351. doi:10.1057/jors.2012.44

Testa, F., & Iraldo, F. (2010). Shadows and Lights of GSCM: Determinants and Effects of These Practices Based on a Multi-national Study. *Journal of Cleaner Production*, 18(10/11), 953–962. doi:10.1016/j.jclepro.2010.03.005

United Nations Multilateral Environmental Agreement. (2013). *Negotiator's Handbook*. Pacific Region.

United Nations Multilateral Environmental Agreement. *Negotiator's Handbook* (2014). Retrieved from http://unfccc.int/resource/docs/publications/negotiators_handbook.pdf

Womack, J. P., & Jones, D. T. (2005). *Lean Solutions: How Companies and Customers Can Create Wealth Together*. New York: Simon and Schuster.

Youn, S., Yang, M. G. M., & Jungbae Roh, J. (2012). Extending the Efficient and Responsive Supply Chains Framework to the Green Context. *Benchmarking: An International Journal*, 19(4/5), 463–480. doi:10.1108/14635771211257954

Yu, L. C., & Hui, H. Y. (2008). An Empirical Study on Logistics Services Provider Intention to Adopt Green Innovations. *Journal of Technology. Management and Innovation*, 3(1), 17–26.

Zhu, Q., & Sarkis, J. (2007). The Moderating Effects of Institutional Pressures on Emergent Green Supply Chain Practices and Performance. *International Journal of Production Research*, 45(18-19), 4333–4355. doi:10.1080/00207540701440345

Chapter 24

A Staged Supplier Pre– Evaluation Model To Determine Risky, Potential and Preferred Suppliers

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ABSTRACT

In the late 1980s, the proportion of outsourced materials in the cost of high-tech products was around 80%. In this respect, with increasing globalization and ever-expanding supply chains, interdependencies between organizations have increased and the selection of suppliers has become more important than ever. This exploratory research study intends to develop a novel approach for a specific type of supplier selection problem which is supplier pre-evaluation. A two-staged multi-layered feed forward neural networks (NN) algorithm for pattern recognition was used to pre-evaluate suppliers under strategy-based organizational and technical criteria. Data for training, validation and testing the network were collected from a global Tier-1 manufacturing company in the automotive industry. The results show that the proposed approach is able to classify candidate suppliers into three separate groups of risky, potential or preferred. With this classification, it becomes feasible to eliminate risky suppliers before doing business with them.

INTRODUCTION

“There is none more important than the selection of a proper source. Indeed, it is in some respects the most important single factor in purchasing” stated Lewis in 1940 (Lewis, 1940). This statement is probably one of the earliest records of the importance of supplier selection. However, it is still consistent with today’s business trends so its importance continues to grow and a new concepts arising about

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the importance of supplier selection is supplier pre-evaluation. For example in 2013, Trans Adriatic Pipeline (TAP) drew attention to the importance of supplier pre-qualification by announcing that they had started a pre-qualification process of candidate suppliers for their gas delivery project. The project development director, Sigurd Hamre, said that the main goal of the pre-qualification was to ensure that there would be enough high quality steel pipes available during the project over the course of three years (Anonymous, 2013).

In globalized world markets, managing supplier risk is a crucial factor that plays a role in the competitive ability of buying firms because cost or any kind of differentiation can no longer guarantee competitive advantage today. Companies achieve sustainable competitive advantage through their supply networks or supply chain management. Therefore, working with a supportive supplier becomes the keyword for success. However, finding a supportive and a proper supplier is not an easy task as there are many of them in global markets. Shortlisting candidate suppliers may ease the final selection process as pre-evaluating candidate suppliers is an important step that enables buying firms to determine and eliminate unqualified or risky suppliers before working with them. It is a step that may ensure the success of the supplier final selection. The aim of this chapter is to present a stepwise model that firstly eliminates unqualified suppliers and classifies the remaining reliable suppliers according to their technical qualifications.

This chapter is organized as follows. The importance of suppliers in globalized markets is discussed under four headings. The concept of supplier risk is explained. The importance of interdependence and inter-firm fit is discussed in respect of supplier pre-evaluation, and a review of literature related to supplier pre-evaluation is presented chronologically. This conceptual frame work and literature review is followed by the method, results, and discussion.

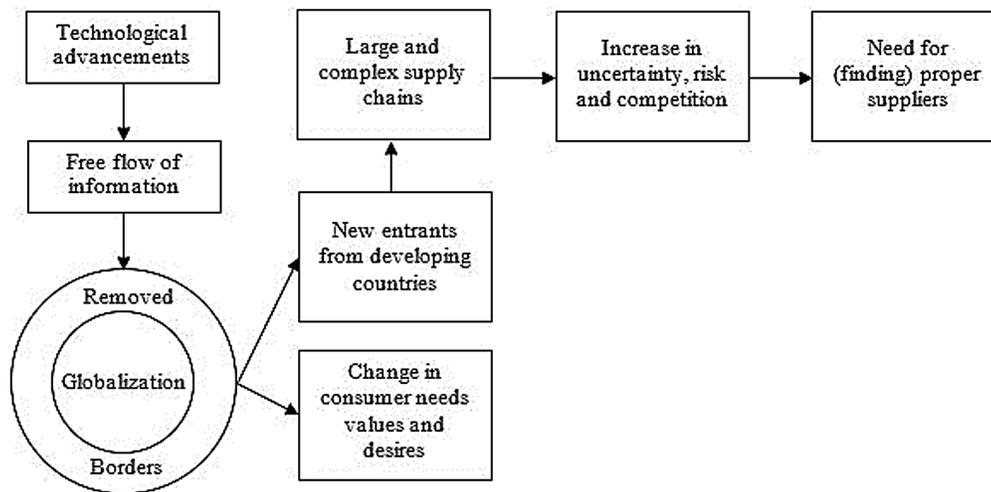
Some terms in this chapter have been used interchangeably as follows. Supplier initial screening, shortlisting, pre-evaluation, pre-selection and pre-qualification were alternately used for eliminating unqualified or misfit candidate suppliers before starting work with them. Unqualified, risky, and misfit suppliers were also alternately used to define the candidate suppliers that do not satisfy organizational criteria. Ordering, buying, and main firm/organization/company were alternately used to define the company that places an order or does outsourcing activities. Emerging, less-developed, developing and low-cost economy/country were also alternately used to define countries/markets with economies of low to middle per capita incomes.

Of the various driving forces behind the importance of suppliers, the main ones are free flow of information, globalization, change in consumer values, needs and desires (Farughi, Azar, Sadeghi, Naseri, & Hajebi, 2011; Noorizadeh, Mahdilo, & Saen, 2012), and increasing the number of new entrants (Gurnani, Gümüş, Ray, & Ray, 2012; Dye & Stephenson, 2010) as shown in Figure 1.

With advanced technology, it can be explained that the flow of information is more rapid than in the past (Khaled, 2007), and it has been widely accepted that globalization has been brought about by an evolving communications revolution (Langhorne, 2001). Basically, technological advances in communication have enabled the free flow of information between geographically remote locations. As a result, all borders between countries disappear and all countries unite together in terms of operations. According to the Ferguson/Mansbach view, globalization involves geographically wider transaction networks and has multiple often-interrelated dimensions, such as ecology, disease, demography, economics, technology, culture politics, military and society. In addition, it has volume and density of transactions and a direction and pace of change. Regardless of whether the direction of the change is forward, static or reverse, and whether the pace is slow, moderate or rapid (Ferguson, 2014), it is undeniable that the influence of globalization on the consumer culture of a society is extremely intensive (Gupta, 2011).

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Figure 1. Drivers behind the importance of suppliers



Craig et al. (2009) observed that in today's world, cultural products and lifestyles from the developed world are spreading through traditional media such as TV and films, and new media such as internet, electronic social networking, blogs, etc., as a result of globalization. This phenomenon is changing the cultural fabric and patterns of society as products, icons, lifestyles and rituals of one culture are being adopted by another. Furthermore, its pervasive influence on consumer behavior affects consumer tastes, preferences and purchasing behavior (as cited in Gupta, 2011, p. 254). Therefore, a new range of consumer expectations, needs and desires emerge. This makes demand very volatile (Christopher & Lee, 2004), so marketing and selling is very complicated for companies. To satisfy these new feelings, or in other words, to stay in the competition, companies must focus on their core activities and outsource non-core activities (Möller & Törrenen, 2003). Correspondingly, in the late 1990s, the proportion of outsourced materials in final products increased, reaching up to 80% in high-tech industries (Burton, 1998). Today, companies have more suppliers than they had in the past and supply networks have become much more extensive.

Global business continues to expand rapidly even though the start of globalization is still under debate (Conversi, 2010). Newer companies, especially from developing countries, enter the market with cheaper offers (Gurnani, Gümüş, Ray, & Ray, 2012). As a result, many organizations from developed nations, are replacing their developed local suppliers with developing ones (Hultman, Johnsen, Johnsen, & Hertz, 2012). As Wheatley (2006) stated, "Companies are rushing to source from low-cost countries..." (Wheatley, 2006), competition intensifies and proper selection of suppliers becomes a competitive advantage (Xie, Peng, & Zhao, 2013; Narasimhan & Talluri, 2009; Ehr Gott, Reinmann, Kaufmann, & Carter, 2013). For example, in 2006, imports into the USA from low-cost countries for the first time were more than those from developed countries (Ruamsok, Russell, & Thomnick, 2009).

A 2007 survey of Accenture, a global management consulting, technology services, and outsourcing company, declared that "230 global supply chain executives plan to double their low-cost country sourcing activities in the next three years..." For the low-cost country sourcing, low labor and material

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cost and opportunity for entering new markets are considered as the major drivers (Ruamsok, Russell, & Thomnick, 2009). Unfortunately, there are significant disadvantages as well as advantages (Coates, 2003) as listed in Table 1.

These disadvantages result in additional costs. According to Davis (1992), these kinds of factors add as much as 40-65% to final procurement costs (as cited in Kusaba, Moser, & Rodrigues, 2011, p.75), and especially in the case of sourcing from China, most ordering companies underestimate the true cost of low-cost country sourcing. In a study by Platts and Song (2010), while the estimated additional cost was around 25% of the quoted price, in reality it totalled 50% of the quoted price (as cited in Najafi, Dubois, & Hulthen, 2013, p. 53).

As a result of these aforementioned drivers, doing business has become very stressful and very complicated. Therefore, outsourcing non-core activities has become the key to success because suppliers can enable firms to focus on their core activities, to reduce cost, and product development cycle time, and to increase product quality at the same time (Tang, 2006). However, increased outsourcing rates lead to a decrease in the number of in-house operations so more suppliers are involved in the business, and business networks expand horizontally (Lumms & Vokurka, 1999).

In order to prevent any supply disruption in extensive networks, the supply base should be kept at an optimum level. Thus, the selection of a proper supplier becomes a competitive advantage. In order to maintain or increase market share, organizations have to not only manage internal operations but also external operations and relationships with their suppliers. However, it is not so easy to find a good supplier that can provide a strategic advantage to the ordering firm because there are so many of them in the global market. This raises the problem of finding a reliable or less risky supplier.

In literature, supplier risk has grown in importance with news of supplier bankruptcies or various disasters that have adversely affected operations of suppliers (Norrman & Jansson, 2004). For example, Apple lost many orders because of a supply shortage of DRAM chips after an earthquake in Taiwan in 1999. Ericsson lost 400 million Euros after their supplier's semiconductor plant caught on fire in 2000, and the fire caused Ericsson's withdrawal from the cellular phone market (Tang, 2006). In Korea in 2002, the bankruptcy of a Tier-1 supplier stopped the assembly line of a car producer. This then led to a series of bankruptcies in 19 Tier-2 suppliers (Jung, Lim, & Oh, 2011). In addition to the external risk factors such as bankruptcies or disasters, there are also internal factors such as quality problems, old technology usage, inadequate production capacity, unqualified personnel, etc.

Table 1. Advantages and disadvantages of low-cost country sourcing

| | | References |
|---------------|--|---|
| Advantages | Low raw material and labor cost, economies of scale, risk pooling, capital investment reduction, ability to focus on core competencies, increased flexibility, increase in sales, increase in size and scope of the business and flexibility to address uncertainty in international markets for the buying (ordering) firms | Simchi-Levi, Kaminsky, & Simchi-Levi, 2000; Kusaba, Moser, & Rodrigues, 2011 |
| Disadvantages | Loss of control, inefficient infrastructure for transportation, communication and IT, lower sourcing and supply chain performance, lower quality of products, unqualified personnel, cultural differences, longer transportation distances, inefficient technology, higher landing cost, more business partners to manage, longer lead times, unexpected political risks (war, strike, epidemics, terrorism), economic risks (volatile exchange rates), governmental risks (customs procedures), intellectual property theft | Lau & Zhang, 2006; Wheatley, 2006; Ruamsok, Russell, & Thomnick, 2007; Ruamsok, Russell, & Thomnick, 2009; Kusaba, Moser, & Rodrigues, 2011 |

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For instance, Toyota Motor Corporation had to recall cars and shut down production for a period of time due to quality problems in supplied parts in 2010. This phenomenon had an adverse effect not only on its customer relations but also on supplier relations (Lockamy & McCormack, 2012). Ojala and Hallikas (2006) consider suppliers of a company as a cooperative production system or a network, the members of which are individually independent. However, they also emphasize that in the most effective supplier networks, all parties should be dependent on each other. The interdependence is considered as a crucial issue because it ensures that neither party can withdraw at any time.

Even though today many supplier networks are still not functioning synchronously (Ojala & Hallikas, 2006), supply networks continue to expand and interdependence is increasing. This makes companies more susceptible to the breakdown of the network (Lockamy & McCormack, 2012; Zsidisin, Melnyk, & Ragatz, 2005) in the case of weak cooperation. This shows how supplier risks arise, and explains why companies should not only focus on their own risks but also on the risks in their suppliers (Norrman & Jansson, 2004). Jung et al. (2011) describe the supplier risk as the purchasing firm's perceived probability of an occurrence of an abnormal operation state, which disrupts the smooth working process of the supply chain, in an upstream supplier (Jung, Lim, & Oh, 2011).

On the other hand, Zsidisin (2003) defines supply risk as the failure probability of a supply market or a supplier. The failure may cause the purchasing firm to put the lives and safety of customers in danger and also not to meet customer demands (Zsidisin, 2003). In the study of Juras (2008), the supplier risk is defined as a hidden cost that undermines the business. The author considers the selection of a wrong supplier, in this case a very risky supplier, as the second most important reason for outsourcing arrangement failure (Juras, 2008). The underlying reason for this may be the uncertainty that supplying firms pose. The Committee of Sponsoring Organizations of the Treadway Commission (COSO) sheds some light on supplier risk by stating that all entities face uncertainty since outsourcing any process introduces uncertainty, which introduces risk into the process. Therefore, the challenge for management is to determine how much uncertainty to bear (Juras, 2008). In other words, the management has to decide on the tolerable level of supplier risk for their organization. Juras (2008) paraphrased this situation as "Risk Management, Not Risk Avoidance".

Choosing a wrong supplier or in other words, a very risky supplier, may worsen performance of the operations, increase the inventory level (Hendricks & Singhal, 2005), decrease the market share and sales (Christopher & Lee, 2004), increase the number of defective products, unstable deliveries and refabricating costs, and damage reputation. All of these outcomes directly and adversely affect the competitiveness of ordering companies. Therefore, finding and selecting the right supplier has become an essential topic for companies in order to reduce their costs and risks (Chen & Wu, 2013) and to increase their competitiveness (Chou & Chang, 2008). In this vein, supplying firms have to help ordering firms satisfy changing market conditions in the firm strategy (as cited in Chou & Chang, 2008, p. 2243). However, it is a very difficult task because uncertainty continues to increase and supply chains expand due to high product complexity and the outsourcing level (as cited in Jung, Lim, & Oh, 2011, p. 609). Therefore, the answers to the questions of how one can manage supplier risks, or how one can find a proper and supportive supplying firm, may lie in interdependence.

To explain interdependence as defined previously, requires synchronous functioning of firms and also an effective relationship between firms. Basically, to have a relationship with any supplier is to have a business alliance, and a business alliance is an ongoing, formal, business relationship between two or more independent organizations to achieve common goals. It refers to the external relationships of a firm with other firms where the relationship is more than a simple customer-supplier relationship (Sheth

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& Parvatiyar, 1992). According to the authors, the external relationships of a firm are grounded in four theories: transaction costs, agency, relational contracting and resource dependence perspective theories.

While the first three theories are about transactions and contracts between firms, only the resource-dependence perspective is related to organizational interdependencies. If a business alliance is formed for operations efficiency among non-competing other firms such as suppliers or customers, it is called a co-operative alliance, the purposes of which are asset utilization, resource efficiency, enhancing core competence and bridging the performance gap. If these purposes are perfectly achieved, they improve corporate efficiency and the current position of the firm. On the other hand, if a business alliance is formed for strategic purpose among non-competing other firms, it is called a collaborative venture. The purposes of a collaborative venture are growth opportunity, diversification, strategic intent and protection against external threat.

Therefore, suppliers are both cooperative and collaborative allies of ordering firms. Accordingly, Richards & Jones (2007) proposed inter-firm fit that includes strategic, operational and personal congruency between buying and selling firms (Richards & Jones, 2007). These types of fitness are based on the Miles & Snow (1978) study of congruency between strategy and the external environment of organizations (as cited in Toulan, Birkinshaw, & Arnold, 2006, p. 63). According to the authors, inter-firm fit between buying and selling organizations fosters relationship effectiveness, reduces uncertainty, replaces dependence with interdependence, increases efficiency and also provides social satisfaction. Strategic fit is the degree to which the strategies of buying and selling firms are aligned. Operational fit is the degree to which effectiveness is shown in exchanging the proper goods and services for payments, and buyers and sellers benefit from low cost. Personal fit is the strength of relationship of employees of buying and selling organizations. Therefore, the higher the organizational fitness (including strategic, operational and personal fitness), the better the synchronization between allies, and as a result, a better working interdependence mechanism can be achieved. This is referred to as inter-firm fit, organizational congruency or organizational fitness in the literature (Voss, Cable, & Voss, 2000; Richards & Jones, 2007).

In summary, to remain competitive companies need to focus on their core activities and receive support for non-core activities from suppliers. However, as the number of supplier increases, so supplier uncertainty and risk also increase. Therefore, both to stay in competition and to keep the supply risk low, companies have to manage their supplier relationships very wisely. This raises the question of supplier selection. Selection is not an easy task to achieve for decision makers because it is a cognitive decision process with inherent uncertainty, subjectivity and risk (Stoddard & Fern, 1999), final choices have long-term consequences (Kull, Oke, & Dooley, 2014) and multiple criteria are involved in the decision-making process.

Any mistake may have a disastrous outcome which is why some companies rely on their existing relationships and take a risk averse position by opting to work with current suppliers, or on the contrary, ignore their relationships and take a risk-seeking position and opt to work with a new/developing supplier for a cheaper offer. If the keyword for a successful supplier network is having a long-term relationship (Stoddard & Fern, 1999; Ojala & Hallikas, 2006; Aissaoui, Haouari, & Hassini, 2007; Kull, Oke, & Dooley, 2014), how can decision makers make a decision about any supplier before working with them?

To reduce supplier uncertainty, a supplier pre-selection step before final selection can be an efficient risk-minimizing approach, and seeking inter-firm fit with the candidates may play a crucial role when determining the less risky or the most supportive and reliable supplier in the pre-selection step. Otherwise, learning the hard way about suppliers may become more costly than expected. Most studies about supplier selection in literature are about the final selection, and most of them are not concerned with

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the pre-evaluation phase. However, the success of the supplier final selection or the quality of the final decision heavily depends on the quality of prior phases such as problem definition, criteria determination, and pre-evaluation.

For example, the traditional supplier selection process in general, consists of four phases (deBoer, Labro, & Morlacchi, 2001). The first phase is problem definition. Decision makers have to find an answer to some questions such as whether there is a need for outsourcing; if there is, what form it should take; how many suppliers to work with, etc. The second phase is criteria formulation. Based on the nature of the product, important evaluation factors are determined by decision makers in this phase. The third phase is qualifications, which is defined as “pre-qualifying suitable suppliers”, and the last phase is making the final choice.

Even though the third phase is defined as pre-qualification, it is actually the collection of a set of candidate suppliers by receiving orders and order specifications from them. In other words, it does not have any elimination activity, and cannot be considered as a pre-qualification phase. To date, only a few researchers have specifically studied supplier pre-evaluation, and these researchers and real life practitioners agree that there is no best way of evaluating and selecting suppliers. Unfortunately, there is no absolute set of supplier selection criteria and selection/evaluation techniques either as they may vary across different products or situations (Vokurka, Choobineh, & Vadi, 1996) as shown in Table 2 and Table 3.

The first two studies about supplier selection encountered in literature were reviews about supplier selection methods including a section on supplier pre-qualification (deBoer, Labro, & Morlacchi, 2001; Aissaoui, Haouari, & Hassini, 2007). The authors state that making a selection from a high number of suppliers in today’s logistics environment is very difficult. Therefore, it is essential to rule out inefficient candidates and reduce them to a small range of acceptable ones (Aissaoui, Haouari, & Hassini, 2007). According to deBoer et al. (2001), pre-qualification is a vital step in the supplier selection process, and the best supplier selection cannot be made without this step. However, not enough attention is paid to the phases prior to supplier final selection as researchers mostly focus on the final choice phase, forgetting that a good quality decision depends on the quality of prior steps.

Table 2. Review of supplier pre-evaluation techniques

| Techniques | References |
|---|--|
| Categorization, data envelopment analysis, cluster analysis and case based reasoning systems, conjunctive screening, disjunctive screening, lexicographical screening | (deBoer, Labro, & Morlacchi, A review of methods supporting supplier selection, 2001) |
| Conjunctive rule, lexicographic rule, categorical method, cluster analysis, data envelopment analysis, neural networks, expert systems | (Aissaoui, Haouari, & Hassini, 2007) |
| Fuzzy ranking | (Sarkar & Mohapatra, 2006) |
| Cluster analysis, radial basis function NN | (Luo, Wu, Rosenberg, & Barnes, Supplier selection in agile supply chains: An information-processing model and an illustration, 2009) |
| Categorical method, cluster analysis, case-based reasoning systems and data envelopment analysis, max-min approach | (Şen, Şen, & Başlıgil, 2010) |
| Genetic algorithm | (Cao, Luo, Kwong, & Tang, 2014) |
| Fuzzy TOPSIS | (Yu & Wong, 2014) |

A Staged Supplier Pre-Evaluation Model*Table 3. Review of supplier pre-evaluation criteria*

| Criteria | References |
|--|--|
| Price, quality, delivery lead time, attitude, quality systems, financial capability, production capacity, management, technological capacity, breadth of product line, supplier's proximity, existence of IT standards, labor problems, reputation | (Sarkar & Mohapatra, 2006) |
| Price, delivery, quality, cost, production capacity and localization | (Aissaoui, Haouari, & Hassini, 2007) |
| Integration ability, strategic programming, R&D investment, manufacture adaptation level, throughput capacity, environment adaptation ability, production techniques level, learning organization, product response time, compatible corporation culture, liquidity ratio, inventory turnover, net assets value per share, earnings per share of stock, net operating margin, asset/liability ratio, net profits growth rates, assets rates of increment, accounts receivable turnover, stockholders' equity ratio, cash flow per share, debt/equity ratio, human resource quality, general reputation, fixed assets scope, information sharing level, IT level, value of trademark, product quality, quality/cost and service quality | (Luo, Wu, Rosenberg, & Barnes, Supplier selection in agile supply chains: An information-processing model and an illustration, 2009) |
| Net price, maintenance cost, quality defects, quality of support services, quality of packing ability, service delivery, production capacities and facilities, reliability to supplier's expertise and performance history | (Şen, Şen, & Başlıgil, 2010) |
| Cost and supply risk | (Cao, Luo, Kwong, & Tang, Supplier pre-selection for platform-based products: a multi-objective approach, 2014) |
| Supply products variety, breadth of product line, R&D capability, supplier's expertise, procedural compliance, information technology, production facilities and capacity, technical capability, financial position, management and organization, environmental performance, quality performance history, delivery performance history and service performance history | (Yu & Wong, 2014) |

If problem definition, criteria selection, and pre-qualification phases are not implemented properly or if any phase is omitted, it cannot be guaranteed that the final selection provides the best choice. Thus, the authors draw attention to the importance of the pre-evaluation. However, the articles discussed in their papers are actually supplier selection studies. Only some of them are considered as pre-qualification papers because the techniques used in these papers are assumed to be applicable to pre-qualification practices. deBoer et al. (2001) considers pre-qualification as a sorting process rather than ranking and therefore, they propose categorical methods, data envelopment analysis (DEA), cluster analysis (CA) and case-based-reasoning (CBR) / artificial intelligence (AI) systems.

In addition to the aforementioned techniques Aissaoui et al. (2007) proposes conjunctive rule and lexicographic rule. Regarding supplier pre-evaluation criteria, deBoer et al. (2001) refer to the studies of Mandal & Desmukh (1994) and Vokurka et al. (1996), although both of those papers use the 23 criteria for final selection criteria of Dickson (1966). The listed criteria in the de Boer et al (2001) study are separated into two groups of criteria for final selection and pre-evaluation although there is no such grouping in the studies referred to. Criteria in Mandal and Deshmukh (1994) are grouped in respect to vendor selection and vendor development situations, and in Vokurka et al.(1996) product types and partnership relations. On the other hand, Aissaoui et al. (2007) also refer directly to 23 criteria of Dickson (1966), according to which, price, quality, delivery, production capacity and location are the most often treated criteria in literature. Apart from deBoer et al (2001), no differentiation is made about pre-evaluation criteria but general selection criteria are separated into two groups of objective & subjective and tangible / intangible.

Sarkar & Mohapatra (2006) discussed the importance of supplier pre-evaluation in the light of supply base reduction (Sarkar & Mohapatra, 2006). Supply base reduction is basically reducing the number of

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suppliers of a company. It presupposes the existence of a large supply base and aims to keep only the best suppliers in the network, thereby limiting the size of the network. According to the authors, developing an effective partnership depends on having a small and easy to manage supply base. Therefore, they propose a supplier pre-evaluation model to help reduce the supply base of a company. The model was based on long and short-term company performances. While short-term performances are represented by price, quality, delivery and attitude, long term performances are represented by different types of capabilities of a company.

For example, quality systems, technology, reputation, financial capability, production facility, management, breadth of product line, proximity, IT standards and labor problems. A weighted average method was proposed for the evaluation. Due to the vague nature of the evaluation factors, fuzzy scale was applied to capture experts' opinions. The outputs of the model provide a final order of preference for suppliers. It ranks and groups them in three categories, de-motivated, balanced and motivated. The most significant drawback of the model is that any high score factor may compensate low score factors. Therefore, it is inevitable that some important factors are overlooked when they are very low. Additionally, hypothetical examples were used for model validation.

Luo et al. (2009) discussed the importance of supplier pre-selection for agile supply chains (Luo, Wu, Rosenberg, & Barnes, 2009). Agile supply chains are defined as dynamic alliances of companies, the formation of which needs to change frequently in response to fast-changing environments. In this respect, supplier selection cannot be a one-off activity due to fast changing market requirements and customer preferences. According to the authors, screening candidate suppliers in the early stages of the selection process may reduce uncertainty and ambiguity. It provides an opportunity for decision makers to make more rational judgments.

The aim of this study is to classify candidate suppliers into four groups of routine, leverage, preference, and strategic suppliers as proposed by Kraljic (1983). The proposed model is based on radial basis function artificial neural network (RBF-ANN) assessing candidate suppliers against multiple criteria including both qualitative and quantitative. Dickson (1966) criteria are synthesized with Lin & Chen (2004) criteria. A total of 31 qualitative and quantitative criteria were obtained and grouped in three categories of management and technological capabilities, financial quality and company resources and quality. However, most of them are either not available in practice or very fuzzy in nature.

For example, there were 12 financial criteria representing the financial quality of evaluated firms. Most of the rate and ratio criteria are not reachable unless the firm is quoted on the stock exchange. Criteria such as integration ability, manufacture adaptation level, learning organization, compatible corporation culture, etc., cannot be easily evaluated. In addition, the model includes product/service quality and cost as criteria. However, these criteria are not also available at the pre-evaluation step, and on the other hand, they should not be used in the pre-evaluation but in final selection.

In another study on pre-selection is by Sen et al. (2010), the authors used the fuzzy analytic hierarchy process (AHP) method to determine the importance weight of the evaluation criteria first, and then applied the max-min approach presented by Talluri & Narasimhan (2003) with a non-parametric statistical test to identify the most effective suppliers. With this approach, the authors aimed to determine the strengths (max approach) and weaknesses (min approach) of each supplier in respect of thirteen criteria, four of which are main (cost, quality, service and reliability), and nine of which are sub criteria (price, maintenance cost, defects, quality of service, packing, delivery, expertise, performance, production facilities).

These criteria may reflect the reality, but if the model in that study pre-evaluates candidate suppliers, cost and price should not be considered as a decision factor because these criteria play an important

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role in final selection, not in pre-evaluation. Moreover, in practice, they are not available in the initial screening of candidate suppliers. The outputs of max-min approach were used as inputs in a Kruskal-Wallis test to identify the groups of suppliers according to their max-min scores. Finally, suppliers were grouped in three homogenous sets. The first set of suppliers is the very best suppliers with very good max and min performances. The second set of suppliers are also best suppliers but with respect to their min performances. The last set of suppliers is the bad performers with very weak min and max performances. The sample used for the pre-evaluation was collected from the current supplier pool of the company and the technique used for the pre-evaluation was static, meaning that if new suppliers enter or some old suppliers leave the pool, all evaluations would have to be re-calculated.

Papadopoulou et al. (2013) synthesized supplier pre-selection with the European Foundation Quality Model (EFQM) to create a standardized process for Fourth Part Logistics (4PL) partner selection (Papadopoulou, Manthou, & Vlachopoulou, 2013). The main criteria of the EFQM Excellence Model were used as decision criteria in the pre-selection. However, the authors do not propose an analytic technique for decision making but a three-month trial period and cognitive evaluation at the end of the trial. Cao et al. (2014) discussed the importance of supplier pre-evaluation in the early stages of product design (Cao, Luo, Kwong, & Tang, 2014). Their aims were to minimize outsourcing costs, supply risk and probability of design change by improving product design by proposing an early stage supplier selection model.

One important aspect of this paper is that the authors created a decision model with consideration of replaceable components, which have similar functionality in the final product. The proposed model provides a set of multiple suppliers for all components to be used in case of any supply network failure. Analytic hierarchy process and reliability matrix were used to determine the risk levels of suppliers, and non-dominated sorting genetic algorithm was used for the optimization. However, the model does not make any elimination but provides a variety of supplier sets for different risk cases. Therefore, the outputs of the model actually represent final decisions for different supply situations. The only criteria used in the model were cost and delivery risk.

As is widely known, supplier selection or evaluation is a multi-criteria decision-making problem with an inherent variety of factors and so has a very complex structure. Therefore, their proposed model may be inadequate in determining the best set of suppliers for outsourcing. The final paper about pre-selection that we examined was a study by Yu and Wong (2014). The authors discussed the importance of pre-selection from a different point of view. According to them, shortlisting a small number of qualified candidate suppliers is necessary for order fulfillment, especially in cases of multi-product orders because of the synergy effect. The synergy effect, which is also known as the complementary effect, is the interaction between two or more products that produces an effect greater than the sum of their individual effects.

The authors proposed a supplier pre-selection model which considers maximizing the synergy effect and evaluates suppliers by the fuzzy Technique for Order Preference by Similarity to Ideal Solution (TOPSIS). The criteria used in TOPSIS were collected from decision-makers in the automotive industry from telephone interviews. A total of 14 criteria were collected and grouped in five main categories of supply variety, supply capability, communication capability, general characteristics and performance history. One important aspect of the criteria is that each criterion was characterized as soft or hard. While negotiable criteria such as price, delivery, service etc. were defined as soft, the criteria that cannot be negotiated such as production capacity, technical capability, financial position etc. were considered as hard criteria. The authors stated that applying hard criteria was more suitable to the pre-selection phase whereas soft criteria better fit the final selection phase.

A Staged Supplier Pre-Evaluation Model

To summarize, to be able to stay in competition, companies need to focus on core activities and receive support for non-core activities from their suppliers. To achieve this goal, both parties of purchasing and supplying firms should work in harmony. However, it is not always easy to find a good supplier for co-operation and collaboration. Therefore, we are proposing a stepwise model that is constructed on strategy-based supplier selection criteria which had been pre-defined in another research project (Gökay, Emel, & Petriçli, 2013). The suggested model in this research paper proposal will eliminate organizationally misfit (disqualified) suppliers first, create a poll of proper or reliable suppliers, evaluate them under technical qualifications and eventually, group them in two categories (potential and preferred). The model will be structured with multi-layered feed forward networks for pattern recognition in MATLAB R2014a version. Data for the networks will be collected from a global Tier-1 seat manufacturing company in the automotive industry.

METHOD

Participants

For the sake of reliability of this empirical research paper, the application industry and company were not selected randomly. A Tier-1 company operating mainly in the automotive industry was chosen. The rationale behind this selection was as follows. First, the automotive industry is one of the most highly globalized industries in the world as companies in this industry operate and trade globally. Second, the supply chains in the automotive industry are extremely extensive and the outsourcing rate is very high (Sturgeon, Memedovic, VanBiesebroeck, & Gereffi, 2009). Third, working with a qualified supplier is very important in this industry because the quality of outsourced goods and services and even, the qualifications of the personnel of suppliers have a direct impact on the quality of the final product as explained earlier.

As a result, any failure or disqualification may put lives and safety of customers at risk. Therefore, the automotive industry is perfect for this empirical research. In addition, as the selected company is a Tier-1 company in a typical automotive production supply chain, this selection is also proper for this research study. The selected company operates in 19 countries worldwide and produces interiors (headrests, armrests, center consoles) and seating systems for automobiles, off-road vehicles, trucks, busses and trains. The design and production of these products requires cutting edge technology and advanced engineering. For example, depending on the type, a seating system may contain up to 1,000 components, some of which are considered as safety parts.

Therefore, producing such a complex mechanism in in-house facilities is impossible. Thus, there is an increase in the number of suppliers and high interdependency between the firms. As a result, as other Tier-1 companies possess, the company has an extensive supply network of approximately 600 suppliers. Moreover, decision makers in the selected company were not also randomly selected because the nature of this research project requires expert opinions. Therefore, two procurement executives and one procurement manager supported this research project with their experience and opinions.

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Materials

There are two important factors that may affect the outcomes of this study. The first one is criteria and the second one is the model used for supplier pre-evaluation. The criteria and the importance weighting used in this study were the outcomes of a previous research project that was also conducted with the same company (Gökay Emel & Petriçli, 2013). Figure 2 briefly shows the framework of that study.

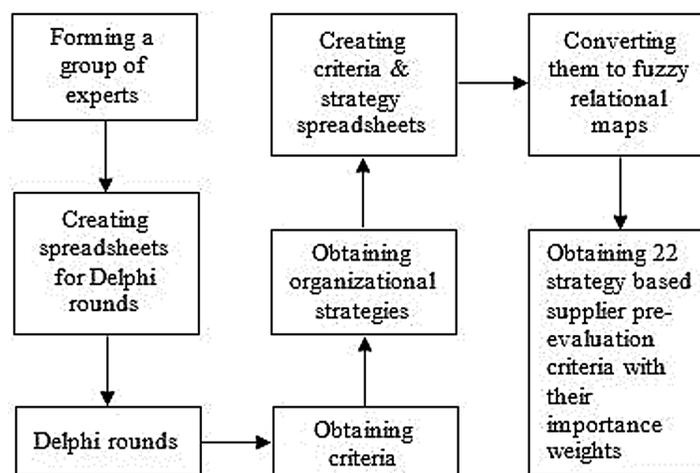
Contrary to traditional supplier selection studies, criteria and the weighting used in this study were based on organizational strategies of the selected company. In other words, they were strategy driven criteria.

As shown in Table 4, there were two separate sets of criteria. While the first set of criteria was used to eliminate organizationally misfit candidates, which were also risky suppliers including de-sourced and business on hold companies, the second group was used to determine technically misfit and fit candidates, which were also potential and preferred suppliers. The aim of the company here was to reach preferred, or if not possible, potential suppliers as shown in Figure 3.

The model in this study had two consecutively working structures, both of which were multilayered feed forward neural networks with scaled conjugate gradient back propagation learning algorithm for pattern recognition as shown in Figure 4.

Neural networks are models used to imitate pattern recognition abilities of humans. They act like people learning and solving problems through examples. They can be trained to become an intelligent system. Once they are trained on the basis of a good sample or historical data with a proper learning algorithm, they become an expert on that specific kind of problem. They are also very successful at processing such a data set that it includes both qualitative and quantitative data. On the other hand, their information processing unit acts like a black box. Users cannot and also do not need to know what occurs inside (Luo, Wu, Rosenberg, & Barnes, 2009). A multi-layer network consists of three main structures which are input, hidden and output layers. The input layer receives values or features of input data and transfers them to the first hidden layer. Each node (neural) in this layer represents each variable in the model, and in this study, they represented supplier pre-evaluation criteria.

Figure 2. Process of determining strategy based supplier pre-evaluation criteria



A Staged Supplier Pre-Evaluation Model*Table 4. Organizational strategy based supplier pre-evaluation criteria, their importance weights and value ranges*

| Organizational Fitness | Criteria | Original Importance Weights | Normalized Importance Weights | Value Ranges |
|--|---|-----------------------------|-------------------------------|--|
| Organizational Fitness | ISO:16949 | 3.3764 | 0.9050 | 0: No, 1: Yes |
| | Short term contract (year) | -2.1300 | -0.5325 | 0: Term \leq 2, 1: Term $>$ 2 |
| | Family owned business | -1.6500 | -0.4125 | 0: Yes, 1: No |
| | Business strategy* | 3.6950 | 0.9225 | 1: Follower or reactor, 2: Analyzer, 3: Defender or competitor, 4: Prospector or innovator |
| | Internal communication ability* | 3.2775 | 0.8175 | 1: Absolutely inappropriate, 2: Slightly inappropriate, 3: Neutral, 4: Slightly appropriate, 5: Absolutely appropriate |
| | Commitment to quality* | 3.3739 | 0.9050 | |
| | Flexibility of employees* | 3.1694 | 0.7900 | |
| | Continuous improvement systems | 3.8203 | 0.9550 | |
| | Average working time with customers (year) | 3.0075 | 0.7500 | 1: Time \leq 2, 2: 2<Time \leq 3, 3: 3<Time \leq 5, 4: 5<Time \leq 8, 5: 8<Time \leq 12 |
| | Eagerness to cooperate* | 3.4764 | 0.8675 | 1: Absolutely inappropriate, 2: Slightly inappropriate, 3: Neutral, 4: Slightly appropriate, 5: Absolutely appropriate |
| | Eagerness to share confidential information | -1.8064 | -0.4500 | |
| | Strategic importance for my company* | 3.3200 | 0.8300 | 1: Not at all important, 2: Slightly important, 3: Neutral, 4: Moderately important, 5: Extremely important |
| | Technical Fitness | Scrap level* | 3.2575 | 0.8144 |
| Internal ppm* | | 3.0925 | 0.7731 | |
| Customer ppm | | 3.3764 | 0.8441 | 1: 50<ppm \leq 100, 2: 20<ppm \leq 50, 3: 10<ppm \leq 20, 4: 5<ppm \leq 10, 5: ppm \leq 5 |
| Co-design* | | 3.3764 | 0.8441 | 1: Absolutely inappropriate, 2: Slightly inappropriate, 3: Neutral, 4: Slightly appropriate, 5: Absolutely appropriate |
| Test equipment quality | | 3.0475 | 0.7619 | |
| Technical qualifications of employees* | | 3.7914 | 0.9479 | |
| Experience of employees (year) | | 3.1325 | 0.7831 | 1: 4>Exp \geq 2, 2: 6>Exp \geq 4, 3: 8>Exp \geq 6, 4: 10>Exp \geq 8, 5: Exp \geq 10 |
| Flexibility of production systems | | 3.1639 | 0.7910 | 1: Absolutely inappropriate, 2: Slightly inappropriate, 3: Neutral, 4: Slightly appropriate, 5: Absolutely appropriate |
| Quality control systems* | | 3.0925 | 0.7731 | |

Table 4. * Please see the Appendix for the explanations

The most common input layer transfer function is linear function as the role of this layer is to directly transfer real data to hidden layers, and in this study the common practice was applied. The hidden layer is the layer located between the input and output layers. It shows interactions between inputs and outputs. Each node in this layer receives signals from each node in the previous layer, creates outputs by an activation function and passes the outputs to the next hidden or the output layer. In this study, tangent sigmoid function was used as the hidden layer transfer/activation function because it provides non-linearly separable solutions and squashes outputs to (-1, +1) as shown in Figure 5.

A Staged Supplier Pre-Evaluation Model

Figure 3. Supplier Pyramid

Preferred suppliers are both organizationally and technically qualified companies. Potential suppliers are organizationally qualified but technically unqualified companies. Business on hold and de-sourced suppliers are organizationally unqualified companies. These companies are not evaluated under technical criteria since they do not satisfy organizational criteria.

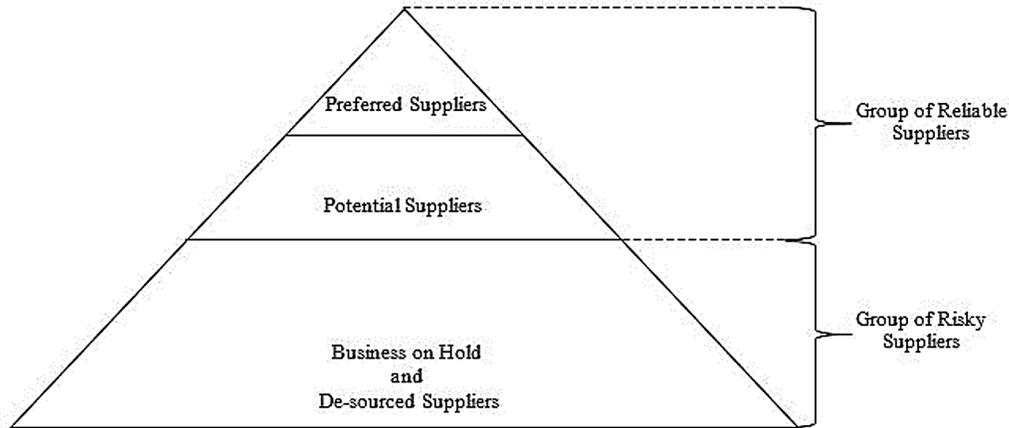
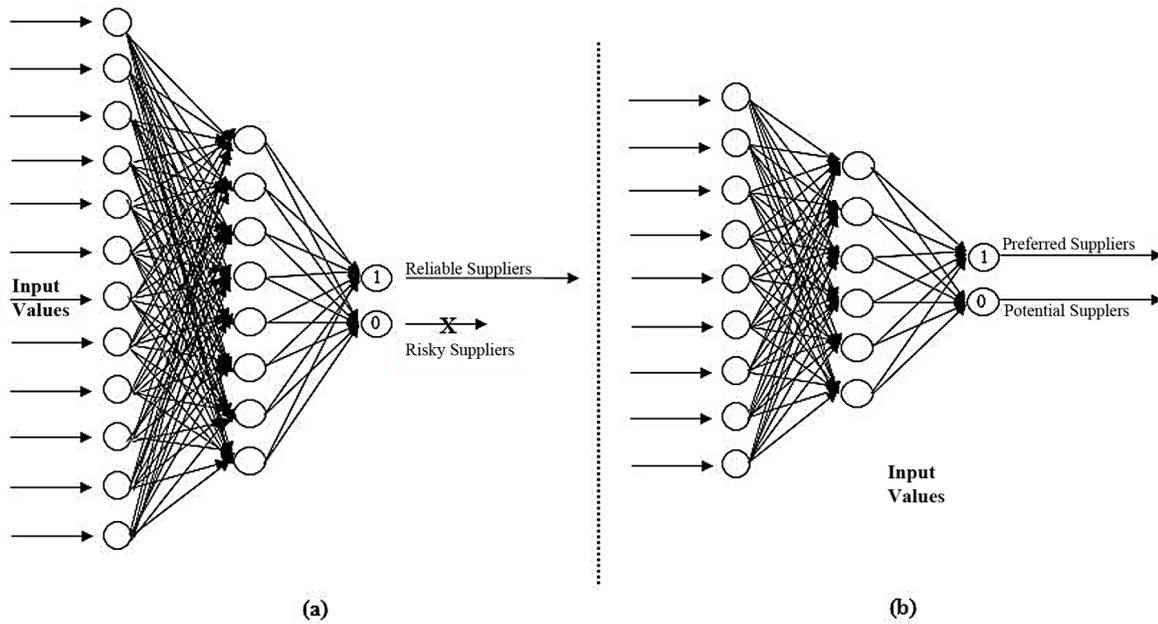


Figure 4. Two staged neural network structure

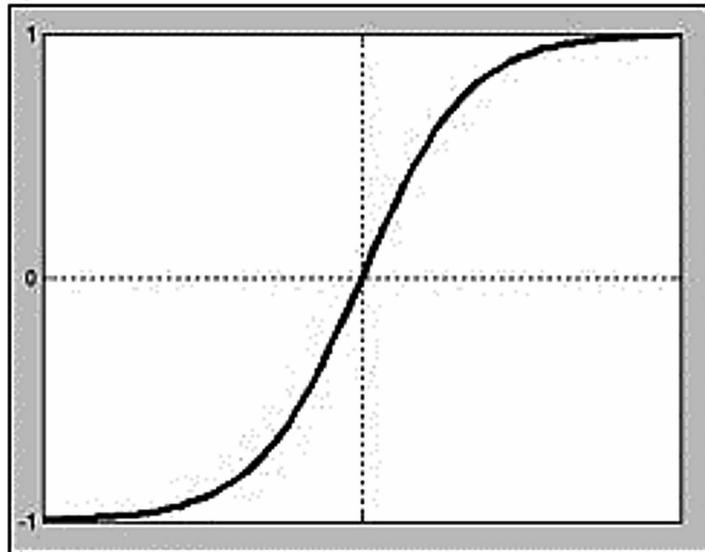
(a) Represents the first stage of the network. In this network, organizational pre-evaluation criteria are used for the evaluation. It has two kinds of outputs. Reliable suppliers are organizationally qualified companies whereas risky suppliers are organizationally unqualified companies.

(b) Represents the second stage of the network. After eliminating risky suppliers, only reliable suppliers are pre-evaluated in this network. Technical pre-evaluation criteria are used for the evaluation. There are also two kinds of outputs. Preferred suppliers are both technically and organizationally qualified companies whereas potential suppliers are organizationally qualified but technically unqualified companies.



A Staged Supplier Pre-Evaluation Model

Figure 5. Tangent sigmoid function



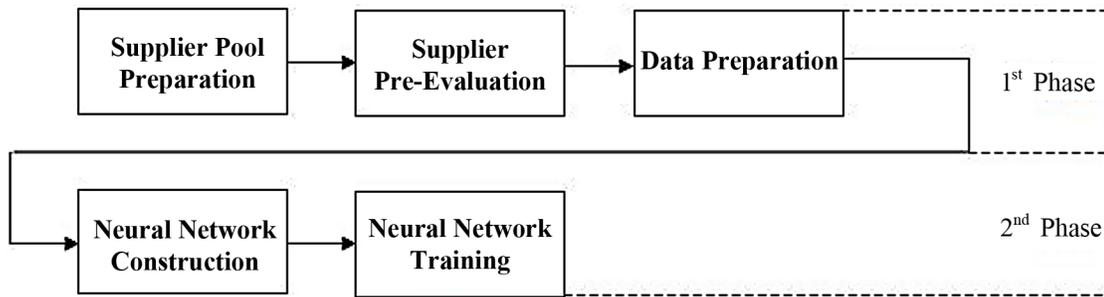
The output layer is the last single layer that calculates final outputs of the network. In this study, the softmax function was used as the output layer activation function as it is very efficient in classification problems (Bishop, 2006). Error back propagation learning algorithm enables the network to optimize weights of the arcs between neurons in all layers. This algorithm is based on the gradient descend method that minimizes the error of the network. It compares calculated outputs with the desired outputs to adjust the weights of the arcs. In this study, scaled conjugate gradient back propagation algorithm was used in order to avoid a time-consuming line search of the standard conjugate gradient algorithm (Moller, 1990; Kostopoulos & Grapsa, 2009; Cetişli & Barkama, 2009).

In this study, the first set of criteria was used in the first network to shortlist candidate suppliers. Organizationally misfit or risky candidates were eliminated and organizationally qualified reliable suppliers were determined with this network. Contrary to the first network, the second network was not used for elimination but to group the shortlisted candidates into two types regarding their technical abilities. The first group of candidates was potential suppliers. They were technically unqualified but organizationally qualified companies. The other group of candidates was preferred suppliers. They were both technically and organizationally qualified companies. Therefore, the second set of criteria was used in this network. The data collection tool is also an important issue in the reliability of empirical research. In this study, two separate matrix-like spreadsheets were used for the data collection.

As shown in Figure 6, commodity groups, supplier types and pre-evaluation criteria were in the columns and the names of the suppliers were in the rows of the both spreadsheets. The only difference between them was while the first spreadsheet had organizational pre-evaluation criteria in the columns Figure 6 (a), the second spreadsheet had technical pre-evaluation criteria Figure 6 (b). In addition, the data acquired with these spreadsheets were collected from the current supplier pool of the company. The supplier pool of the company contains three types of suppliers that are classified regarding their performance scores. The score ranges of each group are as follows. $100 \geq A \geq 90$ are A class supplier,

A Staged Supplier Pre-Evaluation Model

Figure 7. Procedure



and the second spreadsheet (Figure 6b) was sent to the experts for the technical evaluations. Contrary to the first spreadsheet, this one included the names of the reliable suppliers that were preferred and potential companies.

Once the data had been collected, they were prepared to be used in the next phase. Data in the first spreadsheet shown in Figure 6(a) were evaluation values of all suppliers under the organizational criteria. It was used as a matrix, and transposition of this matrix was separated into row vectors. Each vector represented each criteria, and each element (or each column) in a vector represented the evaluation value of each supplier. For example, the 97th element of the 3rd vector represented evaluation value of the 97th company under the 3rd organizational criteria. After row vector separation, each vector was multiplied by different scalars that were normalized importance weights of the organizational criteria that are shown in Table 4(a).

For example, the 7th row vector included evaluation values of all suppliers under the 7th criteria. It was multiplied by the 7th scalar, which was the normalized importance weight of the 7th criteria. At the end of this calculation, a new set of row vectors that included importance weighting of the criteria was obtained. All rows were collated together and created a new matrix of which columns represented the input data that were used in the first neural network. The same procedure was used to prepare the data in the second spreadsheet shown in Figure 6(b) to be used in the second neural network.

After obtaining all the data, a two-stage neural network model was constructed and trained synchronously as Neural Net Pattern Recognition Toolbox of MATLAB R2014a was used for the training, validation and testing of the networks. There were 12 and 9 neurons in the input layers of the first and the second network as shown in Figure 4 (a) (b). While the set of 12 neurons represented organizational pre-evaluation criteria, the nine neurons represented technical pre-evaluation criteria. After determining input layer parameters, the hidden layers were constructed. For the construction, the general principles about determining the number of hidden layers and number of neurons in the hidden layers were applied.

Both networks included only one hidden layer for simplicity as Villiers & Barnard (1992) determined that one and two hidden layer networks performed similarly (Villiers & Barnard, 1993). The number of neurons in both hidden layers was kept between the number of input and output neurons in order to avoid the risk of over and under-fitting (Panchal, Ganatra, Kosta, & Panchal, 2011). Therefore, many trials were made until the perfect classification was reached of training, validation and testing data. Finally, one hidden layer containing eight neurons for the first network, and one hidden layer containing 6 neurons for the second network was determined. Both networks had two neurons as both had two types of output (0-1). The neurons in the first network represented risky (0) and reliable (1) candidate suppliers, and the neurons in the second network represented potential (0) and preferred (1) candidate suppliers.

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RESULTS

A pool of suppliers was obtained in the data collection phase, and 156 companies in 10 commodity groups were randomly selected from the current supplier pool of the company by three experts. They were plastics, steel, textile, mechatronic, chemical, aluminum, indirect, foam, turned parts and wooden commodity suppliers. From those companies, 123 of them were reliable and 33 were risky suppliers. From the reliable suppliers, 33 were preferred and 90 were potential suppliers. In pre-evaluating suppliers under strategy-based organizational criteria, a total of 156 companies were used and a (156x12) evaluation matrix was obtained. Necessary data preparations were made. A (12x156) matrix was obtained with columns representing the input data of the first network. In the technical pre-evaluation, a total of 123 companies were used, and an (123x 9) evaluation matrix was obtained. The necessary data preparations were done and a (9x123) matrix was obtained with columns representing the input data of the second network.

As seen in Figure 8(a), the outputs of the first network that was used to eliminate risky suppliers reached 94.2% success overall. In detail, a total of 75 targets from class 1, which represented reliable suppliers, were correctly (Green) assigned to class 1, a total of five targets from class 1 were incorrectly (Red) assigned to class 2, a total of 26 targets from class 2, which represented risky suppliers, were correctly (Green) assigned to class 2, and four targets from class 2 were incorrectly assigned to class 1 in training data. From 156 companies, a total of 110 (70%) were used for the network training. For the validation, 23 (15%) of 156 companies were used.

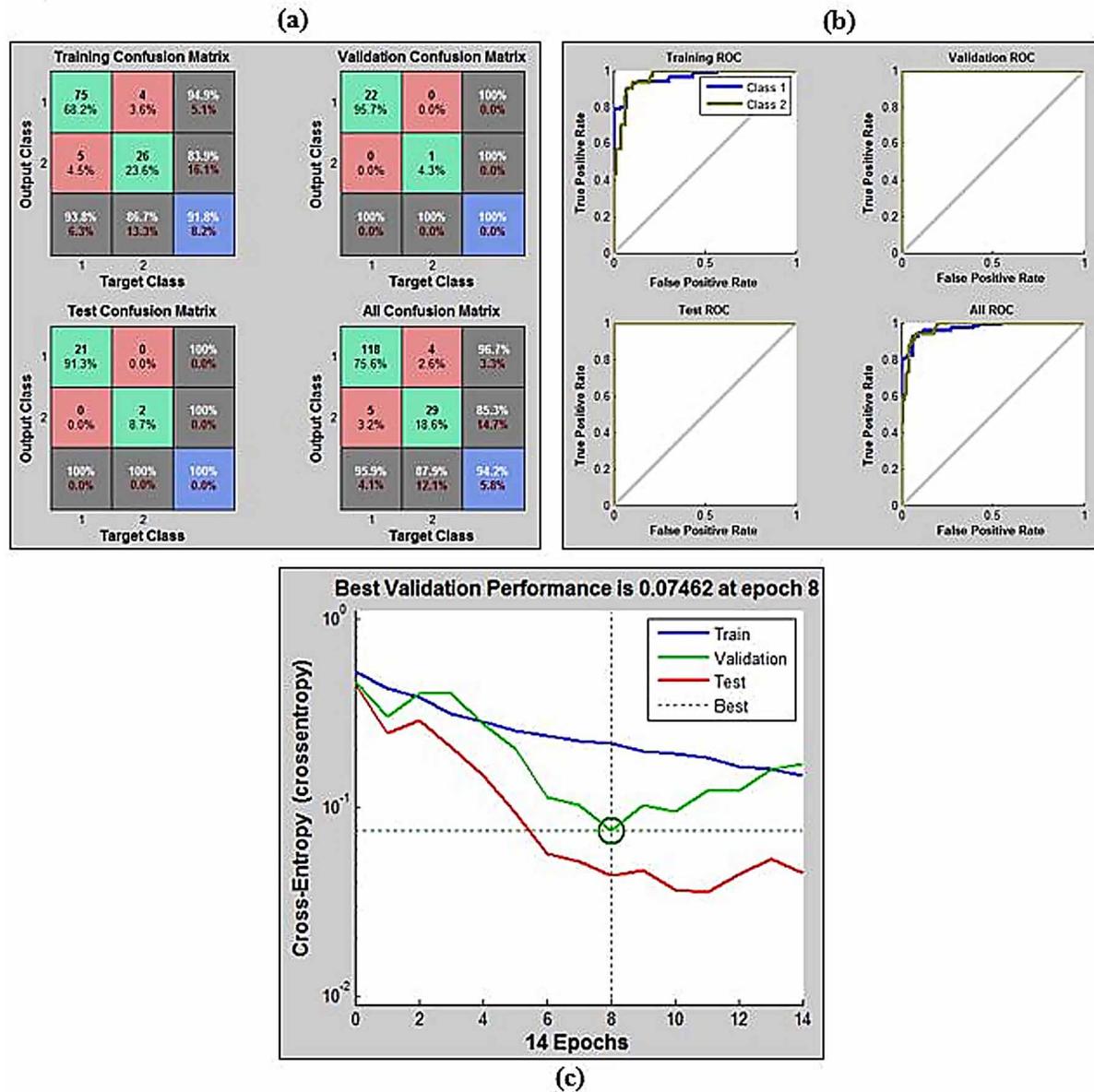
From class 1, a total of 22 targets were correctly (Green) assigned to class 1, and one target from class 2 were correctly (Green) assigned to class 2. The last set of data included 23 (15%) companies for the network testing. From class 1, a total of 22 targets were correctly (Green) assigned to class 1, and two targets from class 2 were correctly (Green) assigned to class 2. When the aim of the first network, which was to identify risky suppliers, was considered, this success level was acceptable since all risky suppliers in validation and testing were assigned to the right class.

As seen in Figure 8 (b), receiver operating characteristics (ROC) curves were also satisfactory as they were close to the upper left corner where true positive rate (sensitivity) was close to 100% and false positive rate (specificity) was close to 0%. As seen in Figure 8 (c), the direction of the validation (Green) and the test (Red) curves were similar. There was not any sudden increase in both of the curves. If the test curve had increased greatly before the validation curve, it might have been possible that some over-fitting had occurred.

As seen in Figure 9 (a), the outputs of the second network, which was used to determine preferred and potential suppliers, reached 95.9% success overall. In detail, a total of 21 targets from class 1, which represented preferred suppliers, were correctly (Green) assigned to class 1, two targets from class 1 were incorrectly (Red) assigned to class 2, and 64 targets from class 2, which represented potential suppliers, were correctly (Green) assigned to class 2 in the training data. From 123 companies, a total of 87 (70%) were used for the network training. For the validation, a total of 18 (15%) of 123 companies were used. From class 1, three targets were correctly (Green) assigned to class 1, 1 target from class 1 was incorrectly (Red) assigned to class 2, and 14 targets from class 2 were correctly assigned to class 2. The last set of data that included 18 (15%) companies was used for the network testing. From class 1, five targets were correctly (Green) assigned to class 1, one target from class 1 was incorrectly (Red) assigned to class 2, a total of 11 targets from class 2 were correctly (Green) assigned to class 2, and one target from class 2 was incorrectly (Red) assigned to class 1.

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Figure 8. Results of the first network

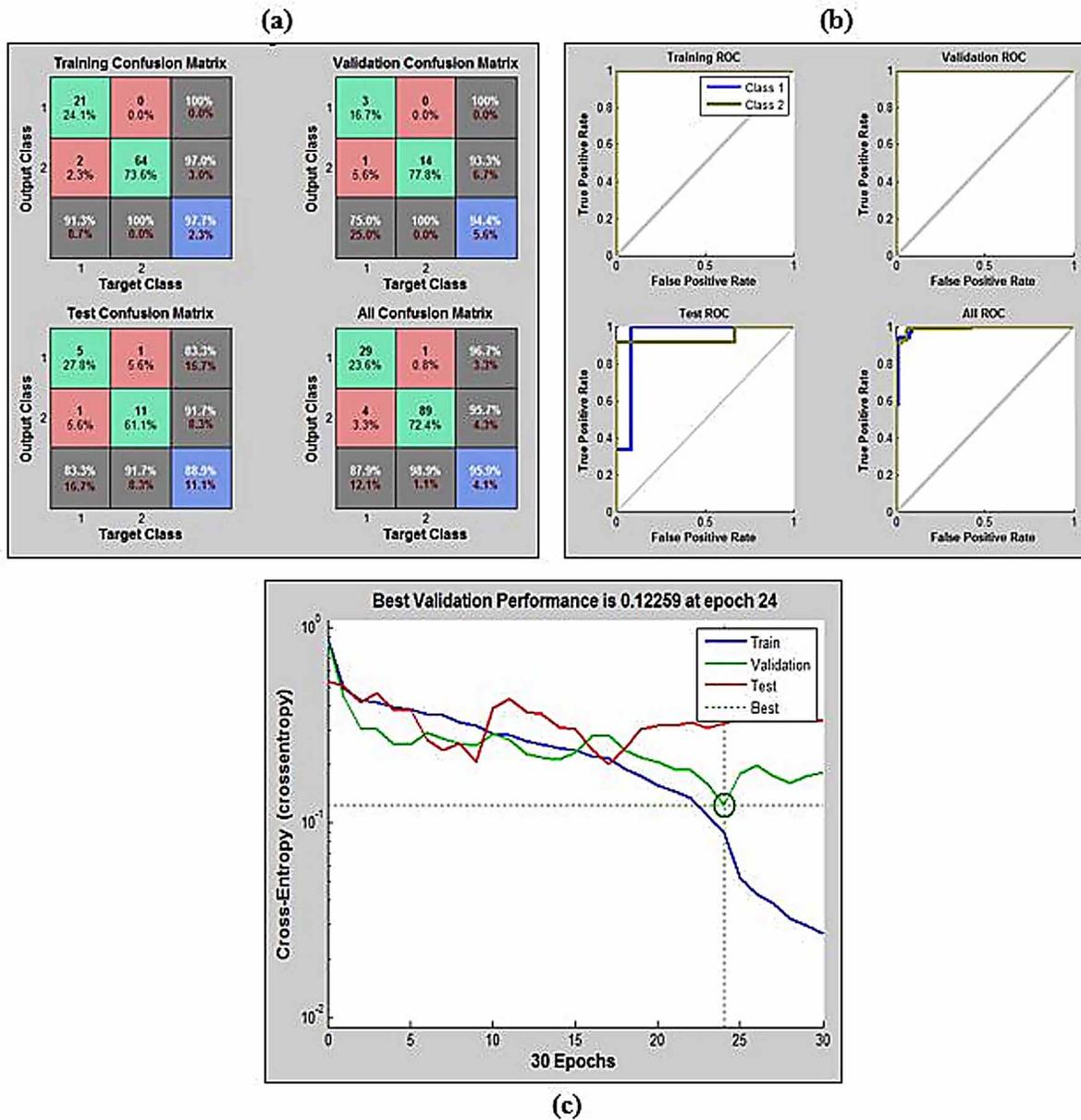


As seen in figure Figure 9 (b), receiver operating characteristics (ROC) curves were satisfactory as they were in the upper left corner. As seen in Figure 9 (c), there was a problem with the validation curve (Green) when it was compared to the testing and training curve (Blue). As explained earlier, a risk of over-fitting might have occurred. Therefore, a new approach was developed. If the suppliers, which were classified into two groups with this network, were from the same or similar commodity groups, processing all the data in the same neural network might have been a reasonable method.

However, they were from different commodity groups, such as foam, textile and mechatronic, so the problem with this situation was that some technical requirements, for example scrap level, ppm or

A Staged Supplier Pre-Evaluation Model

Figure 9. Results of the second network



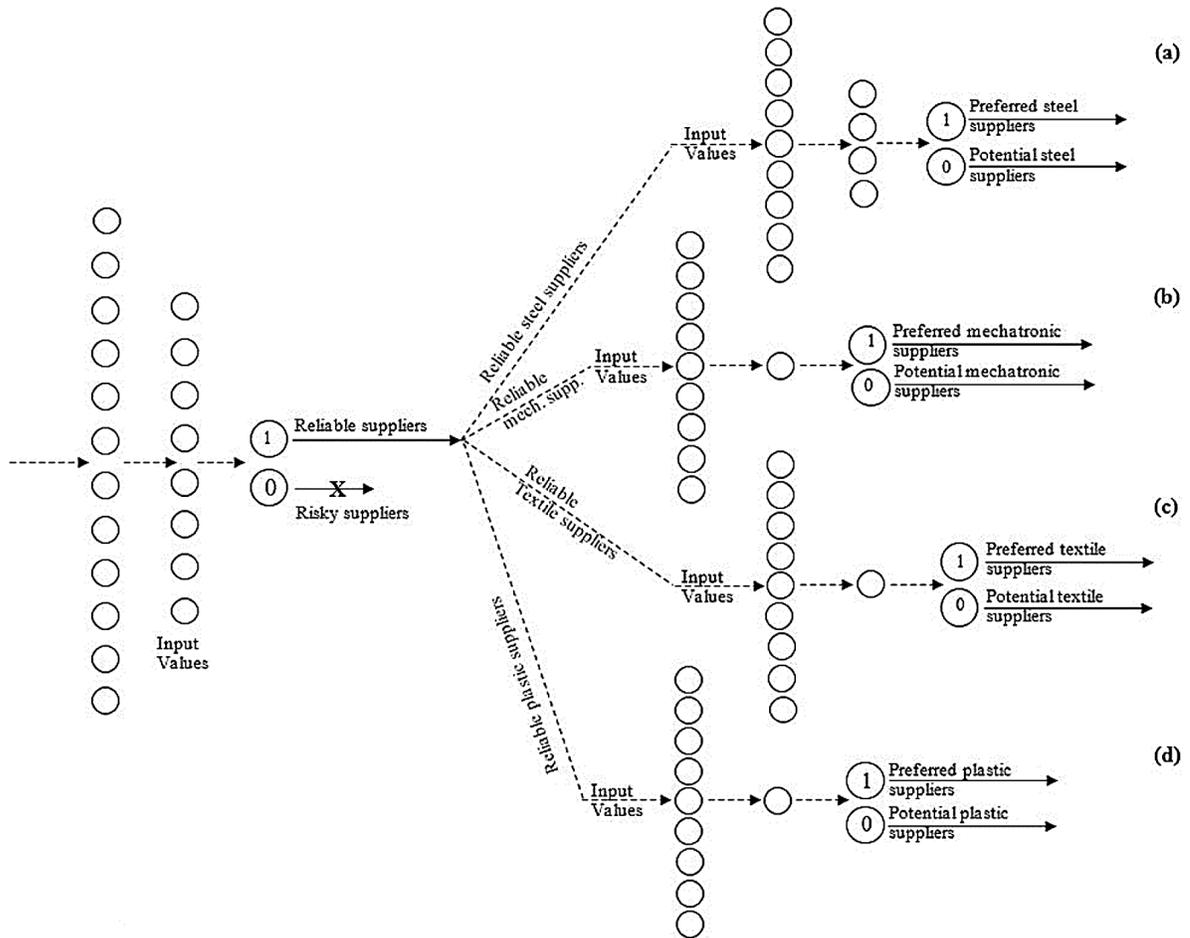
flexibility of production systems, may not be the same for these companies. In other words, the same evaluation values (input data) may not have same meanings (outputs) for different commodity groups. Therefore, different neural networks for each of the commodity groups were constructed from the beginning. On the other hand, since there was not enough sample data for all the commodity groups, only four neural networks could be created for steel, mechatronic, textile and plastics suppliers.

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The first network was constructed to determine potential and preferred steel suppliers. As seen in Figure 10 (a), there were a total of 33 steel suppliers. After the necessary data preparations, a (9x33) matrix was obtained to be used as the input data in this network. The outputs of the network were as shown in Figure 11.

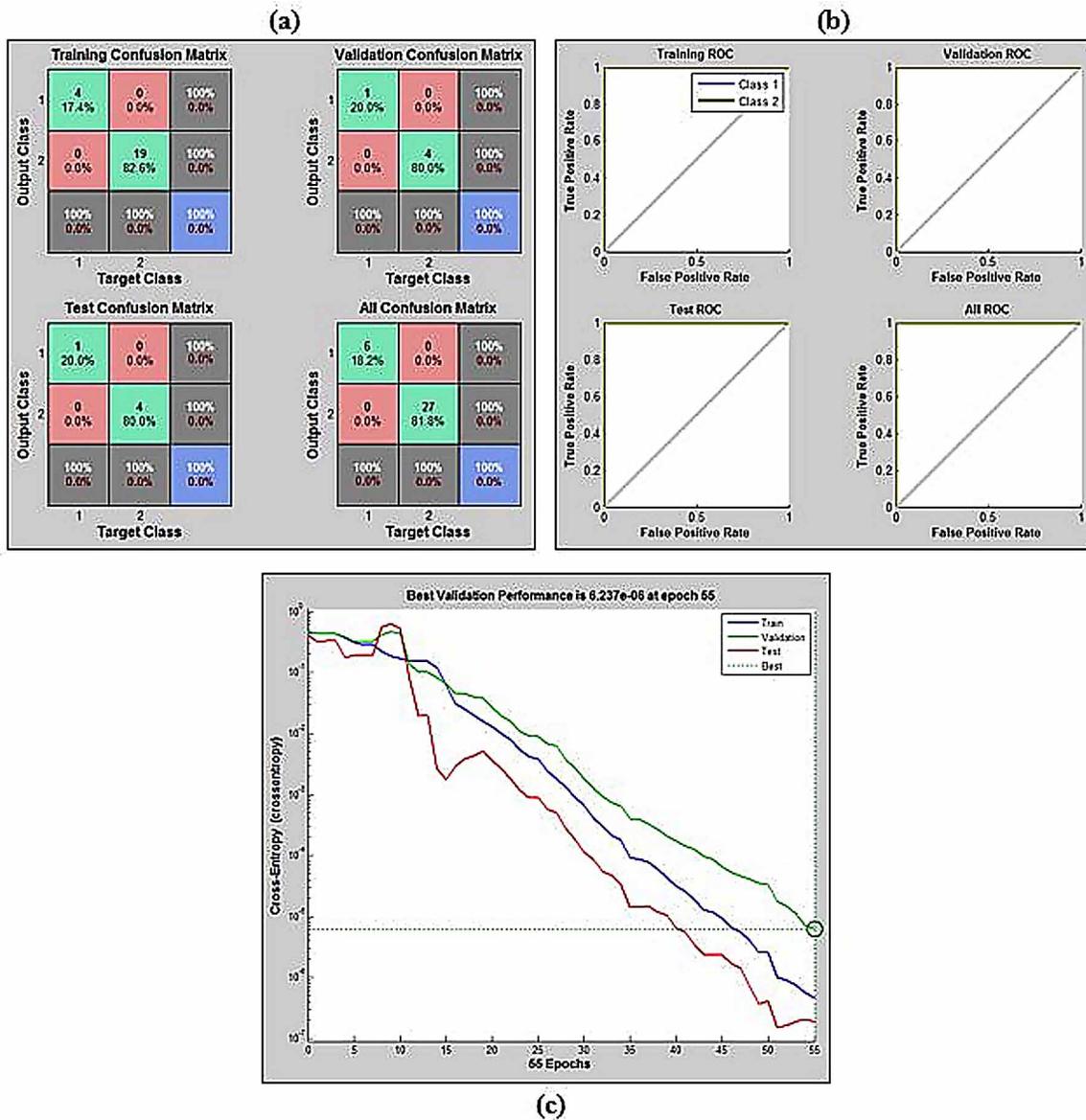
The second network was constructed to determine potential and preferred mechatronic suppliers. As seen in Figure 10 (b), there were 21 steel suppliers. After the necessary data preparations, a (9x21) matrix was obtained to be used as the input data in this network. The outputs of the network were as shown in Figure 12.

Figure 10. Restructured two staged neural network
Dashed arrows represent all the arcs between neurons in the layers.



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Figure 11. Results of the second network for steel parts suppliers

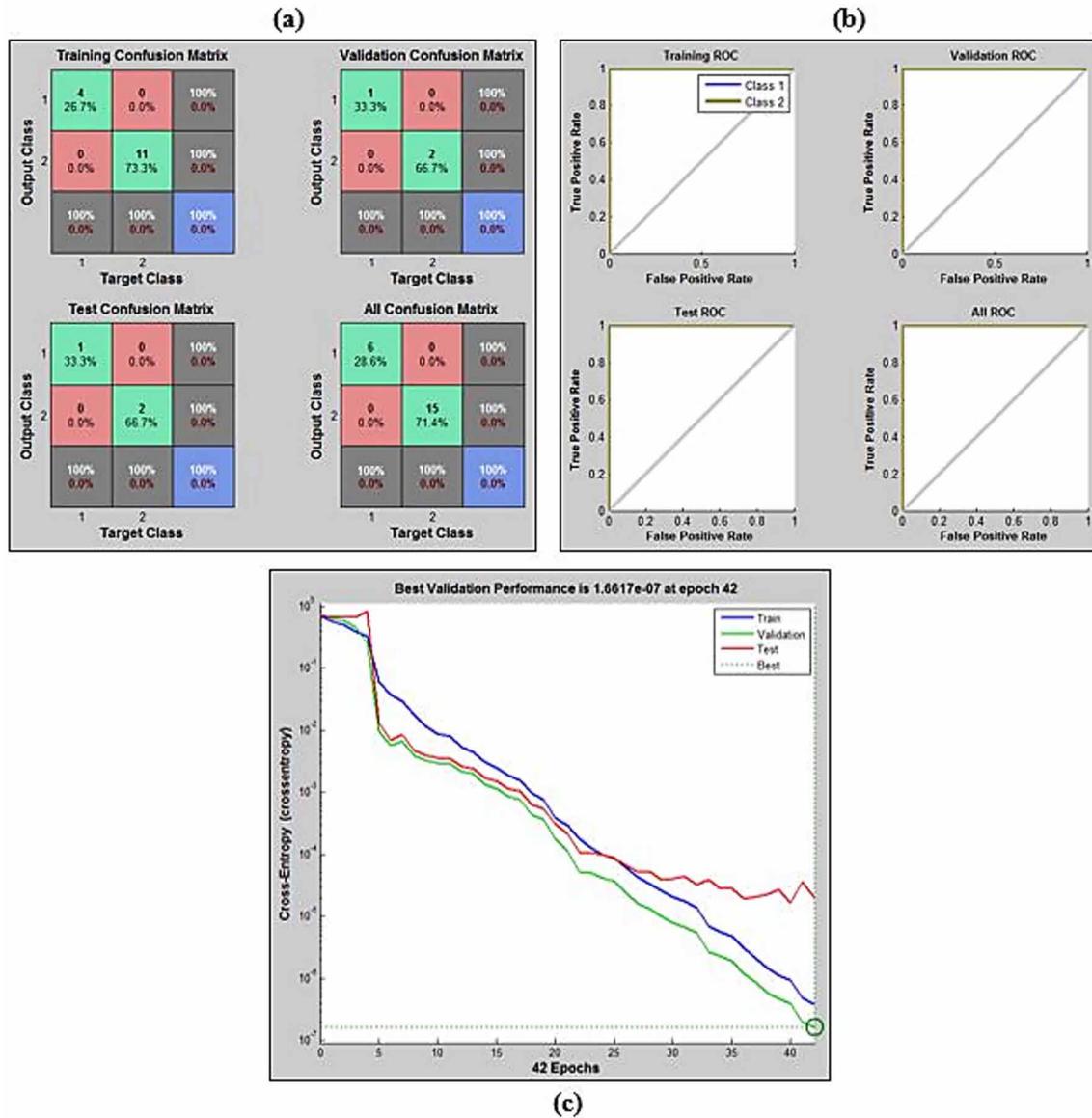


The third network was constructed to determine potential and preferred textile suppliers. As seen in Figure 10 ©, there were 18 steel suppliers. After the necessary data preparations, a (9x18) matrix was obtained to be used as the input data in this network. The outputs of the network were as shown in Figure 13.

The last network was constructed to determine potential and preferred plastic suppliers. As seen in Figure 10 (d), there were 15 steel suppliers. After the necessary data preparations, a (9x15) matrix was obtained to be used as the input data in this network. The outputs of the network were as shown in Figure 14.

A Staged Supplier Pre-Evaluation Model

Figure 12. Results of the second network for mechatronic parts suppliers

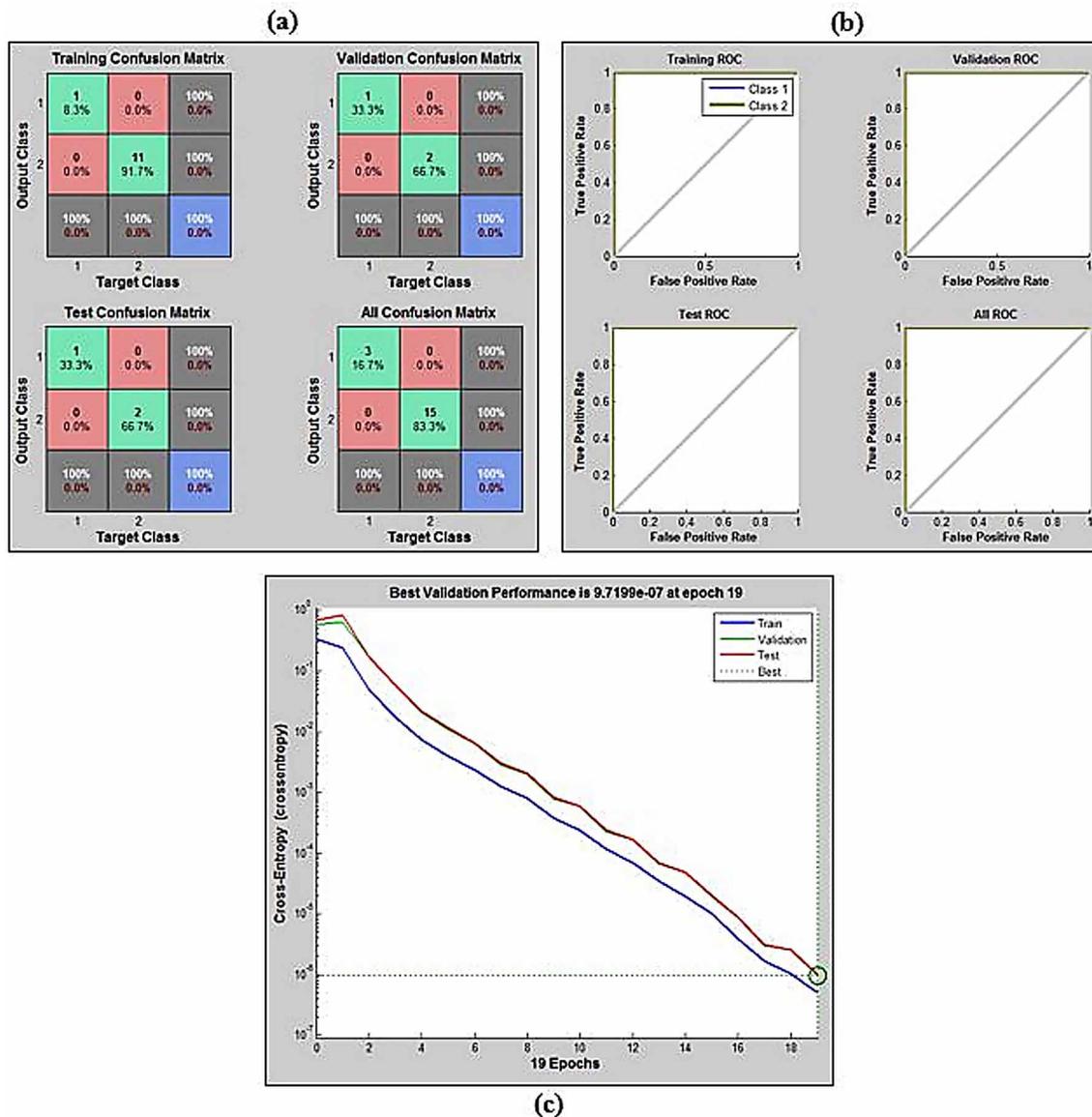


DISCUSSION AND CONCLUSION

It is obvious that ordering and supplying firms should operate interdependently like habitants of an ecosystem. Therefore their aims, targets, or visions should comply with each other if both sides would like to stay in the competition and benefit from the abilities of the other. In this framework, suppliers are recognized as strategic partners among which proper ones strongly assure high product quality and low cost for ordering firms. Selecting an appropriate supplier is an important and very complex task for all companies since uncertainty, subjectivity, and risk are involved in the decision-making process.

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Figure 13. Results of the second network for textile suppliers

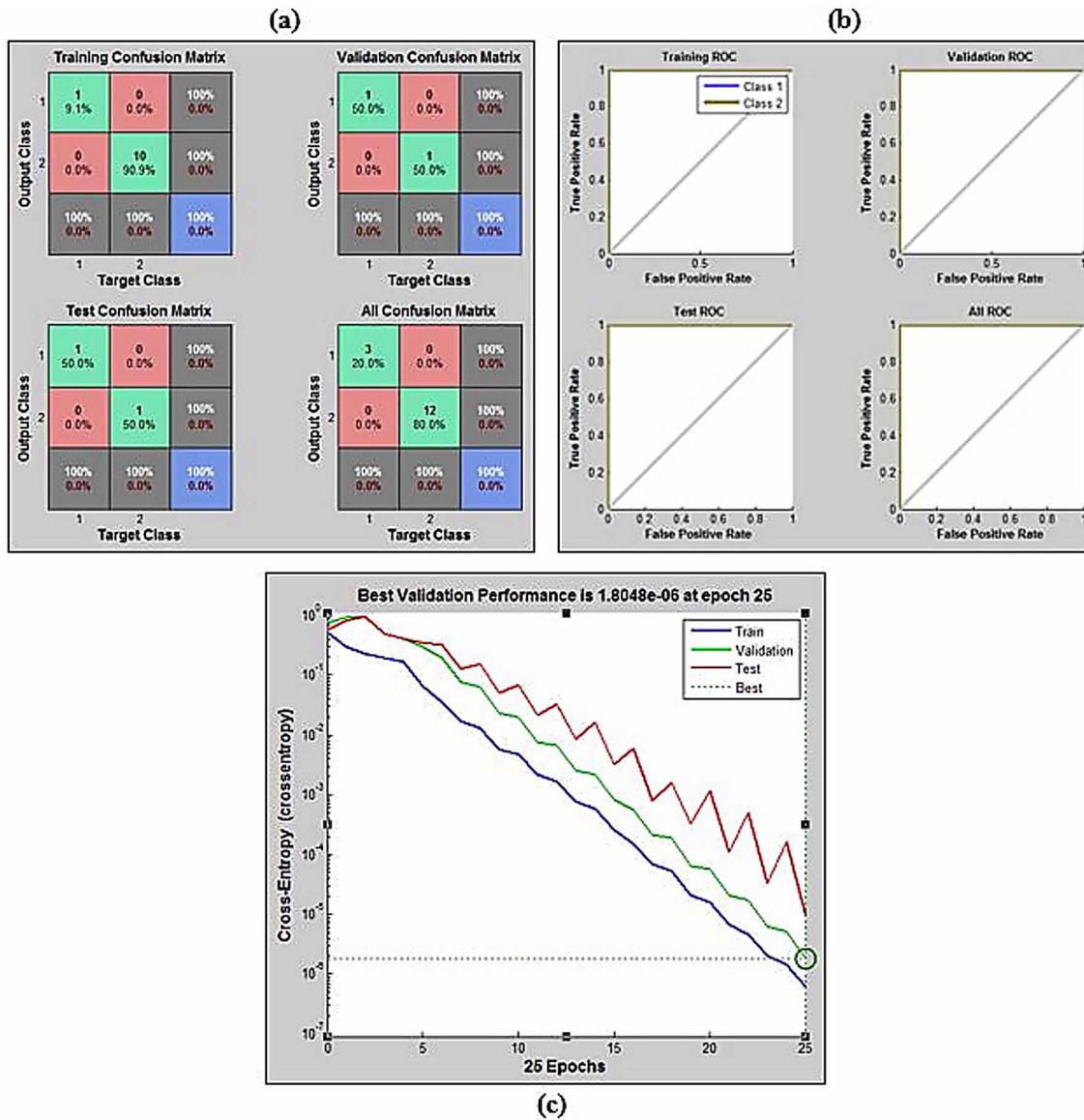


This is a common case if there are a large number of candidate suppliers to be considered. In real life practices, supplier selection decisions would be improved if decision makers could make more time to evaluate all candidate suppliers. However, the scarcest source of an enterprise is time. There is no time to evaluate candidate suppliers before working with them. Therefore, companies take a risk and collect offers from current and candidate suppliers, and try to make an intelligent decision about which offer to accept. This common practice may and often does result in disastrous outcomes.

Consequently, we proposed a two-stage neural network-based decision-making model that can be used before risky suppliers enter the supplier pool of the company. It identifies and eliminates risky

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Figure 14. Results of the second network for plastic parts suppliers



suppliers first, and categorizes reliable ones. In addition, we intended to consider organizational and technical fitness criteria in the proposed model. They were separately and consecutively used in the model to enable the enterprise to make a stepwise decision by the elimination and categorization steps.

The proposed model was successful in distinguishing risky suppliers from reliable suppliers. However the second network was restructured as a probable over-fitting occurred. After restructuring the second network, preferred and potential suppliers were successfully distinguished from each other. Findings showed that looking for organizational fitness determined with mostly intangible and subjective criteria, may enable ordering firms to identify risky suppliers that are most likely to cause enormous problems in the future. In other words, companies may wisely manage their supplier risks by determining risky

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suppliers and not working with them. For example, the companies, all of which were determined as risky in the pre-evaluation in this paper were really problematic suppliers with which communication problems occurred most of the time.

Based on the experts' experiences, these companies caused quality problems, delays in shipments and increases in internal costs due to rework operations and delays. The company determined these problems from experience over time. In addition to the organizational fitness, seeking technical fitness that was determined with mostly tangible and objective criteria, may enable ordering firms to identify both organizationally and technically fit suppliers.

Another key finding of this study showed that evaluating different commodity suppliers under same technical criteria in the same model is a great mistake because the same technical criteria require different satisfaction levels for suppliers from different industries. Therefore, it is necessary to evaluate suppliers that are from same or similar commodity groups separately. This was the reason that the second network was restructured from the beginning, and four different networks for four different commodity groups were created.

In addition, the criteria sets used in this study were strategy-based. While the first set of criteria was used to determine organizational inter-firm fit, the second set of criteria was used to determine technical inter-firm fit. Using strategy-based evaluation criteria in the network successfully met the aim which was to be able to classify suppliers in three groups of risky, potential and preferred. Additionally, the underlying aim was met. It was to reveal the importance of organizational fitness and supplier pre-evaluation in the problem of supplier selection by showing that it is possible to identify risky suppliers using organizational strategy-based criteria in a two-staged neural network model.

Another key feature of this study is the supplier pyramid. It increases the evaluation visibility of each candidate supplier, thus providing an opportunity for decision makers to make better judgments about suppliers. For example, if a candidate supplier is pre-evaluated and classified in the first level of the pyramid, decision makers should directly reject working with that company. If it is classified in the second level of the pyramid, which means this company is organizationally qualified but technically unqualified, decision makers may give some time to that company to improve technical abilities. In this case, a supplier development program may be created and these kinds of suppliers may be incorporated into this development program. If it is classified in the top level of the pyramid, decision makers may create a pending supplier list that includes both organizationally and technically fit candidate suppliers with which the ordering company can directly start working in the near future.

Regarding the method used for modeling this framework, the neural network approach is usually incorporated with other techniques in literature such as genetic algorithm (Golmohammadi, Creese, Valian, & Kolassa, 2009), particle swarm optimization (Kuo, Hong, & Huang, 2010) and fuzzy logic (Vahdani, Iranmanesh, Mousavi, & Abdollahzade, 2012). NN models can easily consider quantitative and qualitative measures at the same time. In addition, because of the black box characteristic, NN models are easy to use by decision-makers if commercial software tools are used. Compared to other approaches, it enables great numbers of candidate suppliers to be classified into different types. To the best of our knowledge, there has not been any research to date on the application of a two-stage neural network to overcome the supplier selection problem or, as in our case, supplier pre-evaluation problem.

However, there are some deficiencies of NN applications. For example, the company may need an expert to use NN structures with large data even though there is some commercial software available. In addition, the outputs or the performance of the network totally depends on the criteria and the data. If there is inconsistency, especially with the subjective data, training cannot be achieved. On the other

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hand, the black box structure of the network makes it difficult to identify any problem with the network. If there is a change in the evaluation parameters, the network should definitely be restructured. This means that all the procedures should be repeated and a new decision model is created.

For future research, the last component of inter-firm congruency to be considered is the subject of personal fitness. In addition, the proposed two sets of criteria can be used with different decision making techniques to solve supplier pre-evaluation problem, and outcomes or the efficiency of each technique can be compared with the other. Also, the present model can be re-tested on a larger sample size for each commodity group. A fuzzy logic approach may also be another issue to be examined in future research as some criteria used in this study have subjective characteristics.

In conclusion, the outcomes of this research may fill a gap in literature since we are proposing to use two different sets of strategy-based supplier selection criteria in a staged neural network model for supplier pre-evaluation, which is a specific problem type of supplier selection.

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REFERENCES

- Aissaoui, N., Haouari, M., & Hassini, E. (2007). Supplier selection and order lot sizing modeling: A review. *Computers & Operations Research*, 34(12), 3516–3540. doi:10.1016/j.cor.2006.01.016
- Anonymous. (2013, March). TAP begin pre-qualification of pipe suppliers. *Pipeline & Gas Journal*, 240(3), 14.
- Bishop, C. (2006). *Pattern Recognition and Machine Learning*. Singapore: Springer.
- Burton, T. T. (1998). JIT/Repetitive sourcing strategies: Tying the knot with your suppliers. *Production and Inventory Management Journal*, 4, 38–41.
- Cao, Y., Luo, X., Kwong, C., & Tang, J. (2014). Supplier pre-selection for platform-based products: A multi-objective approach. *International Journal of Production Research*, 52(1), 1–19. doi:10.1080/00207543.2013.807376
- Cetişli, B., & Barkama, A. (2009). Speeding up the scaled conjugate gradient algorithm and its application in neuro-fuzzy classifier training. *Soft Computing*, 14(4), 365–378. doi:10.1007/s00500-009-0410-8
- Chen, P.-S., & Wu, M.-T. (2013). A modified failure mode and effects analysis method for supplier selection problems in the supply chain risk environment: A case study. *Computers & Industrial Engineering*, 66(4), 634–642. doi:10.1016/j.cie.2013.09.018
- Chou, S.-Y., & Chang, Y.-H. (2008). A decision support system for supplier selection based on a strategy-aligned fuzzy SMART approach. *Expert Systems with Applications*, 34(4), 2241–2253. doi:10.1016/j.eswa.2007.03.001

A Staged Supplier Pre-Evaluation Model

- Christopher, M., & Lee, H. (2004). Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, 34(5), 388–396. doi:10.1108/09600030410545436
- Coates, J. (2003, July). Sourcing in emerging markets. *World Trade*, 16(7), 40.
- Conversi, D. (2010). The limits of cultural globalization. *Journal of Critical Globalisation Studies*, 2010(3), 36-59. Retrieved from http://www.criticalglobalisation.com/Issue3/36_59_LIMITS_CULTURAL_GLOBALISATION_JCGS3.pdf
- de Boer, L., Labro, E., & Morlacchi, P. (2001). A review of methods supporting supplier selection. *European Journal of Purchasing & Supply Management*, 7(2), 75–89. doi:10.1016/S0969-7012(00)00028-9
- Dye, R., & Stephenson, E. (2010, May). *Five forces reshaping the global economy: McKinsey Global Survey results*. McKinsey & Company. Retrieved from http://www.mckinsey.com/insights/globalization/five_forces_reshaping_the_global_economy_mckinsey_global_survey_results
- Ehrgott, M., Reinmann, F., Kaufmann, L., & Carter, C. R. (2013). Environmental development of emerging economy suppliers: Antecedents and outcomes. *Journal of Business Logistics*, 34(2), 131–147. doi:10.1111/jbl.12015
- Farughi, H., Azar, S., Sadeghi, H., Naseri, H., & Hajebi, S. (2011). Using multi criteria decision making models to evaluate suppliers in outsourcing process of supply chain management. *Australian Journal of Basic and Applied Sciences*, 5(12), 1999–2009.
- Ferguson, Y. (2014, March 7). The history and dynamics of globalization. *Diplomacy and Statecraft*, 25(1), 135–155. doi:10.1080/09592296.2014.873615
- Gökay Emel, G., & Petriçli, G. (2013). An Approach for Determining Corporate Strategy Based Supplier Selection Criteria. *Proceedings of the XI Balkan Conference on Operational Research*. Belgrade & Zlatibor.
- Golmohammadi, D., Creese, R., Valian, H., & Kolassa, J. (2009). Supplier Selection Based on a Neural Network Model Using Genetic Algorithm. *IEEE Transactions on Neural Networks*, 20(9), 1504–1519. doi:10.1109/TNN.2009.2027321 PMID:19695996
- Gupta, N. (2011). Globalization does lead to change in consumer behavior. *Asia Pacific Journal of Marketing and Logistics*, 23(3), 251–269. doi:10.1108/13555851111143204
- Gurnani, H., Gümüş, M., Ray, S., & Ray, T. (2012). Optimal procurement strategy under supply risk. *Asia Pacific Journal of Operational Research*, 29(1), 1–31. doi:10.1142/S0217595912400064
- Hendricks, K., & Singhal, V. (2005). Association between supply chain glitches and operating performance. *Management Science*, 51(5), 695–711. doi:10.1287/mnsc.1040.0353
- Ho, W., Xu, X., & Dey, P. (2010). Multi-criteria decision making approaches for supplier evaluation and selection. *European Journal of Operational Research*, 202(1), 16–24. doi:10.1016/j.ejor.2009.05.009

A Staged Supplier Pre-Evaluation Model

- Hultman, J., Johnsen, T., Johnsen, R., & Hertz, S. (2012). An interaction approach to global sourcing: A case study of IKEA. *Journal of Purchasing and Supply Management*, 18(1), 9–21. doi:10.1016/j.pursup.2011.11.001
- Hung Lau, K., & Zhang, J. (2006). Drivers and obstacles of outsourcing practices in China. *International Journal of Physical Distribution & Logistics Management*, 36(10), 776–792. doi:10.1108/09600030610714599
- Jung, K., Lim, Y., & Oh, J. (2011). A Model for Measuring supplier risk: Do operational capability indicators enhance the prediction accuracy of supplier risk? *British Journal of Management*, 22(4), 609–627. doi:10.1111/j.1467-8551.2010.00697.x
- Juras, P. (2008). The hidden costs of outsourcing. *Journal of Corporate Accounting & Finance*, 19(6), 7–15. doi:10.1002/jcaf.20428
- Khaled, M. (2007, June 28-29). *Globalization and religion*. Proceedings of the Conference on Globalization Conflict & the Experience of Localities: Retrieved from <http://www.ihmsaw.org/resource-files/1260067215.pdf>
- Kostopoulos, A., & Grapsa, T. (2009). Self-scaled conjugate gradient training algorithms. *Neurocomputing*, 72(13-15), 3000–3019. doi:10.1016/j.neucom.2009.04.006
- Kull, T., Oke, A., & Dooley, K. (2014). Supplier selection behavior under uncertainty: Contextual and cognitive effects on risk perception and choice. *Decision Sciences*, 45(3), 467–505. doi:10.1111/deci.12078
- Kuo, R., Hong, S., & Huang, Y. (2010). Integration of particle swarm optimization-based fuzzy neural network and artificial neural network for supplier selection. *Applied Mathematical Modelling*, 34(12), 3976–3990. doi:10.1016/j.apm.2010.03.033
- Kusaba, K., Moser, R., & Rodrigues, A. (2011). Low cost country sourcing competence: A conceptual framework and empirical analysis. *Journal of Supply Chain Management*, 47(4), 73–93. doi:10.1111/j.1745-493X.2011.03242.x
- Langhorne, R. (2001). *The Coming of Globalization: Its Evolution and Contemporary Consequences*. New York: Palgrave. doi:10.1057/9780333985564
- Lewis, H. (1940). Industrial purchasing - principles and practice. *Journal of Marketing*, (11): 73–74.
- Lockamy, A. III, & McCormack, K. (2012). Modeling supplier risks using Bayesian networks. *Industrial Management & Data Systems*, 112(2), 313–333. doi:10.1108/02635571211204317
- Lummus, R., & Vokurka, R. (1999). Defining supply chain management: A historical perspective and practical guidelines. *Industrial Management & Data Systems*, 99(1), 11–17. doi:10.1108/02635579910243851
- Luo, X., Wu, C., Rosenberg, D., & Barnes, D. (2009). Supplier selection in agile supply chains: An information-processing model and an illustration. *Journal of Purchasing and Supply Management*, 15(4), 249–262. doi:10.1016/j.pursup.2009.05.004
- Mandal, A., & Deshmukh, S. (1994). Vendor selection using interpretive structural modelling (ISM). *International Journal of Operations & Production Management*, 14(6), 52–59. doi:10.1108/01443579410062086

A Staged Supplier Pre-Evaluation Model

- Möller, K., & Törrenen, P. (2003). Business suppliers' value creation potential: A capability-based analysis. *Industrial Marketing Management*, 32(2), 109–118. doi:10.1016/S0019-8501(02)00225-0
- Møller, M. (1990, November). Scaled conjugate gradient algorithm for fast supervised learning. *Neural Networks*, 6, 525-533. Retrieved from <http://citeseer.ist.psu.edu/viewdoc/download?doi=10.1.1.38.3391&rep=rep1&type=pdf>
- Najafi, N., Dubois, A., & Hulthen, K. (2013). Opportunism or strategic opportunity seeking? Three approaches to emerging country sourcing. *Journal of Purchasing and Supply Management*, 19(1), 49–57. doi:10.1016/j.pursup.2012.12.002
- Narasimhan, R., & Talluri, S. (2009). Perspectives on risk management in supply chains. *Journal of Operations Management*, 27(2), 114–118. doi:10.1016/j.jom.2009.02.001
- Noorizadeh, A., Mahdilo, M., & Saen, R. (2012). Using DEA cross efficiency evaluation for suppliers ranking in the presence of dual-role factors. *Trends in Applied Sciences Research*, 7(4), 313-323. Retrieved from <http://scialert.net/qredirect.php?doi=tasr.2012.314.323&linkid=pdf>
- Norrman, A., & Jansson, U. (2004). Ericson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal of Physical Distribution & Logistics Management*, 34(5), 431–456. doi:10.1108/09600030410545463
- Ojala, M., & Hallikas, J. (2006). Investment decision-making in supplier networks: Management of risk. *International Journal of Production Economics*, 104(1), 201–213. doi:10.1016/j.ijpe.2005.03.006
- Panchal, G., Ganatra, A., Kosta, Y., & Panchal, D. (2011). Behaviour analysis of multilayer perceptrons with multiple hidden neurons and hidden layers. *International Journal of Computer Theory and Engineering*, 3(2), 332–337. doi:10.7763/IJCTE.2011.V3.328
- Papadopoulou, E., Manthou, V., & Vlachopoulou, M. (2013). 4PL network partnerships: The pre-selection phase. *International Journal of Logistics Research and Applications: Leading Journal of Supply Chain Management*, 16(3), 175–192. doi:10.1080/13675567.2013.809708
- Richards, K., & Jones, E. (2007). Relationship effectiveness and key account performance: Assessing interfirm fit between buying and selling organizations. *AMA Winter Educators' Conference Proceedings*, Houston. American Marketing Association.
- Ruamsok, K., Russell, D., & Thomnick, E. (2007). U.S. sourcing from low-cost countries: A comparative analysis of supplier performance. *The Journal of Supply Chain Management*, 43(4), 16–30. doi:10.1111/j.1745-493X.2007.00038.x
- Ruamsok, K., Russell, D., & Thomnick, E. (2009). Sourcing from low-cost countries: Identifying sourcing issues and prioritizing impacts on logistics performance. *The International Journal of Logistics Management*, 2(1), 79–96. doi:10.1108/09574090910954855
- Sarkar, A., & Mohapatra, P. (2006). Evaluation of supplier capability and performance: A method for supply base reduction. *Journal of Purchasing and Supply Management*, 12(12), 148–163. doi:10.1016/j.pursup.2006.08.003

A Staged Supplier Pre-Evaluation Model

- Şen, C. G., Şen, S., & Başlıgil, H. (2010). Pre-selection of suppliers through an integrated fuzzy analytic hierarchy process and max-min methodology. *International Journal of Production Research*, 48(6), 1603–1625. doi:10.1080/00207540802577946
- Sheth, J., & Parvatiyar, A. (1992). Towards a theory of business alliance formation. *Scandinavian International Business Review*, 1(3), 71–87. doi:10.1016/0962-9262(92)90012-U
- Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2000). *Designing and Managing The Supply chain: Concept, Strategies and Case Studies*. New York: Mc Graw Hill.
- Stoddard, J., & Fern, E. (1999). Risk-taking propensity in supplier choice: Differences by sex and decision frame in a simulated organizational buying context. *Psychology and Marketing*, 16(7), 563–582. doi:10.1002/(SICI)1520-6793(199910)16:7<563::AID-MAR2>3.0.CO;2-J
- Sturgeon, T., Memedovic, O., VanBiesebroeck, J., & Gereffi, G. (2009). Globalisation of the automotive industry: Main features and trends. *International Journal Technological Learning, Innovation and Development*, 2(1/2), 7–24.
- Tang, C. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics*, 103(2), 451–488. doi:10.1016/j.ijpe.2005.12.006
- Toulan, O., Birkinshaw, J., & Arnold, D. (2006). The role of interorganizational fit in global account management. *International Studies of Management & Organization*, 36(4), 61–81. doi:10.2753/IMO0020-8825360403
- Vahdani, B., Iranmanesh, S., Mousavi, S., & Abdollahzade, M. (2012). A locally linear neuro-fuzzy model for supplier selection in cosmetics industry. *Applied Mathematical Modelling*, 36(10), 4714–4727. doi:10.1016/j.apm.2011.12.006
- Villiers, J., & Barnard, E. (1993). Backpropagation neural nets with one and two hidden layers. *IEEE Transactions on Neural Networks*, 4(1), 136–141. doi:10.1109/72.182704 PMID:18267711
- Vokurka, R., Choobineh, J., & Vadi, L. (1996). A prototype expert system for the evaluation and selection of potential suppliers. *International Journal of Operations & Production Management*, 16(12), 106–127. doi:10.1108/01443579610151788
- Voss, G., Cable, D., & Voss, Z. (2000). Linking organizational values to relationships with external constituents: A study of nonprofit professional theatres. *Organization Science*, 11(3), 330–347. doi:10.1287/orsc.11.3.330.12497
- Wheatley, M. (2006, December). Emerging perils. *Financial Director*, 37-39.
- Xie, E., Peng, M., & Zhao, W. (2013). Uncertainties, resources, and supplier selection in an emerging economy. *Asia Pacific Journal of Management*, 30(4), 1219–1242. doi:10.1007/s10490-012-9321-9
- Yu, C., & Wong, T. (2014). A supplier pre-selection model for multiple products with synergy effect. *International Journal of Production Research*, 52(17), 5206–5222. doi:10.1080/00207543.2014.900199

A Staged Supplier Pre-Evaluation Model

Zsidisin, G. (2003). Managerial perceptions of supply risk. *The Journal of Supply Chain Management*, 39(4), 14-26. doi:10.1111/j.1745-493X.2003.tb00146.x

Zsidisin, G., Melnyk, S., & Ragatz, G. (2005). An institutional theory perspective of business continuity planning for purchasing and supply management. *International Journal of Production Research*, 43(16), 3401–3420. doi:10.1080/00207540500095613

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APPENDIX

Explanations of Some Pre-Evaluation Criteria

“Business strategy” has four values. Follower or reactor companies do not have any proactive strategy and usually react to events as they occur. Analyzer companies take less risk by usually expanding into areas similar to their core competency. Defender or competitor companies try to find and maintain secure and stable markets by keeping their prices low, advertising and promotional costs low, engaging in vertical integration, having a limited product portfolio. Prospector or innovator companies act aggressively by expanding into new markets and developing new products. Most of their revenues come from new products and new markets and they keep the advantage of being a first mover to untapped markets.

“Internal communication ability” represents effective communication within an organization. Communication should be done through multiple channels which may be electronic, print and face-to-face. For example, communication infrastructure should be reliable and sustainable; each employee in the firm should have an email address and a phone number. Also meetings for short briefings and for vision and targets revisions should be held periodically. Information boards, Andon boards, employee suggestion systems, company bulletins or newspapers and social activities are some other efficient ways to develop communication ability.

“Commitment to quality” represents that the management not only allocates a budget for corrective & preventive actions, quality trainings and internal audit systems but also enables employees to use this budget. Also top management should be aware of quality costs and keep track of them. They should actively participate in periodic review meetings and should encourage employees to attend these meetings.

“Eagerness to cooperate” represents that the firm has a positive attitude such as being cooperative, communicative and negotiable in case of any problem.

“Strategic importance for my company” represents that core competence, technology, patents and new investments of an organization is very valuable and make a difference in the market position of the buying firm if worked with that organization. On the other hand, if the organization is a monopoly, it is also strategically important to the buying firm.

“Scrap level” and “internal ppm” values differ depending on the commodity group. In other words, there is not any standard for scrap level or ppm target that fits all commodity groups.

“Co-design” represents that employees of the firm is able to cooperate with the buying firm for creating solutions together; they are also able to understand the technical needs and requirements of the buying firm. The existence of project teams in the supplying firm also represents that supplying firm has co-design ability.

“Technical qualifications of employees” represents that both blue and white collar employees have enough experience in automotive industry; their educational background is related to production or automotive industry; they have comprehensive knowledge of automotive production process and quality system tools.

“Quality control systems” represents that the firm use statistical process control, poke yoke and quality gate tools.

Chapter 25

An Empirical View of Knowledge Management

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ABSTRACT

This chapter is a comprehensive investigative documentary on knowledge management (KM). It was extensively cover past researches done on knowledge management, exposing its varied dimensions to readers as well as guide the readers through its role in research, business, and daily life. The chapter was well discussed about knowledge, knowledge management and knowledge management systems. It also address the Nonaka's Knowledge Management Model or known as SECI modal in order the readers can understand the knowledge creation process.

INTRODUCTION

This chapter is designed to help the readers gain an understanding about the concepts of knowledge, knowledge management, and knowledge management systems. The chapter is well defined, and concentrates on the basics of aforementioned concepts. The discussed concepts are critical to research in the field of knowledge management. Discussions on the effect of knowledge management systems on organisations are also provided. The process of knowledge creation, and the Nonaka's Knowledge Management Model (SECI Model) for knowledge creation are also discussed in the chapter. Discussions on tacit knowledge and explicit knowledge are also provided.

Learning Objectives

After reading this chapter, readers will be familiar with the following:-

1. Understanding of knowledge management
2. The concepts of knowledge and knowledge management

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3. The development of knowledge management systems
4. Understanding tacit knowledge and explicit knowledge
5. The process of knowledge creation
6. Summarize the Nonaka's Knowledge Management Model (SECI Model)

BACKGROUND OF THE STUDY

Today every business entity must contend with multifaceted, fast changing business settings in order to survive in the progressively competitive global economy. The value of knowledge is the main element of great benefits for most of organisations and certainly entire economies has become a hotly discussed topic. Drucker (1995) stated that “knowledge is the only meaningful economic resource” (p.56). It follows that for an organisation, individuals and society, the processes by which knowledge is created or learned, communicated, applied and utilized must be effectively accomplished. The idea that knowledge may be managed is clearly essential to the related philosophies of the learning organisation, the knowledge-based business, the administration of intangible assets and of intellectual capital.

Demarest (1997) expressed that the recent impetuous of statements that knowledge is somehow or other-the key to functioning competition, place difference and lucrativeness in the global post-capitalist economy aid to highlight the extent to which the normal organization is unfitted for this innovative economic environment, in three critical ways. The production, possession and the use of knowledge are a central element in the expansive formulation of environmental issues. Thus, knowledge is used in environmental advices reflects the actors' clarifications of reality but also produces new cooperatively shared understandings (Peuhkuri, 2002).

With the rapid change world and great pace of current life, today's organizations are facing aggressive market rivalry. Wang, Guo, Fan, and Bi (2014) stated that to deal with the drastic changing environment, there is a need for the market and the multifaceted business environment and people came to recognize the worth of knowledge. Corporations tend to pay additional attention on the subject of knowledge, thus transform the business strategy from products-based to knowledge-based (Kahreh, 2011). Knowledge form is a main advantage in modern business environment especially in the financial services industry.

To improve and maintain the competitive advantage, long-term relationships with customers and sustainable profitability, financial services organisations must work on their knowledge capitals, which are referred to as knowledge management (Farzin, Kahreh, Hesan, & Khalouei, 2014). The importance of maximizing knowledge to increase competence and success within the organisation is now broadly recognized not only among large scale business entity and small and medium enterprises (SMEs), but also among an organisation dedicated to education. Valuable human and knowledge resources will be useless except management willingly receives and put efforts to gather, sort, transform, record, and share knowledge (Haslinda & Sarinah, 2009).

KNOWLEDGE

Knowledge can be defined in several ways. Sveiby (1997) defined knowledge as “a capacity-to-act (which may or may not be conscious)” (p. 37). The stress of the definition is on the action element which is a capacity-to-act can only express in action (Polanyi, 1958; Wittgenstein, 1995). Each person must gener-

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ate his or her own capacity-to-act and reality through experience a view that is similar to constructivism (von Glasersfeld, 1987). Generally, knowledge also can be expressed as human faculty subsequent from defined information; understanding that developed from mixture of data, information, experience, and individual interpretation (Lortie, Desmarais, & Laroche, 2012). Knowledge is defined as facts, information, and skills acquired through experience or education; the theoretical or practical understanding of a subject (Knowledge, 2015), which can simplify as understanding of an individual about the subject matter and perception on that particular subject matter.

Knowledge has been recognized as a significant source of competitive advantage and value making (King & Zeithalm, 2003; Massa & Testa, 2009) as a crucial element for the expansion of vibrant competencies and, more generally, as a determinant aspect for firms with international desires. Such organisation requires vigorous knowledge resources with excellent knowledge management. A growing range of disciplines has pulled attention both to the significance of knowledge and its various organised and explicit forms in terms of business triumph (Shaw & Williams, 2009). It is important to emphasize that the concepts of knowledge and information tend to be used interchangeably throughout the literature and praxis (Ritcher & Niewiem, 2009). Knowledge management must include people, process, technology, and culture (Farzin *et al.*, 2014).

Knowledge is formed through interaction with the surroundings where individuals themselves construct their thoughtful of the world through experience (Darroch & McNaughton, 2002). Its exchange is an integral part of learning as well as helping the individual to shape his or her abilities by converting theoretical and practical skills into new knowledge (Fenwick & Parsons, 2000; Greeno, Pearson, & Schoenfeld, 1999). Human knowledge is mostly acquired through communication and its processes. Knowledge is the key to the prevention of human error and education is the key to develop and obtain knowledge.

Nonaka and Takeuchi (1995) defined knowledge as “justified true belief that increases an entity’s capacity for effective action” (p. 21). It is initially shaped by individuals and that the knowledge generated by particular organisation member becomes organisational knowledge through certain procedure. Both Sveiby (1997) and Nonaka and Takeuchi (1995) had the same perception on the theory of knowledge. Sveiby (2001) and von Krogh, Ichijo, and Nonaka (2000) explained that knowledge as a justified true belief, when somebody builds knowledge, he or she finds the logical out of a new condition by holding justified beliefs and obligating to them. The stress in this definition is on the sensible act of creating meaning.

KNOWLEDGE MANAGEMENT

As an English Philosopher, Francis Bacon said, “Knowledge is Power”. The strength of knowledge is a very important supply for conserving appreciated heritage, discovering new ideas, settling troubles, generating essential competences, and starting new circumstances for both individual and organisations now and in the next era. Skills to manage this knowledge have become a crucial task in the past few decades, and the knowledge management community has grown an extensive range of technologies and applications for both educational research and real-world applications. In addition, knowledge management has concerned much struggle to discover its nature, concepts, frameworks, architectures, methodologies, tools, functions, real world applications in terms of representative knowledge management technologies and their presentations (Liao, 2003).

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Knowledge is a concept and a term that arose about two decades ago with much research continuing until today to possess a better understanding of it. One might easily say it means combining an organisation's information and knowledge holistically, but that sounds a bit unclear and, surprisingly enough, even though it sounds overbroad, it is not the entire picture. Davenport (1994) highlighted knowledge management as the progression of capturing, distributing, and effective use of knowledge. Knowledge management has also been merged into multidiscipline areas of interest. In this wild growing era, knowledge management turn out to be a crucial element for every effective organisation to maintain their triumph in the global arena. It can also be defined per the following:

Knowledge management is a discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise's information assets. These assets may include databases, documents, policies, procedures, and previously un-captured expertise and experience in individual workers. (Duhon, 1998, p. 8)

Currently, numerous business entities are introducing knowledge management creativities, believing that their well-intended effort will logically result in the higher exploitation of knowledge properties for economic benefit. Operates in organizations are steadily hoping for better paths to advance the show and business results by gaining new understandings into the underlying but multifaceted mechanisms of knowledge and knowledge management to particular organisation's efficiency. Certainly, it has been recognized that knowledge management is comprehensive and multi-dimensional and included most features of the firm's actions.

A champion organization must generate and kept harmonised intellectual capital portfolio for the long term. Managers and executive must establish a set of broad priorities and integrate the aims of handling intellectual resources and effective knowledge process (Wiig, 1997). In this scenario, not only have knowledge and knowledge management been the centre of attention and broad discourse amongst members in organizations, they have also attracted huge attention in education. Interest in knowledge and knowledge management has been observed in economics, management, information technology, anthropology, sociology, epistemology, psychology, and other disciplines (Quintas, Lefrere, & Jones, 1997).

In an economy ruled by uncertainty, success of a business entity depends on knowledge. While trends change, markets shift, technologies flourish, competitors grow, and products become out of date overnight, triumphant companies are those who consistently create new knowledge, distribute it widely throughout the organisation, and quickly embody it into new technologies and products (Nonaka, 1991). Quintas, Lefrere, and Jones (1997) stated knowledge management is a progression of managing knowledge which aims to maintain current and learned knowledge assents to reach targets for now and cultivate opportunities for the future.

The terminology of knowledge management is not simply created because management normally means that 'something' must be managed (Wiig, Hoog, & Spex, 1997). In Polanyi's (1966) debate of the distinction between explicit and tacit knowledge, investigators created a bundle of management meanings, ideas, actions, phases, flows, and processes, all focused on dealing with objects in order to define the framework of knowledge management as knowledge management methodology. It is one of the most favorite topics among the researchers which have studied many fields of knowledge such as cognitive sciences, sociology, management science, information science, knowledge engineering, artificial intelligence, and economics (Makani, 2008; Sinotte, 2004; Rowley, 2007; Wild & Griggs, 2008;).

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Knowledge integration is explained as the procedures by which several individuals or members merge their information and exclusively held knowledge to develop new knowledge (Söderlund, 2010). Knowledge management helps to improve a business' effectiveness in the challenging business atmosphere (He, Qiao, & Wei, 2009). Drucker (2000) described knowledge, rather than capital or labour, as the only meaningful supply in the knowledge society. Since many business entities suffer from learning disabilities, they are unable to act as knowledge based organisations many business entities in world arena (Senge, 1990).

Although the importance of knowledge society and the knowledge economy have widely understood that knowledge is a key for current business environment, some organizations are still positioned in the early stages of understanding the implications of knowledge management, a fact which can hamper their success. Bhatt (2000) and Rowley (1999) determined organizational capabilities and core competencies combined with an increased awareness of knowledge are critical factors in the current business world for survival of most organizations (Prahalad & Hamel, 1990).

Most of the extant knowledge management literature mainly classified knowledge as either explicit or tacit (that which is in people's heads), and such classification appears to be oversimplified and misleading (Koenig, 2012). A much more nuanced and useful characterization is to describe knowledge as explicit, implicit, and tacit. The scholars look at knowledge management as a big tree consisting of many branches.

KNOWLEDGE MANAGEMENT SYSTEMS

Modern life mechanisms and structures empower the sharing of organizational knowledge in novel and various ways (Anand, Glick, & Manz, 2002; Hansen, Nohria, & Tierney, 1999). Researchers, academicians, and professionals from different fields have viewed knowledge management systems as a way to share knowledge in organizations (Alavi & Leidner, 1999; Sabherwal & Becerra-Fernandez, 2002). Many knowledge management systems are designed to gain and collect knowledge from every individual and share the benefits with the entire organization.

The best way to optimize knowledge management systems is to capture and broadcast knowledge frequently which requires that individuals donate their knowledge to the organization instead of retaining it for by distributing it directly with others via a variety of communication methods (King & Marks, 2008). It appears some organizations strongly believe that "knowledge is power", so knowledge sharing will only happen when external motivation or forces occur (Beckman, 1999; Marcus, 2001; Khalil, 2004). Due to unknown beneficiaries, people who are willing contributors sometimes tend to be reluctant to share their knowledge (Goodman & Darr, 1999).

Knowledge management systems increase organizational learning by capturing internal knowledge and making it available to employees for reuse (Damodaran & Olphert, 2000; Haseman, Nazareth, & Paul, 2005). Knowledge management systems are very helpful to uphold a company's history, valuable experience, and long-term employee's expertise for future development. In order to keep the business successful, it is necessary to track employee knowledge and incorporated into systems (Lin & Huang, 2008). Many researchers have agreed that knowledge is not simple measured or audited, so every organizations must make extensive effort to manage their knowledge efficiently to optimize the skills and

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experience that are deep-rooted in their organisations. This includes the tacit knowledge belonging to the employees of the organization. (Heaidari, Moghimi, & Khanifar, 2011; Hung, Huang, & Lin, 2005; Zaid, Hussein, & Hassan, 2012). Development of a systemized information model will assist the process of integration and effective knowledge management.

KNOWLEDGE CREATION: NONAKA'S KNOWLEDGE MANAGEMENT MODEL

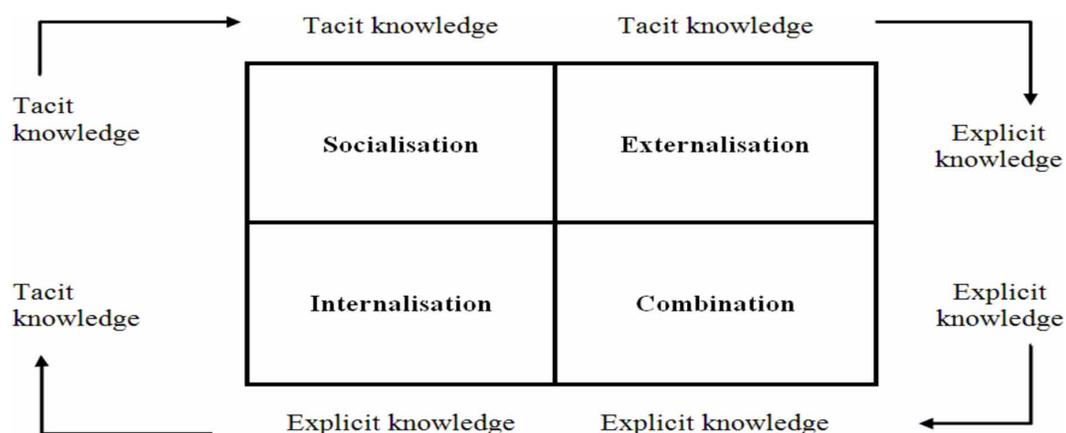
Creation of new concepts and ideas are formed in every individual mind is based on continual dialogue between explicit and tacit knowledge (Nonaka, 1994). Knowledge creation in an organization will undergo similar processes for explicit and tacit knowledge (Nonaka, Umemoto, & Senoo, 1996). Normally, tacit knowledge is explained knowledge that is not verbalized, intuitive, or articulated, while the knowledge that can be specified in writing, drawings and computer programming is explicit knowledge (Haslinda, & Sarinah, 2009). The interaction between these two knowledge ware named as "knowledge conversion" (Ale, Toledo, Chiotti, & Galli, 2014).

The conversion process (SECI Model) will enlarge both tacit and explicit knowledge in terms of quality and quantity. The conversion can classify into four categories; namely, socialization, externalization, combination, and internalization. Tacit knowledge will convert to tacit knowledge at socialization, in externalisation sate the tacit knowledge will convert to explicit knowledge); in combination condition the explicit knowledge will pass as explicit knowledge, while at the internalization phase explicit knowledge will turn into tacit knowledge.

All four modes must be organizationally managed and dynamically interacted to carry out the organizational knowledge creation processes, although all four modes may act independently to create knowledge. Another process called as 'knowledge spiral' will take place with an unique pattern, an informal network of relations will start among the individual in organisation, followed by the group (collective) level and eventually last it goes to the organisational level. Then, it ultimately creates a 'spiralling effect' of knowledge gathering and development which endorses organisation innovation and learning (Nonaka, 1994; Nonaka & Takeuchi, 1995) (see Figure 1).

Figure 1. Nonaka's knowledge management model (SECI model)

Source: Nonaka (1994)



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In practice, tacit knowledge can be divided into two dimensions; namely, technical and cognitive (Nonaka & Takeuchi, 1995; Polanyi, 1966). The technical dimensions involve hands-on work captured in concrete 'know-how' exemplified by the master craftsman who is often unable to articulate what he or she knows. The phenomena of 'knowhow' cannot always be arranged since it often has important tacit dimensions (Polanyi, 1966). Another dimension of tacit knowledge is cognitive which is classified as 'mental models' (Johnson-Laird, 1982) such as schemata, paradigms, perspectives, principles, images of reality and future vision, which mould an individual's view about the world. Real-time scenario and specific practical life helps to generate tacit knowledge in an individual (Bateson, 1972). In the Adaptive Character of Thought (ACT) model, tacit knowledge is described as cognitive psychology's definition of 'procedural' knowledge (Anderson, 2013; Single, 1989).

Knowledge that is transmittable in some general or proper language with assistance of words, numbers, diagrams or models is categorised as 'codified' knowledge (explicit knowledge) (Polanyi, 1966), which can be simply conveyed orally and in written or electronic form. In this condition, the knowledge can be manipulated and stored in various databases and repositories. It is also rooted in the past actions or objects and is oriented towards a context-free theory (Polanyi, 1966), arranged in consecutively captured by 'there and then' and, thus, possesses a 'digital' activity (Bateson, 1972). The different level of education, multiple sources of reading materials, and work context assist to provide explicit knowledge for people.

Socialisation

Socialisation is a process of creating new and common tacit knowledge through shared experiences (Nonaka, Toyama, & Konno, 2000). It is tacit knowledge from individual to individual, and in the process people actualize the expression and conversion of knowledge by means of observation and imitation (Wan, Zhang, Wan, & Huang, 2010). Socialisation begins with building an interaction when individuals share their life and work experiences at the same time and space, thereby creating mutual unarticulated beliefs or embodied skills (Nonaka *et al.*, 1996).

The difficulty of tacit knowledge is to formalize and often time- and space-specific tacit knowledge can be gained only through shared experience, such as living in the ecosystem. Socialisation typically occurs in a traditional traineeship where trainees learn the tacit knowledge needed in their skills through live experience rather than from written manuals or textbooks. Informal social meetings outside the work place where all the organization's members share their views and understandings will create tacit knowledge that can be shared. Socialisation also occurs beyond organizational boundaries; smart and intelligent firms often acquire and take advantage of the tacit knowledge rooted in customers or suppliers by interacting with them for their own development.

Externalisation

Externalisation is a process of articulating tacit knowledge into explicit knowledge (Nonaka *et al.*, 2000) as concepts and/or diagrams, often using metaphors, analogies, and/or sketches (Nonaka *et al.*, 1996). This mode is triggered by a dialogue intended to create concepts from tacit knowledge. When tacit knowledge is made explicit, knowledge is crystallized, thus allowing it to be shared by others which becomes the basis of new knowledge. Concept creation in new product development is an example of this conversion process (Nonaka *et al.*, 1996). Another example is a quality control circle which allows

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employees to make improvements on the manufacturing process by articulating the tacit knowledge accumulated on the shop floor over years on the job. The successful conversion of tacit knowledge into explicit knowledge depends on the sequential use of metaphor, analogy and model (Nonaka *et al.*, 2000).

Combination

Combination is the process of converting explicit knowledge into more complex and systematic sets of explicit knowledge (Nonaka *et al.*, 2000). In order to convert information into something more tangible, a newly-created concept or idea should be combined with existing explicit knowledge. The new knowledge is formed by processing collected explicit knowledge whether from inside or outside the organisation with necessary changes, and then distributing it among the organisation members. This mode of knowledge conversion is very effective with latest and upgraded technologies in communication. Since computer systems are implemented, all the information about the organization is collected very easily and transformed into a report which is actually new knowledge in the sense that it synthesizes knowledge from many different sources in one context.

Thus, this mode play good role in connecting different bodies of explicit knowledge. The so-called “breakdown” can occur in this mode in which the corporate work different direction from top management’s vision in the organization can create a deductively systemic, explicit knowledge. The critical stage for top management to create a thought-provoking and fertile concept, or Nonaka *et al.*, (1996) is called a “mother concept,” which creates too many “offspring concepts.”

Internalisation

The process of converting explicit knowledge into tacit knowledge is known as internalisation. The generated explicit knowledge is shared throughout an organization and converted into tacit knowledge by individuals in this mode (Nonaka *et al.*, 2000). “Learning by doing or using” is a trigger point for internalisation. The process is enhanced by capturing explicit knowledge into varies formats such as text, sound, or video format. Therefore, manuals, which quintessential explicit knowledge, are widely used for internalisation.

It is a valuable asset for an organization when knowledge is internalised to become part of an individuals’ tacit knowledge bases in the form of shared mental models or technical know-how. This tacit knowledge is gathered by any particular member or individual and then begins a new spiral of knowledge creation when it is shared with others through socialisation. The expanding the scope of direct experience and encouraging organisational members to reflect upon the experience are very important to the provision of such explicit knowledge among organisational members (Nonaka *et al.*, 1996).

MANAGERIAL IMPLICATIONS

Knowledge transfer is a unique process which is varied from one organization to another (Zbilgin, 2009). An effective knowledge transfer is a multifaceted procedure that involves a manager and policy makers to consider issues on several levels. To improve and gain the most effective knowledge transfer between organizational members, levels, and work groups, trust is one of the important tools that must be provided adequate attention (Politis, 2003). Trust consolidates the process of knowledge transfer and

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knowledge sharing. The successes of knowledge management in each organization highly depends on several factors; namely, collaboration and co-operation among the individuals continues learning culture, horizontal communication, level of skills and competencies among works, approach to encourage knowledge transfer, and knowledge sharing and reward systems (Goh, 2002).

Each of these factors determines how the knowledge management will occur in each organization. One of the important elements that should be considered is the motivation factor (Sutton, 2006). Most of the time, reward and motivation work simultaneously. The reward system must not be dedicated purely to organizational production and financial perspectives. Other aspects such as successful knowledge sharing, co-operation, and teamwork should also be included in reward systems (Goh, 2002).

SOLUTIONS AND RECOMMENDATIONS

Much work has been conducted in the field of knowledge management. The rapidly changing business environment has forced researchers to come out with advanced and unique ideas. Knowledge generation and transformation among organizational members change over time. For effective transformation of knowledge, the process of knowledge creation should be based on local taste and preferences, and benefit the organizational culture and current environment.

FUTURE RESEARCH

Nonaka's (2000) knowledge creation process is based on Japanese organizational structure. Therefore, for model suitability to cross-industrial studies, cultural variations across geographical areas need to be considered, and the model modified or adapted to the new environment. Any future research must focus on knowledge management in multinational organizations which consist of members from varied socio-demographic backgrounds. Such research will highly contribute to sustainable development among multinational organisations in conjunction with creating a knowledgeable community. For future research, it will be vital to inspect how organizations, governments, universities, and research centres can collaborate to make knowledge creation more feasible across the world.

CONCLUSION

The importance of knowledge management is increasing on a worldwide basis due to global hypercompetition. Since knowledge management is contributing to the economic benefit of organizations, it is necessary to remain vigilant in its collection and dissemination. Understanding the entire process of knowledge creation helps make knowledge management more efficient and effective. It is time for the top level managers to make use of it to increase the efficiency of their organisational operations. Effective knowledge transfer is an important knowledge management activity for organizations. The SECI model is critical in the conversion of both tacit and explicit knowledge among the organization in four ways; namely, socialisation, externalisation, combination, and internalisation. The depth of understanding of knowledge management and its process will provide an advantage for every organization in this highly competitive world.

An Empirical View of Knowledge Management**REFERENCES**

- Alavi, M., & Leidner, D. E. (1999). Knowledge management systems: Issues, challenges, and benefits. *Communications of the AIS, 1*.
- Ale, M. A., Toledo, C. M., Chiotti, O., & Galli, M. R. (2014). A conceptual model and technological support for organisational knowledge management. *Science of Computer Programming, 95*, 73–92. doi:10.1016/j.scico.2013.12.012
- Anand, V., Glick, W. H., & Manz, C. C. (2002). Thriving on the knowledge of outsiders: Tapping organizational social capital. *The Academy of Management Executive, 16*(1), 87–101. doi:10.5465/AME.2002.6640198
- Anderson, J. R. (2013). *The architecture of cognition*. New York: Psychology Press.
- Bateson, G. (1972). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*. Chicago: University of Chicago Press.
- Beckman, R. J. (1999). The current state of knowledge management. In J. Liebowitz (Ed.), *Knowledge Management Handbook* (pp. 1.1–1.22). Boca Raton, FL: CRC Press.
- Bhatt, G. (2000). Organizing knowledge in the knowledge development cycle. *Journal of Knowledge Management, 4*(1), 15–26. doi:10.1108/13673270010315371
- Damodaran, L., & Olphert, W. (2000). Barriers and facilitators to the use of knowledge management systems. *Behaviour & Information Technology, 19*(6), 405–413. doi:10.1080/014492900750052660
- Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital, 3*(3), 210–222. doi:10.1108/14691930210435570
- Davenport, T. H. (1994, March-April). Saving IT's Soul: Human Centered Information Management. *Harvard Business Review, 72*(2), 119–131.
- Demarest, M. (1997). Understanding knowledge management. *Long Range Planning, 30*(3), 374–384. doi:10.1016/S0024-6301(97)90250-8
- Drucker, P. E. (1995). The information executives truly need. *Harvard Business Review, January-February*, 54–62.
- Drucker, P. F. (2000). Management Challenges for the 21st Century. *International Journal of Contemporary Hospitality Management., 12*(6), 238–247.
- Duhon, B. (1998, September). It's all in our Heads. *Inform (Silver Spring, Md.), 12*(8), 8–13.
- Farzin, M. R., Kahreh, M. S., Hesan, M., & Khalouei, A. (2014). A Survey of Critical Success Factors for Strategic Knowledge Management Implementation: Applications for Service Sector. *Procedia: Social and Behavioral Sciences, 109*, 595–599. doi:10.1016/j.sbspro.2013.12.512
- Fenwick, T. J., & Parsons, J. (2000). *The Art of Evaluation: A Handbook for Educators and Trainers*. Niagara Falls, NY, USA: Thompson Educational Publishers.

An Empirical View of Knowledge Management

- Goh, S. C. (2002). Managing effective knowledge transfer: An integrative framework and some practice implications. *Journal of Knowledge Management*, 6(1), 23–30. doi:10.1108/13673270210417664
- Goodman, P., & Darr, E. (1999). Computer-aided systems and communities: Mechanisms for organisational learning in distributed environments. *Management Information Systems Quarterly*, 22(4), 417–440. doi:10.2307/249550
- Greeno, J. G., Pearson, P. D., & Schoenfeld, A. H. (1999). Achievement and theories of knowing and learning. *Learning and Knowledge*, 136–53.
- Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *The Knowledge Management Yearbook 2000–2001*.
- Haseman, W. D., Nazareth, D. L., & Paul, S. (2005). Implementation of a group decision support system utilizing collective memory. *Information & Management*, 42(4), 591–605. doi:10.1016/S0378-7206(04)00074-6
- Haslinda, A., & Sarinah, A. (2009). A Review of Knowledge Management Models. *Journal of International Social Research*, 2(9).
- He, W., Qiao, Q., & Wei, K. K. (2009). Social relationship and its role in knowledge management systems usage. *Information & Management*, 46(3), 175–180. doi:10.1016/j.im.2007.11.005
- Heidari, M., Moghimi, S. M., & Khanifar, H. (2011). The critical success factors in implementing knowledge management: Agricultural organization in Islamic Republic of Iran. *British Journal of Science*, 1(2), 54–75.
- Hung, Y. C., Huang, S. M., Lin, Q. P., & Tsai, M.-L. (2005). Critical factors in adopting a knowledge management system for the pharmaceutical industry. *Industrial Management & Data Systems*, 105(2), 164–183. doi:10.1108/02635570510583307
- Johnson-Laird, P. N. (1982). Ninth Bartlett memorial lecture. Thinking as a skill. *The Quarterly Journal of Experimental Psychology*, 34(1), 1–29. doi:10.1080/14640748208400855 PMID:6291097
- Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness (No. 6)*. Cambridge, MA: Harvard University Press.
- Kahre, M.S. (2011). Economics of Strategic Knowledge Management: A New Model for Assessment. *International Journal of Trade, Economics & Finance*, 2(3).
- Khalil, E. L. (2004). What is altruism? *Journal of Economic Psychology*, 25(1), 97–123. doi:10.1016/S0167-4870(03)00075-8
- King, W. R., & Marks, P. V. Jr. (2008). Motivating knowledge sharing through a knowledge management system. *Omega*, 36(1), 131–146. doi:10.1016/j.omega.2005.10.006
- Koenig, M. E. (2012). What is KM? Knowledge management explained. Retrieved from <http://www.km-world.com/Articles/Editorial/What-Is-.../What-is-KM-Knowledge-Management-Explained-82405.aspx>.
- Liao, S. H. (2003). Knowledge management technologies and applications—literature review from 1995 to 2002. *Expert Systems with Applications*, 25(2), 155–164. doi:10.1016/S0957-4174(03)00043-5

An Empirical View of Knowledge Management

- Lin, T. C., & Huang, C. C. (2008). Understanding knowledge management system usage antecedents: An integration of social cognitive theory and task technology fit. *Information & Management*, 45(6), 410–417. doi:10.1016/j.im.2008.06.004
- Lortie, M., Desmarais, L., & Laroche, É. (2012). Knowledge Managers and Transfer Agents: Their Role and Integration in the Development and Implementation of Knowledge Translation Tools. *Proceedings of the 13th European Conference on Knowledge Management* (pp. 217-225).
- Makani, J. (2008). KM and international organisations: Perspectives on information professionals. *Role. Libri*, 58(4), 144–154.
- Markus, M. L. (2001). Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success. *Journal of Management Information Systems*, 18(1), 57–94.
- Massa, S., & Testa, S. (2009). A knowledge management approach to organizational competitive advantage: Evidence from the food sector. *European Management Journal*, 27(2), 129–141. doi:10.1016/j.emj.2008.06.005
- McAdam, R., & McCreedy, S. (1999). A critical review of knowledge management models. *The Learning Organization*, 6(3), 91–101. doi:10.1108/09696479910270416
- Nasser H. Zaied, A., Soliman Hussein, G., & M. Hassan, M. (2012). The Role of Knowledge Management in Enhancing Organizational Performance. *International Journal of Information Engineering and Electronic Business*, 4(5), 27. doi:10.5815/ijieeb.2012.05.04
- Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, 69(6), 96–104.
- Nonaka, I. (1994). A Dynamic Theory of Organisational Knowledge Creation. *Organization Science*, 5(1), 14–37. doi:10.1287/orsc.5.1.14
- Nonaka, I., & Takeuchi, K. (1995). *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford: Oxford University Press.
- Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and Leadership: A Unified Model of Dynamic Knowledge Creation. *Long Range Planning*, 33(1), 5–34. doi:10.1016/S0024-6301(99)00115-6
- Nonaka, I., Umemoto, K., & Senoo, D. (1996). From information processing to knowledge creation: A paradigm shift in business management. *Technology in Society*, 18(2), 203–218. doi:10.1016/0160-791X(96)00001-2
- Oxford Dictionaries. (2015). Definition of Knowledge. Retrieved from <http://www.oxforddictionaries.com/definition/english/knowledge>
- Peuhkuri, T. (2002). Knowledge and interpretation in environmental conflict: Fish farming and eutrophication in the Archipelago Sea, SW Finland. *Landscape and Urban Planning*, 61(2), 157–168. doi:10.1016/S0169-2046(02)00110-X
- Polanyi, M. (1958). *Personal Knowledge*. New York: Routledge & Kegan Paul.
- Polanyi, M. (1966). *The tacit dimension*. London: Routledge and Kegan Paul.

An Empirical View of Knowledge Management

- Politis, J. D. (2003). The connection between trust and knowledge management: What are its implications for team performance. *Journal of Knowledge Management*, 7(5), 55–66. doi:10.1108/13673270310505386
- Prahalad, C. K., & Hamel, G. (1990). *The core competence of the corporation*. Boston.
- Quintas, P., Lefrere, P., & Jones, G. (1997). Knowledge management: A strategic agenda. *Long Range Planning*, 30(3), 385–391. doi:10.1016/S0024-6301(97)90252-1
- Richter, A., & Niewiem, S. (2009). Knowledge transfer across permeable boundaries: An empirical study of clients' decisions to involve management consultants. *Scandinavian Journal of Management*, 25(3), 275–288. doi:10.1016/j.scaman.2009.05.007
- Rowley, J. (1999). What is Knowledge Management? *Library Management*, 20(8), 416–420. doi:10.1108/01435129910291175
- Rowley, J. (2007). The wisdom hierarchy: Representations of the DIKW hierarchy. *Journal of Information Science*, 33(2), 163–180. doi:10.1177/0165551506070706
- Sabherwal, R., & Becerra-Fernandez, I. (2003). An empirical study of the effect of knowledge management processes at individual, group and organisational levels. *Decision Sciences*, 34(2), 225–255. doi:10.1111/1540-5915.02329
- Senge, P. M. (1990). *The Fifth Discipline*. New York: Doubleday/Century.
- Shaw, G., & Williams, A. (2009). Knowledge transfer and management in tourism organisations: An emerging research agenda. *Tourism Management*, 30(3), 325–335. doi:10.1016/j.tourman.2008.02.023
- Singley, M. K. (1989). *The Transfer of Cognitive Skill (No. 9)*. Cambridge, MA: Harvard University Press.
- Sinotte, M. (2004). Exploration of the field of knowledge management for the library and information profession. *Libri*, 54(3), 190–198. doi:10.1515/LIBR.2004.190
- Söderlund, J. (2010). Knowledge entrainment and project management: The case of large-scale transformation projects. *International Journal of Project Management*, 28(2), 130–141. doi:10.1016/j.ijproman.2009.11.010
- Sutton, M. (2006). Knowledge citizen's approach to knowledge sharing, rewards and incentive. *SA Journal of Information Management*, 8(3).
- Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*. London: Berrett-Koehler Publishers.
- Sveiby, K. E. (2001). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of Intellectual Capital*, 2(4), 344–358. doi:10.1108/14691930110409651
- Von Glasersfeld, E. (1987). *The Construction of Knowledge, Contributions to Conceptual Semantics*. Salinas, CA: Intersystem Publications.
- Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). *Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation*. Oxford: Oxford University Press. doi:10.1093/acprof:oso/9780195126167.001.0001

An Empirical View of Knowledge Management

Wan, J., Zhang, H., Wan, D., & Huang, D. (2010). Research on knowledge creation in software requirement development. *Journal of Software Engineering and Applications*, 3(05), 487–494. doi:10.4236/jsea.2010.35055

Wang, H., Guo, X., Fan, Y., & Bi, J. (2014). Extended Access Control and Recommendation Methods for Enterprise Knowledge Management System. *IERI Procedia*, 10, 224–230. doi:10.1016/j.ieri.2014.09.081

Wiig, K. M. (1997). Knowledge management: Where did it come and where will it do? *Expert Systems with Applications*, 13(1), 1–14. doi:10.1016/S0957-4174(97)00018-3

Wiig, K. M., de Hoog, R., & van der Spek, R. (1997). Supporting knowledge management: A selection of methods and techniques. *Expert Systems with Applications*, 13(1), 15–27. doi:10.1016/S0957-4174(97)00019-5

Wilcox King, A., & Zeithaml, C. P. (2003). Measuring organizational knowledge: A conceptual and methodological framework. *Strategic Management Journal*, 24(8), 763–772. doi:10.1002/smj.333

Wild, R., & Griggs, K. (2008). A model of information technology opportunities for facilitating the practice of knowledge management. *Vine*, 38(4), 490–506. doi:10.1108/03055720810917732

Wittgenstein, L. (1995). *Philosophical Investigations (orig. 1953)*. Oxford: Blackwell.

Zbilgin, M. F. (2009). *Career choice in management and entrepreneurship: a research companion*. London: Edward Elgar Publishing.

KEY TERMS AND DEFINITION

Combination: Process of transform explicit knowledge to explicit knowledge to create new knowledge.

Explicit Knowledge: The knowledge that able to quantify and able transfer via communication tools.

Externalisation: The process of articulating tacit knowledge into such explicit knowledge.

Internalisation: Creation of explicit knowledge using tacit knowledge and is shared across the organisation.

Knowledge Creation: An on-going process of knowledge generation at different level for users practices and gain advantage on it.

Knowledge Management Systems: The systems that enhance knowledge management process in organisation.

Socialisation: The process of knowledge creation through social activities.

Tacit Knowledge: The knowledge that unable to quantified and embedded within an individual.

Chapter 26

Supply Chain Processes as Key Drivers for Upgrading in the Semiconductor Global Supply Chain: The Case of Brazilian Design Houses

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ABSTRACT

Brazilian government has developed public policies during the last years in order to promote a national semiconductor industry. Under this program, 22 new Design Houses have started their operations. Considering this context, this study aims to understand how Brazilian Design Houses are upgrading to operate as players in the semiconductor global chain. To really move up in the semiconductor global chain, DHs need to improve key supply chain processes, such as marketing and sales, outsourcing and relationship management. This new scenario will characterize the achievement of functional upgrading, in which the companies will develop capabilities to move to higher value added activities in the global chain.

INTRODUCTION

The characteristics and challenges of the global market have been creating new rules for sustaining competitive advantage. This competitive market, along with the constant advances in communication technologies and transportation, motivates the continuing evolution of supply chain management and different techniques for managerial efficiency (Hausman et al., 2010). Recently, Supply Chain Management (SCM) deserves further attention because it has been transformed by the influence of globalization and the conceptual fundamentals of Global Supply Chain Management (GSCM) remain underdeveloped

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(Connelly et al., 2013). Different factors can be considered to represent this new scenario, such as the necessity of mass customization, the presence of global consumers segments, time and quality competition, advances in communication and information technology, and a strong dependence on government policies (Mentzer et al., 2007b).

For being part of these global chains, companies must identify the key factors that would enable their operations as players as well as the important elements behind forming interorganizational relations across borders to upgrade and move up in the supply chain. Therefore, one important issue that must be pursued by companies, especially in developing and emerging countries, is how to gain access to the skills and capabilities required to participate and to upgrade in global chains (Bair, 2005). It is also critical because for companies in developing and emerging countries, their inclusion in global chains not only provides new markets for their products, but also plays a growing and crucial role in access to knowledge and enhanced learning and innovation (Pietrobelli & Rabellotti, 2011).

Participating in global markets which allows for sustained income growth requires the capacity to learn and upgrade (Kaplinsky & Morris, 2001). Upgrading is often seen in the extant literature as one of the main ways through which developing country firms or industries can respond to the challenges of globalization and increased competition. Companies may upgrade in various ways, as for example, by entering higher unit value market niches, by entering into new sectors, or by undertaking new productive or service functions (Pietrobelli & Rabellotti, 2004). It is necessary to understand the upgrading challenge in a wider perspective, capturing the central idea that it may involve changes in the nature and mix of activities, both within each agent in the chain, and in the distribution of intra-chain activities. This relates both to the achievement of new product and process development, and in the functional reconfiguration of who does what in the chain as a whole (Kaplinsky & Morris, 2001).

The semiconductor industry has been one of the most important industries for the past three decades. Because of its critical position in modern industry, the research on the semiconductor industry is plentiful (Li et al., 2010). The semiconductor industry has a supply chain network that is distributed worldwide, and its manufacturing process has the particular characteristics that should be considered in the supply chain framework (Lee et al., 2006). GSCM strategies have helped the semiconductor companies to gain competitive advantage, with high investments in international operations with successive stages of outsourcing and offshore activities (Jiang et al., 2010).

Semiconductor production is one of the priorities of the Brazilian economic planning and technological development. The federal government aims to move from being a high consumer of microelectronics items to a competitive player in the semiconductor chain. The incentives promoted by the Brazilian industrial policy have already developed operations in the three main stages of the semiconductor chain: Design, Manufacturing, and Packaging. Since 2005, the Microelectronics National Program has been inducing project services activities as priority with the creation and implementation of the microelectronics design in the country (Bortolaso et al., 2013). According to Borges and Vieira (2014), currently there are 22 Design Houses (DH) and 2 training centers distributed throughout the national territory. It is recognized that the levels of technological and productive maturity of the national DHs are still far below if compared with leading countries, and the capability of prospecting international market represents the main barrier to increase their productivity.

The identification and improvement of key processes, aligned with the pressures and opportunities established by the global market, can allow the DHs to upgrade in the semiconductor chain with consequent increase of their competitiveness. Considering this context, this chapter aims to describe how

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Brazilian DHs are developing capabilities to upgrade in order to become competitive players in the to operate as players in the semiconductor global supply chain.

GLOBAL CHAIN: SUPPLY CHAIN PROCESS MANAGEMENT FOR UPGRADING

In the current global competitive market, the management evolution is oriented for network operation, value and supply chain. Many companies serve multiple global markets with products sourced and produced across many continents (Sanders, 2012). This perspective has created the challenge of designing and managing a network of interdependent relationships developed and fostered through strategic collaboration (Chen & Paulraj, 2004). This was accelerated mainly by rapid changes in information technology and the new competitive globalized environment created by economic, demographic and political developments (Giannakis & Croom, 2004).

The global environment provides many organizations with an incentive to establish a value added chain, where complex inter-firm relationship management, collaboration and coordination occur in the areas of product design, production, supplier selection, and marketing (Kotzab et al., 2011). Supply chain management involves multiple firms, multiple business activities and the coordination of those activities across functions and across companies. The literature presents several definitions and categories, what suggests that the term “supply chain management” is still vague (Mentzer et al., 2001).

These perspectives lead us to the definition of a supply chain orientation as the recognition by an organization of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain (Mentzer et al., 2001). Supply chain management is the integration of key business processes from end user through suppliers that provides products, services, and information that add value for customers and other stakeholders (Lambert & Cooper, 2000).

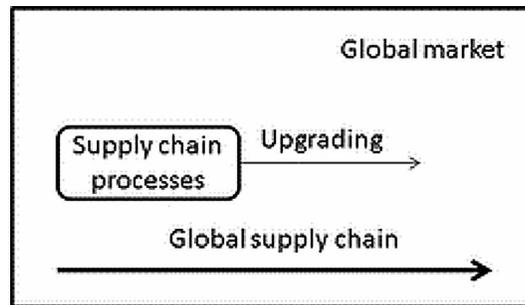
Supply chain strategy is a global issue, and Slack and Lewis (2011) pose that a global supply means identification, evaluation, negotiation, and configuration across multiple countries. Companies are increasingly seeking suppliers in quite remote locations. According to these authors, many companies have accomplished to save from 10% to 35% in costs by working with suppliers from low-cost countries. Considering this scenario, GSCM represents a central area of focus for many businesses and business schools today (Mentzer et al., 2007a).

Managers who seek to leverage supply chain processes in order to enhance performance must understand the relative importance of the various competencies in each particular operating arena. The needs of key customers may vary across international borders, and the means for developing an effective fulfillment and replenishment process may also vary across international locations (Closs & Mollenkopf, 2004). The complexities of cross-border operations are exponentially greater than in a single country, and the ability to compete in the global environment often depends on understanding the specificities that emerge only in cross border trade in a GSCM (Mentzer et al., 2007a). The operation in a GSCM is based on the development of capabilities to integrate different companies, from different countries, languages, and cultures within distinguished economic and technological level.

All these fundamental changes in the industrial competition have led to an increasing level of uncertainty and turbulence in the global economy, resulting in the emergence of new theories largely emphasizing the importance of considering interrelationships, interactions and networking while developing a operations strategy (Sharifi et al., 2013). This growing strategic importance of supply chain management has also motivated the need for managers to keep more detailed attention to external factors (Sanders, 2012) in

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Figure 1. Supply chain processes as drivers for upgrading in a global chain



order to clearly understand the links among products, the supply chain processes used to produce and deliver them and the strategy used to manage the supply chain activities (Stavroulaki & Davis, 2010).

It means that a proper management of key processes, aligned with the conditions of external factors, is the basis for a firm's strategy to achieve capabilities for upgrading in global chains. Figure 1 identifies the main supply chain processes that need to be prioritized and managed by companies in order to upgrade in a global chain. These elements that compose the supply chain processes and the upgrading levels in a global chain are discussed in the following sections.

Supply Chain Processes

Successful SCM requires a change from managing individual functions to integrating activities into key supply chain processes. Operating an integrated supply chain requires continuous information flows, which, in turn, help to create the best product flows (Lampert & Cooper, 2000). All the functions within a supply chain are reorganized as key processes which aim to meet the customer's requirements, and the firm is organized around these processes (Mentzer et al., 2001). In many major corporations, management has concluded that optimizing the product flows cannot be accomplished without implementing a process approach to the business (Lampert & Cooper, 2000).

Lambert et al. (1998) and Mentzer et al. (2001) propose a framework for SCM composed by several business processes. A comparison between the two propositions detaches the following key supply chain process: i) Customer Relationship Management (CRM); ii) Customer Service Management (CSM); iii) Demand; iv) Manufacturing Management; v) Supplier Relationship Management (SRM); vi) Research and Development (R&D); vii) Commercialization and Marketing; and viii) Returns Management which includes different activities related to reverse logistics returns and avoidance. Integrating all these business processes is the best practice in supply chain management that involves coordinating decisions across multiple facilities and tiers (Meixell & Gargeya, 2005).

Upgrading

The evolution of global-scale industrial organization affects not only the structure of industries, but also how and why countries advance – or fail to advance – in the global chain (Gereffi, 2005). Participating in global markets which allows for sustained income growth requires the capacity to learn and upgrade

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(Kaplinsky & Morris, 2001). Humphrey and Schmitz (2000) consider upgrading as the acquisition of capabilities that will allow firms to enter higher margin.

They propose four types of firms upgrading working in global chains: i) Process upgrading means transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology; ii) Product upgrading is moving into more sophisticated product lines in terms of increased unit values; iii) Functional upgrading is acquiring new, superior functions in the chain, such as design or marketing, or abandoning existing low-value added functions to focus on higher value added activities; and iv) Intersectoral upgrading is applying the competence acquired in a particular function to move into a new sector.

METHOD

This work is part of a larger ongoing project based on an exploratory research to map the entire semiconductor chain and to obtain the empirical insights of the current Brazilian operations and strategies to leverage its participation in the national and international market. It is based on interview procedures conducted with employees of Brazilian DHs who were selected for their knowledge and experience in the company and on different stages and activities of Brazilian operation in the semiconductor chain. In each company, the interviews were conducted with two executives and one project manager. The executives provided strategic insights while the project managers provided a clearer view of operational issues of product development and relationship management. Secondary sources available in DHs and industrial reports were also used.

The specific lens of this study aimed to bring elements to understand and analyze the current semiconductor national industry, main issues about their DH development, issues on product development process, collaboration with partners, sourcing, market perceptions, the role of innovation, barrier and opportunities. For the purpose of this chapter, three Design Houses were selected. The selection of those three DHs was made according to their characteristics. In the universe of 24 Design Houses (DH) and training centers distributed throughout the national territory, three different business models were identified: private DHs, public DHs, and Projects that are part of some non-profit foundations. Each DH selected for this study represents one kind of investment/ownership. Table 1 presents a summary of the sample.

The interview protocol was developed to bring elements to understand and analyze their perceptions about semiconductor national industry, main issues about their DH development, issues on product development process, collaboration with partners, sourcing, market perceptions, the role of innovation, and

Table 1. DHs and interviewee profiles

| | Type of company | Main focus | Interviewees position |
|-----|------------------------------------|---|---|
| DH1 | Private | Integrated Circuit (IC) design from specification to prototyping and manufacturing of the chip. | Chief Executive Officer Chief Technology Officer Project leader |
| DH2 | Project in a non-profit foundation | Development of customized projects and services of a new chip. | |
| DH3 | Public | Development and production of semiconductors in Brazil. | |

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barrier and opportunities. Based on the insights of the interviews, content analysis was used to emerge the criteria and elements for the study.

DESIGN HOUSES AS PART OF THE NATIONAL SEMICONDUCTOR INDUSTRY

The semiconductor industry can be characterized as a global chain due to the need for low costs, flexibility, and mass production, and the different phases of its production flow are performed in different countries with distinguished economic and technological levels (Lee et al., 2006). The semiconductor industry is a capital intensive industry with sophisticated R&D processes composed of a small number of leading companies. The management/business models in this global industry require the implementation of outsourcing/offshoring and supply chain management (Jiang et al., 2010).

The semiconductor supply chain is composed fundamentally of three value activities: i) design (makes an assessment of market demands and designs the products); ii) front-end (performed by means of physical-chemical processes to produce the wafer); and iii) back-end (packaging and test of the IC) (Gutierrez & Leal, 2004). According to Gutierrez and Mendes (2009), in this chain we can find different classification of companies, according to their business model. The more traditional ones are: i) IDMs (Integrated Device Manufacturers): they operate in all of the chain activities, from conception to customer services; ii) Fabless companies: they accomplish the conception and customer services activities and outsource the front and back-end; iii) Dedicated foundries: they perform the physical-chemical processes of the components; iv) Assembly and test services: they are responsible for the back-end activities; and v) Design Houses: they are independent and are hired by manufactures, by IDMs or by fabless companies.

Brazil stands out in the global economy as an emerging country and has promoted policies and incentives for the development of semiconductor industry. As part of the Microelectronic National Program promoted by the Ministry of Science and Technology, the CI-Brasil program was created to leverage the industry through the implementation of the Design Houses in the country. This strategy aims to promote the economic activity in the project area of Integrated Circuits, to develop an ecosystem in microelectronics and to leverage the country in the international arena of semiconductors (ABDI, 2011).

Currently, there are 22 Design Houses and two training centers in Brazil which represent solid opportunities for R&D activities. They are partially supported by the CI-Brasil program, and 13 of these are non-profit organizations. Most of them are spin-offs that have arisen or are connected to universities or public research institutions (CI-Brasil, 2014). This value activity has been chosen as a priority for two reasons: design is fundamental and decisive for generating innovation and it involves less investment if compared to manufacturing activities (ABDI, 2011).

Brazilian DHs Operation

The content of the interviews carried out with these three Brazilian DHs allowed the mapping of their current operations. DH1 is a spin-off of a research center that deliveries engineering services. Today, this DH is changing its strategy to move focus to products instead of services. This new strategy involves the source of international foundries and back-end operations to work together in the parameterization of the product and also to outsource the production. DH2 is still considered a project in a research institute. In parallel to the service delivery activities, it has been developing a product to start its operation

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as a fabless company. During this process, it has also sourced international suppliers to configure and prototype the product.

The next step should be the creation of a company to commercialize the product and formalize a contract with an international foundry and back-end operation for mass scale production. DH3 is the only company that has manufacturing capacity to produce, package and test a microchip. Even so, the CEOs argue that most of the time the company needs to work as fabless. They explained it is not possible to have all the manufacturing technology to produce what their DH is able to protect. Once again, it is reinforced the need for international agreements.

Even considering that the three DHs operate in different business models (one is private, one is public, and the other is a project), we could identify a pattern of agreement in relation to the current scenario of the Brazilian DHs. Formally, a DH is responsible for the project of the Integrated Circuit and delivering engineering services (Gutierrez & Mendes, 2009). Following this concept, and considering that there is no production scale in Brazil, the only way to expand business would be to cooperate with design solutions for international companies (International Foundries, Fabless Companies, or IDMs). There is an agreement between the executives of those companies that the barrier here is that few of the DHs have capabilities to prospect clients and market their services internationally.

They also argue that there is no tradition of the Brazilian expertise in Design among global technological and manufacturer leaders. The executives of DH1 and DH2 declare that the deadlines and development costs are high, a fact which has also been a barrier to being successful in their businesses. Additionally, considering the immaturity of this industry in Brazil, executives of the DH3 reinforce the low number of private investors willing to take risks in this business. This scenario represents what Pietrobelli and Rabellotti (2004) discuss as the gap between the statements of principles of the policies and their actual implementation in the emerging economies.

According to the results and considering the current organizational and process structure of the DHs, it is only possible to operate exclusively offering service if the DH is connected to a university or a research institute as a non-profit organization. In this case, the governmental program "CI-Brasil" offers not only funds for human resource development, but it is also possible to access funding for the provision of software licenses and computational infrastructures. This situation, according to the executives of DH1 and DH2, is keeping the Brazilian DHs far away from the global market rules. The interviewees recognize that they are good technically once they were created close to research centers, but they are not upgrading their entrepreneurial capabilities.

Therefore, how can these DHs upgrade in this scenario? There is a consensus that the great opportunity is to focus in developing products for the Brazilian market. In this case, the only alternative is to offer products instead of services. In this case, the business model must change and the company needs to operate as fabless. This capability to learn and upgrade in order to find new opportunities for development emerges when companies are looking for sustained income growth in global markets (Kaplinksky & Morris, 2001).

Through the description of this scenario, we can identify some important elements that turn the operations of these companies adherent to a global supply chain model. Considering that the microchip will be part of some other electro-electronic component to compete in this market, the Brazilian DHs must follow global standards of quality, costs, and reliability. To operate purely as a DH, the companies will need to prospect global customers. To operate as fabless, the companies will have to develop capa-

Supply Chain Processes as Key Drivers for Upgrading in the Semiconductor Global Supply Chain

bilities to outsource the manufacturing activities to international foundries. The adequacy to the global operational standards of this industry is necessary to supply both national and international market.

Companies with worldwide focus need to pay attention to diverse and scattered markets, production facilities and suppliers (Sanders, 2012). The scenario presented by these three companies also allow to detach which main supply chain processes need to be considered for upgrading in the global semiconductor chain. These elements are discussed in the next section.

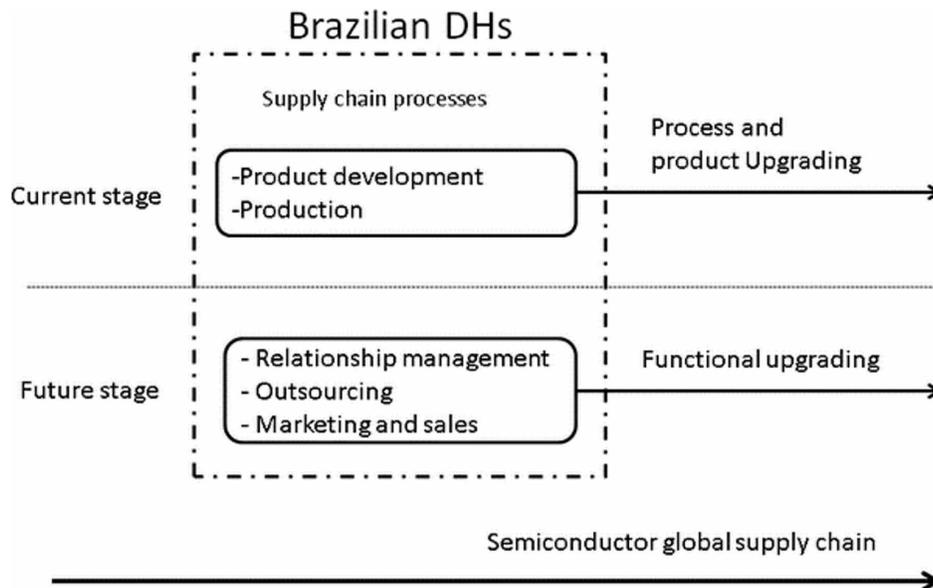
Upgrading in the Semiconductor Global Chain

Based on supply chain processes management, the findings of this study are presented below with the identification of how Brazilian companies are upgrading in the semiconductor global chain. The group of DHs is first evaluated according to their current situations and secondly according to their future and strategic plans. The CI-Brasil program is clear when it expresses that if the Brazilian DHs want to be competitive, they must develop capabilities to design, manage, and operate on a global scale (ABDI, 2011).

Analyzing the content of the interviews, we could identify the key drivers for the DHs upgrading in the semiconductor chain. Figure 2 presents the current and future upgrading level of the Brazilian DHs, identifying the key supply chain processes identified as the main drivers of both scenarios. The identification and of those key processes represents important managerial skills that must be developed by Brazilian DHs to ensure an adequate level of competitiveness and to move up in the global chain, thus achieving competitiveness and attractiveness in the global market.

DHs should understand which critical processes need to be prioritized for the development of a strategy for growing and seeking competitive advantage in this industry. Mentzer et al. (2001) presents that value in the supply chain is specially acquired by the management of these key processes. The findings

Figure 2. Key processes for upgrading in the global chain



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highlight the importance of production and development product processes to get the minimum requirements needed to be part of a global chain. DHs are advancing in terms of recognition and implementation of an operational capability and they are also prospecting new opportunities and market niches that can be reached by their new services and products. Those processes represent the fundamental conditions for the DHs to operate as engineering service suppliers and also to make a prospection of the market needs to develop products to accomplish the strategy to operate as fabless in the semiconductor industry. Through these elements, we can infer that the three Brazilian DHs studied are currently in a stage of process and product upgrading.

It is possible to identify in those DHs that they are facing difficulties while managing their relationship, especially with international suppliers and their customers. In this case, relationship management processes should be improved. Another process that appears as critical is the outsourcing of the manufacturing. The DHs need to learn how to evaluate and prospect global suppliers and deal with contracts in international basis. The last process that appears as critical is the prospection of marketing as definition of guidelines for the products and services commercialization. Those three supply chain processes are identified as the main drivers for the achievement of a functional upgrading in which the Brazilian DHs will be able operate in more added value activities the semiconductor global chain.

Considering the current scenario presented in this chapter, we can verify that the Brazilian DHs are still in a phase of product and process upgrading. They are achieving maturity with regard to their capacity in terms of production and to the opportunities in terms of products and services to supply the needs of the national market. This will give DHs conditions to reach competitiveness and effectively move up in the semiconductor global chain. According to Pietrobelli and Rabellotti (2011), it is the moment when the companies develop capabilities to make the required investments in design, product development and marketing that explains why some firms succeed and others do not in a global chain.

CONCLUSION

Due to the expansion of the semiconductor's applications in most of the products of the new economy, this industry is recognized as a key driver for the global economic growth. The Brazilian government has created a Microelectronics National Program in order to reduce the external dependence, to increase the value added of the domestic production and to reduce the deficit of the trade balance. This strategy aims to move the country from a strong consumer of microelectronics items to a strong player in the semiconductor global chain. One of the priorities of this new policy is the promotion of the project activity. It is an activity with a great potential to generate innovation and knowledge, and it involves lower investments if compared to manufacturing activities.

This chapter describes three Brazilian DHs which are advancing and reaching the first results. The DHs are upgrading specially in terms of products and processes. It is known that the results are still incipient if compared with leading countries. To really move up in the semiconductor global chain, DHs need to improve key supply chain processes such as marketing and sales, outsourcing, and relationship management. This new scenario will characterize the achievement of what Humphrey and Schmitz (2000) refer to as functional upgrading in which the company will develop capabilities to move to higher value added activities in the global chain. Brazilian companies will be able of developing international

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partnership to develop products, compete with foreign companies to supply the national market and also move up to the global market.

The qualitative exploratory approach used to evaluate the upgrading level of the Brazilian DHs suggests some important elements to move forward in the research exploring some gaps that were identified: i) Is the fabless model ideal to foster a national industry, once it do not bring to the country expertise in manufacturing activities? ii) How can Brazilian industrial policy support the main limitations detached by the companies, especially in terms of access to venture capital and prospection of national and international market channels? iii) What are the managerial elements that need to be considered in the supply chain process to upgrade the companies as supplier of the international market?

This chapter contributes to a relevant discussion for companies from developing and emerging countries that are becoming part of global supply chains. Considering this scenario, this research presents contributions in two different perspectives with relevance both for business practice and for academia. In terms of managerial contributions, it presents a discussion of how Brazilian companies are developing strategies to move up as players in the semiconductor global chain. The approach based on supply chain processes can be useful to support companies' strategies and managerial guidelines (Lambert et al., 1998; Mentzer et al., 2001). In terms of academic contributions, it presents a framework to evaluate the generation of capabilities to upgrade in global chains.

The upgrading level achieved by companies depends on how they coordinate their resources to achieve competitiveness in the market (Gereffi, 2005;Kaplinsky & Morris, 2001;Humphrey and Schmitz, 2000). The supply chain processes are presented as the source of companies' capabilities and an evaluation of those processes maturity can be useful to analyze strategic positioning in a global context. The structure and elements that compose this framework turn it flexible to be applied in different type of companies operating in different global industries. Therefore, this debate can be further expanded through studies in other industries and countries.

REFERENCES

- ABDI. (2011). A Agência Brasileira de Desenvolvimento Industrial As Design Houses (DHs) Brasileiras: Relatório Analítico. Brasília. Retrieved from http://www.abdi.com.br/Estudo/Relatorio_Design_Houses_FINAL_280312.pdf
- Bair, J. (2005). Global Capitalism and Commodity Chains: Looking Back, Going Forward. *Competition and Change*, 9(2), 153–180. doi:10.1179/102452905X45382
- Borges, M. A. V., & Vieira, L. M. (2014). Brazil Moving up in the Semiconductor Global Chain. *Journal of Operations and Supply Chain Management*, 7(1), 69–84. doi:10.12660/joscmv7n1p68-84
- Bortolaso, I. V., Balestrin, A., Teixeira, R., & Faccin, K. (2013). Trajectory of the Brazilian Semiconductor Industry and Supply Chain: Economic, Governmental, and Technological Perspectives. *Journal of Operations and Supply Chain Management*, 6(2), 20–39.
- Chen, I., & Paulraj, A. (2004). Towards a Theory of Supply Chain Management: The Constructs and Measurement. *Journal of Operations Management*, 22(2), 119–150. doi:10.1016/j.jom.2003.12.007
- CI-Brasil. (2014). Retrieved from <http://www.ci-brasil.gov.br/index.php/pt/>

Supply Chain Processes as Key Drivers for Upgrading in the Semiconductor Global Supply Chain

- Cloos, D. J., & Mollenkopf, D. A. (2004). A global supply chain framework. *Industrial Marketing Management*, 33(1), 37–44. doi:10.1016/j.indmarman.2003.08.008
- Connelly, B. L., Ketchen, D. J., & Hult, G. T. M. (2013). Global supply chain management: Toward a theoretically driven research agenda. *Global Strategy Journal*, 3(3), 227–243. doi:10.1111/j.2042-5805.2013.01041.x
- Gereffi, G. (2005). The Global Economy: Organization, Governance, and Development. In N.J. Smelser, & R. Swedberg (Eds.), *The Handbook of Economic Sociology* (2nd ed., pp. 160-182). Princeton and Oxford: Princeton University Press; New York: Russell Sage Foundation.
- Giannakis, M., & Croom, S. R. (2004). Toward the Development of a Supply Chain Management Paradigm: A Conceptual Framework. *The Journal of Supply Chain Management*, 40(2), 27–37. doi:10.1111/j.1745-493X.2004.tb00167.x
- Gutierrez, R. M. V., & Leal, C. F. C. (2004). Estratégias para uma Indústria de Circuitos Integrados no Brasil. *BNDES Setorial*, 19, 3-22.
- Gutierrez, R. M. V., & Mendes, L. R. (2009) Complexo Eletrônico: Projeto em Microeletrônica no Brasil. *BNDES Setorial*, 30, 157-209.
- Hausman, W. H., Lee, H. L., Napier, G. R. F., Thompson, A., & Zheng, Y. (2010). A process analysis of global trade management – an inductive approach. *Journal of Supply Chain Management*, 46(2), 5–29. doi:10.1111/j.1745-493X.2010.03187.x
- Humphrey, J., & Schmitz, H. (2000). *Governance and Upgrading: Linking Industrial Cluster and Global Value Chain Research* (IDS Working Paper 120). Brighton: Institute of Development Studies, University of Sussex.
- Jiang, W. Y., Quan, X., & Zhou, S. (2010). Historical, Entrepreneurial and Supply Chain Management Perspectives On The Semiconductor Industry. *International Journal of Innovation and Technology Management*, 7(1), 1–18. doi:10.1142/S0219877010001805
- Jiang, W. Y., Quan, X., & Zhou, S. (2010). Historical, Entrepreneurial And Supply Chain Management Perspectives On The Semiconductor Industry. *International Journal of Innovation and Technology Management*, 7(1), 1–18. doi:10.1142/S0219877010001805
- Kaplinsky, R., & Morris, M. L. (2001). *A Handbook for Value Chain Research*. Institute of Development Studies, University of Sussex and School of Development Studies, University of Natal, Retrieved from www.ids.ac.uk/global
- Kotzab, H., Teller, C., Grant, D. G., & Sparks, S. (2011). Antecedents for the adoption and execution of supply chain management. *Supply Chain Management: An International Journal*, 16(4), 231–245. doi:10.1108/13598541111139053
- Lambert, D. M., & Cooper, M. C. (2000). Issues in Supply Chain Management. *Industrial Marketing Management*, 29(1), 65–83. doi:10.1016/S0019-8501(99)00113-3

Supply Chain Processes as Key Drivers for Upgrading in the Semiconductor Global Supply Chain

- Lee, Y. H., Chung, S., Lee, B., & Kang, K. H. (2006). Supply chain model for the semiconductor industry in consideration of manufacturing characteristics. *Production Planning and Control*, 17(5), 518–533. doi:10.1080/09537280600804976
- Li, Y. T., Huang, M. H., & Chen, D. Z. (2011). Semiconductor industry value chain: Characters' technology evolution. *Industrial Management & Data Systems*, 111(3), 370–390. doi:10.1108/0263557111118260
- Meixell, M. J., & Gargeya, V. B. (2005). Global Supply Chain Design: A Literature Review and Critique. *Transportation Research Part E, Logistics and Transportation Review*, 41(6), 531–550. doi:10.1016/j.tre.2005.06.003
- Mentzer, J., Dewitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain Management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Mentzer, J., Stank, T. P., & Myers, M. B. (2007a). *Why Global Supply Chain Management? Handbook of Global Supply Chain Management* (pp. 1–16). Thousand Oaks, CA: SAGE. doi:10.4135/9781412976169.n1
- Mentzer, J., Stank, T. P., & Myers, M. B. (2007b). *Global Supply Chain Management Strategy. Handbook of Global Supply Chain Management* (pp. 19–38). Thousand Oaks, CA: SAGE. doi:10.4135/9781412976169.n2
- Pietrobelli, C., & Rabellotti, R. (2004, January) Upgrading in clusters and value chains in Latin America: The role of policies. Best Practices Series MSM-124. Washington, DC: Inter-American Development Bank.
- Pietrobelli, C., & Rabellotti, R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries? *World Development*, 39(7), 1261–1269. doi:10.1016/j.worlddev.2010.05.013
- Sanders, N. R. (2012). *Supply Chain Management: A Global Perspective*. New York: John Wiley & Sons, Inc.
- Sharifi, H., Ismail, H. S., Qiu, J., & Najafi Tavani, S. (2013). Supply chain strategy and its impacts on product and market growth strategies: A case study of SMEs. *International Journal of Production Economics*, 14(1), 397–408. doi:10.1016/j.ijpe.2013.05.005
- Slack, N., & Lewis, M. (2011). *Operations Strategy* (3rd ed.). Harlow: Prentice Hall.
- Stavrulaki, E., & Davis, M. (2010). Aligning products with supply chain processes and strategy. *The International Journal of Logistics Management*, 21(1), 127–151. doi:10.1108/09574091011042214

Chapter 27

Picking with Impact: Best Practices for the Quality Improvement and Cost Minimizing of Consignment in the Logistics of an International Manufacturer

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ABSTRACT

The picking process in warehouses is an important step in global supply chains because it causes significant costs and has a high impact on customer satisfaction. Especially manual systems may cause high costs and can generate many picking errors such as type and quantity failures. Using the example of consignment at an international manufacturer located in Switzerland, this contribution provides in-depth fundamentals on picking processes. The picking system, typical workflows of manual picking procedures and theoretical considerations of optimal picking quality are given. Using a quality cost as well as a process cost analysis and a cause and effect analysis, the picking process is investigated in this scenario. It turns out that the optimal picking quality is surpassed in the case, which requires a systematic process re-design in order to cut costs. Therefore exemplary technical, organizational and soft best practices are shortly presented. In the scenario a business and technical case of the introduction an innovative weighting system is described.

INTRODUCTION

The picking process is one of the central functions within the warehouse logistics (Rammelmeier, Galka, & Günthner, 2012). However, in many companies this process generates most of the labor and operating costs (Goetschalkx, & Ashayeri, 1989). According to a recent study, the proportion of the cost of picking, meaning the gathering and bundling of items related to one order, is about 50% of the overall costs within logistics centers (de Koster, Le-Duc, & Roodbergen, 2007). In addition, the accuracy of picked

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Picking with Impact

orders has a strong impact on the customer satisfaction (Taljanovic, Salihbegovic, & Pandzo, 2012; Boysen et al., 2015). Therefore, the optimization of the picking process influences the overall success of a supply chain as well as of a logistics center (de Koster, Le-Duc, & Roodbergen, 2007; Liu, 2007). Although the re-design of picking and packaging processes is a complex management task, applications and studies in different domains can show the optimization potential in this specific step of SCM value chains (Hellström, & Saghir, 2007).

Despite the high importance of the picking workflow, so far no sufficient effort has been made in the scenario of an international manufacturer¹, which serves as illustrative case study for this chapter. By now a variety of efforts have been made to optimize for example the stock placement strategies, the tracking and tracing of truck suppliers as well as the integration of vendors in order to holistically optimize the SCM. Simultaneously, the picking process needed to be analyzed and re-designed due to high labor costs. This chapter will outline the specific value of picking processes within international supply chains based on the case study of a global manufacturer. First, basic theoretical foundations on picking systems are made. Then, the case study shows how to analyze and improve the efficiency of the picking process using technical, process-oriented, and soft optimization initiatives.

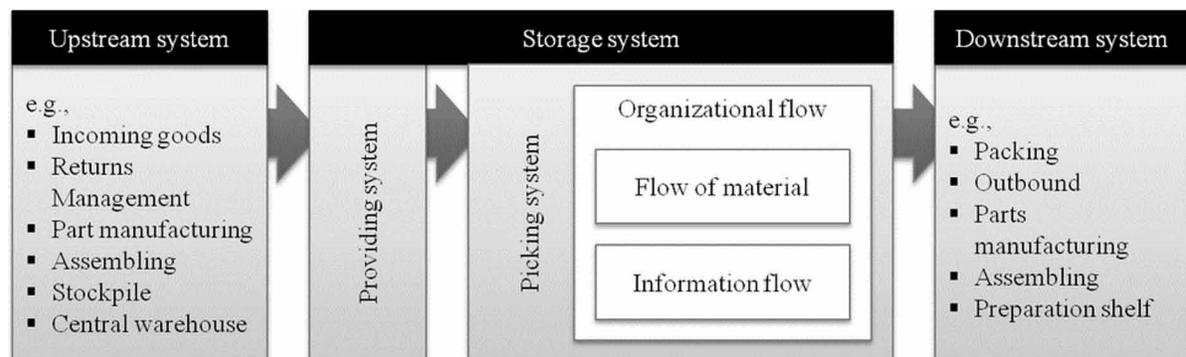
Theoretical Foundation

The picking process has the general target to arrange subsets of goods (e.g., of a packet) based on requests (e.g., orders) from a total amount of goods (e.g., an assortment). Picking is becoming an increasingly important part of SCM because it realizes the almost last stage before the visibility line of the customer. Furthermore, picking also has a direct impact on later SCM stages which are visible for the customer such as the process step which provides suitable packing and delivery documents. In addition, the sub-step of SCM combines all previous data of the customer and his/her request to be processed. In particular, the modern age in which more and more items for end-consumer are ordered via modern information technology (e.g., via Internet) requires new solutions in picking as an integral part of SCM.

Picking System

Figure 1 outlines the necessary flows enabling the picking process (VDI, 1994):

Figure 1. Flows in a picking system
Own illustration adopted from Lolling (2003)



Picking with Impact

- **Information Flow:** The implementation of an information flow system can be divided into preparatory and performing operations (Menk, 1999). Preparatory operations include, for example, the acquisition of orders as well as the way through stock (VDI, 1994). In particular, the provision of information plays a major role because it influences the performance and quality of the picking. Performing operations include for example the identification of the deployment location and the removal of the goods as well as its acknowledgment and control (Klaus, 1996; Menk, 1999).
- **Flow of Material:** The flow of material describes the physical movement of goods, people and work equipment within the picking system (Crostack et al., 2007). Basic alternatives are that workers move to the items to be picked or the system moves the item to workers.
- **Organizational Flow:** This regulates the structure and control of the processes (ten Hompel, Sadowsky, & Beck, 2011). Organization includes aspects of the organizational structure (e.g., division of stocks into zones, design of storage compartments, etc.), the operational structure (e.g., order-based picking or article-based picking), and personal organization (e.g., staffing and scheduling) (VDI, 1994).

Manual Picking Process

Manual picking processes as were implemented in the case study are usually modeled with five basic steps (see Figure 2). The actual main task of picking, meaning the collection of items ordered, always needs preparatory activities. The picker needs, for example, to obtain the necessary information for commissioning as well as necessary tools, such as a hydraulic lift truck. Then, the picker must move to the storage compartment and remove the required items. Steps two and three are iterative, so they are repeated until all required items have been picked (Günthner, Blomeyer, Reif, & Schedlbauer, 2009). Then, the commissioner moves to a delivery station, where he/she completes the job by delivering the picked pallet. Afterwards, the commissioner can take a new job.

Picking Quality

The quality requirements for the picking process result from the logistics contract to be fulfilled (e.g., the demands of the customer) or from the general tasks of the operational logistics (e.g., logistics best practices, benchmarks, etc.). In the extant literature, the opinion is established that the quality is considered high if the right objects (e.g. goods), in the right quantity, at the right place, at the right time, in the right quality and at the right costs are provided (Gudehus, 2010; Jünemann, 1989; Menk, 1999).

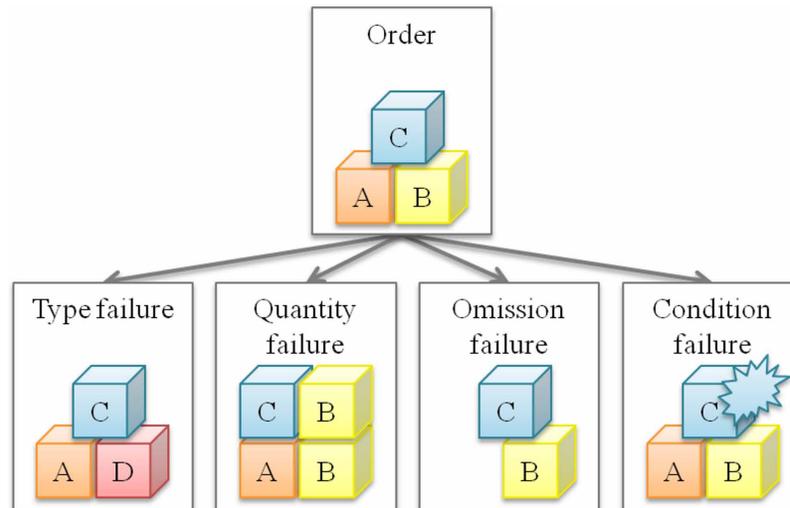
Figure 2. Generic manual picking process
Own illustration adopted from Günthner, & Rammelmeier (2012)



Picking with Impact

Figure 3. Picking failures

Own illustration adopted from Menk, & Heinz (1997)



The most obvious reasons for less quality in picking arise by four typical picking failures (see Figure 3) (Lolling, 2002; Menk, 1999; Menk, & Heinz, 1997; Crostack et al., 2007):

- **Type Failure:** A type failure occurs if the delivery unit contains items that were not ordered by the customer. This applies both to the case in which the picker mistakes an item or in which an additional item was sent.
- **Quantity Failure:** If the result of the picking is an incorrect number of items, a quantity failure raised. It does not matter whether more or less articles have been picked.
- **Omission Failure:** An omission failure occurs when the picking was incomplete. In this case, the unit lacks one or more items.
- **Condition Failure:** This failure occurs if an item is damaged. This is also the case if relevant accompanying products are missing or damaged (e.g., packaging). However, this failure will only be considered in the context of picking quality, if the damage was caused during the picking process.

Studies show that picking errors cause annual costs by an average of about €280,000 (Woods, 2013). While the average cost per picking errors are estimated between €20 and €25 (Rammelmeier, Galka, & Günthner, 2012; Woods, 2013), the compensation costs of one individual error can vary greatly. Findings indicate that the actual costs are highly dependent on the time of their discovery: The later a failure is discovered, the greater the damage is (Rammelmeier, Galka, & Günthner, 2012).

CASE STUDY

In the case study of an international manufacturer located in Switzerland, some action plans were already implemented in the past to optimize the picking process. While the picking quality was rated as appropriate in an external benchmarking, the process causes much high costs compared to industry

Picking with Impact

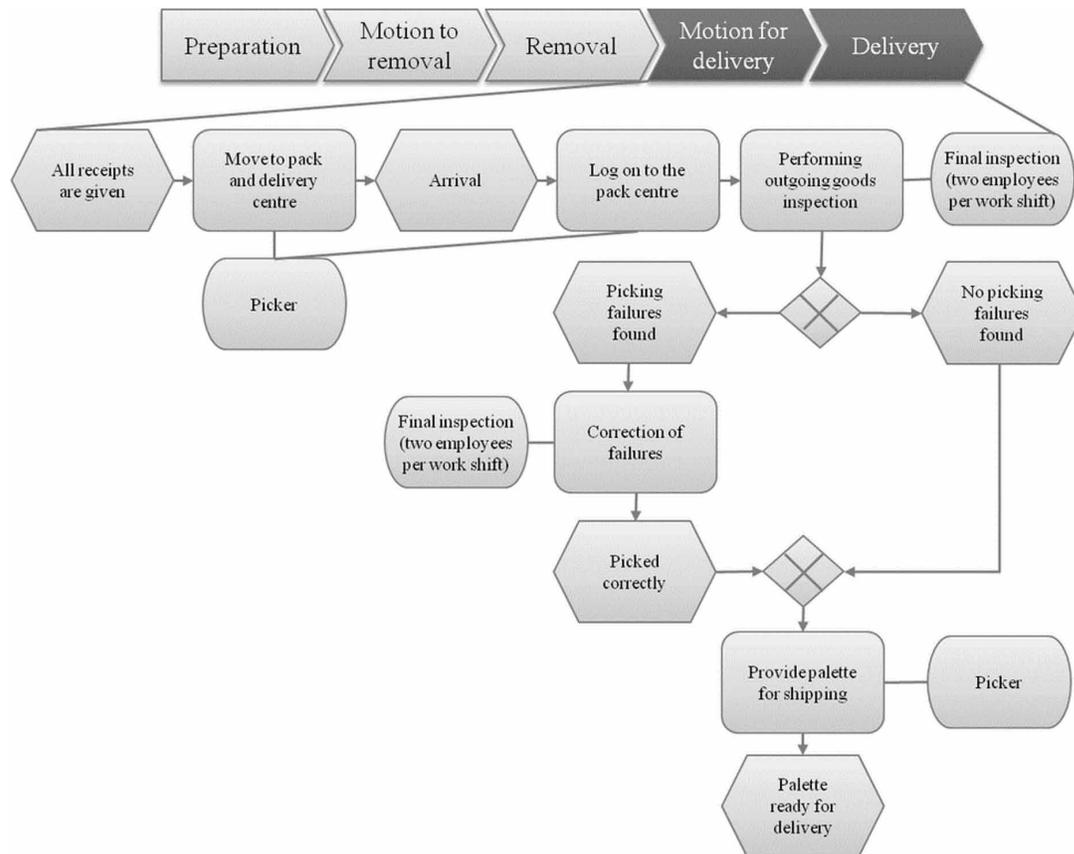
average. The main reason for this was the labor costs: many employees were involved in the preparation and implementation of picking instances as well as in the final inspection at the warehouse before shipment. However, especially these manual steps were necessary to correct picking failures. It was up to the project team to identify possibilities to reduce failures so that the cost-intensive final inspection as well as control steps could be removed.

In an interdisciplinary project team, two SCM managers have been tasked to develop initiatives to reduce costs without lowering the picking quality with the support of an external process consultant. Since the initial situation (e.g., high staff costs, manual picking) is a typical starting point for many companies, this case study can serve as possible analysis and action approach other companies may follow.

Initial Situation

In a first step, the entire picking process was modeled with event-driven process chains (see Figure 4). The starting point was not the official process of documents, but rather a member of the project team who observed numerous instances on the job. The generic manual process (see Figure 2) was subdivided with many details, so that cost drivers could be identified explicitly (e.g., by roles modeled).

Figure 4. Sub-processes motion to final inspection and final inspection



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Figure 4 shows the detailed view of the last two steps: After the commissioner has taken his/her job from the IT system, he/she moves step by step to the articles to be picked. After the final pick, he/she moves to the packing center where the final inspection is provided. This center is equipped with two employees per shift to finally review the collected orders. If no errors are found, the picked orders are moved to the shipment.

As-Is Process Analysis

In a first step, the SCM target system was cascaded to the picking process. The strategic targets (T) to be fulfilled were defined: (1) Delivery in time, (2) delivery in a correct type, quantity and quality, (3) service at suitable market conditions and (4) generation of all necessary shipping documents. For selecting suitable process analysis methods, able to investigate the picking process by supporting the strategic targets, the team followed the approach by Lederer, & Schott (2012) and Lederer et al. (2013). This strategic business process analysis model provides 10 key statements (K) which were answered (see table 1) by the team on a six-polar scale (higher ratings represent a higher relevance).

The resulting recommendation matrix (see table 2) comprises 31 state-of-the-art process analysis methods which were compared with the relevance of the key statements. These statements were multiplied with the given set by Lederer, & Schott (2012) and Lederer et al. (2013). Then, each row was added together. As a result, six analysis methods have a significant higher score, which represents the potential of these methods to analyze the process in order to implement the given strategic targets.

Initial analysis showed an average of 100 quantity failures and two type failures per month which were corrected in the final inspection. In order to analyze the picking beside this pure error counting,

Table 1. Quantification of strategic targets for the picking process

| K | Key statement: "Relevant information to achieve the strategic goal are..." | Quantification of targets | | | |
|-----|--|---------------------------|----|----|----|
| | | T1 | T2 | T3 | T4 |
| K1 | cost structure and cost drivers." | 1 | 5 | 5 | 0 |
| K2 | throughput times and time drivers." | 2 | 0 | 1 | 0 |
| K3 | qualitative characteristics, error rates and completeness of the process output." | 2 | 5 | 5 | 2 |
| K4 | Internal and external customer satisfaction regarding the process performance and the added value of the process." | 4 | 4 | 2 | 1 |
| K5 | process relationships and process-orientation of the company." | 2 | 3 | 0 | 1 |
| K6 | information coverage, quality of information and information transparency." | 2 | 1 | 0 | 4 |
| K7 | quality of information transport, exchange of information and the need for communication." | 2 | 1 | 0 | 4 |
| K8 | likelihood of potential negative process events and impacts of their consequences." | 4 | 5 | 1 | 1 |
| K9 | supply situation with all necessary goods and equipment and its distribution over time." | 3 | 2 | 0 | 1 |
| K10 | the effort required for changes in the process flow." | 0 | 0 | 0 | 0 |

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Table 2. Scoring of business process analysis methods

| Method \ Key statements | Score | K1 | K2 | K3 | K4 | K5 | K6 | K7 | K8 | K9 | K10 |
|---|-------|----|----|----|----|----|----|----|----|----|-----|
| Critical path analysis | 17 | 11 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Core process / core competence analysis | 12 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| ABC analysis | 12 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| Information requirements analysis | 21 | 0 | 0 | 14 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| Communication Analysis | 24 | 0 | 3 | 0 | 0 | 0 | 7 | 14 | 0 | 0 | 0 |
| Networking analysis | 19 | 0 | 0 | 0 | 0 | 12 | 0 | 7 | 0 | 0 | 0 |
| Vulnerability analysis | 36 | 11 | 0 | 14 | 0 | 0 | 0 | 0 | 11 | 0 | 0 |
| Cause and effect analysis | 36 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 22 | 0 | 0 |
| FMEA | 39 | 0 | 3 | 14 | 0 | 0 | 0 | 0 | 22 | 0 | 0 |
| Value analysis | 25 | 0 | 3 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| Force field analysis | 14 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fragmentation / concentration analysis | 6 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Runtime analysis | 6 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dependency Analysis | 17 | 0 | 3 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fault analysis | 39 | 0 | 0 | 28 | 0 | 0 | 0 | 0 | 11 | 0 | 0 |
| Process cost analysis | 36 | 22 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| “Moments of truth” analysis | 22 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 |
| “Voice of the customer” analysis | 28 | 0 | 0 | 0 | 22 | 6 | 0 | 0 | 0 | 0 | 0 |
| Interface analysis | 34 | 0 | 6 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| IT resource analysis | 20 | 0 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 6 | 0 |
| Analysis the operational structure | 12 | 0 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 |
| Organizational structure analysis | 20 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Knowledge-centered process analysis | 28 | 0 | 0 | 14 | 0 | 0 | 7 | 7 | 0 | 0 | 0 |
| Quality cost analysis | 36 | 22 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Portfolio analysis | 23 | 0 | 0 | 0 | 11 | 12 | 0 | 0 | 0 | 0 | 0 |
| Process potential analysis | 34 | 0 | 0 | 14 | 11 | 6 | 0 | 0 | 0 | 3 | 0 |
| Process environment analysis | 28 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 22 | 0 | 0 |
| Process-oriented SWOT Analysis | 33 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 22 | 0 | 0 |
| Cost Benchmarking | 22 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

the project team decided to perform an in-depth *process cost*, *quality costs* as well as a *cause-and-effect analysis* to later choose adequate optimization actions.

Process Costs Analysis

The *process cost analysis* provides the opportunity to look at the total cost of picking in the logistics center. For the project team it was particularly interesting to identify cost drivers. The performed analysis followed the German VDI guideline 4405 (VDI, 2003). Table 3 outlines the most relevant cost drivers.

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Table 3. Cost drivers

| No | Process step | Process cost of each range picked |
|----|--------------------------------|-----------------------------------|
| 1 | Placing item on the pallet | 2.90 € |
| 2 | Provide goods for shipping | 2.23 € |
| 3 | Performing outgoing inspection | 1.32 € |
| 4 | Scan batches and barcodes | 1.32 € |

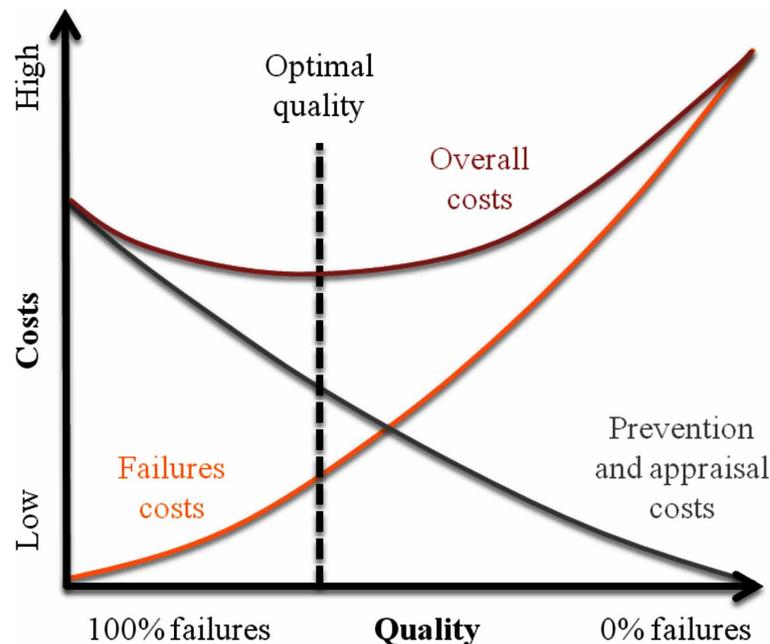
The results show that especially the taking from a compartment as well as the provision for shipping generates high costs. Moreover, the scan activities are very costly. However, while these process steps are an indispensable part of picking, the outgoing inspection is not directly adding value and can therefore provide a starting point for optimization.

Quality Costs Analysis

The quality cost analysis makes it possible to identify the consequences of poor picking quality (Mohanadas & Sankaranarayanan, 2009). Beyond many other forms, the PAF approach is the most common analysis. It uses the costs of *prevention*, *appraisal* and *failures* for the calculation (Kazaz, Talat Birgonul, & Ulubeyli, 2005). By taking these costs into a graphical figure, the minimum of the total costs ($K' = 0$) can be considered as the *best quality* (see Figure 5).

The exact determination of the quality-related costs is difficult since many costs cannot be directly considered to single picking procedures (Crostack et al., 2007; Rammelmeier, Galka, & Günthner, 2012).

Figure 5. Graphical representation of the quality cost analysis
Own illustration adopted from Plunkett & Dale (1988)



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For example, the cost of a handheld scanner cannot fully be considered as appraisal costs since, in addition to the identification of the storage locations, further actions to avoid errors are done with such a tool (e.g., the system to access to stock-flows) (Crostack et al., 2007). As described above, especially the final inspection causes very high costs because two employees per shift are just manually checking the picking result. In addition, this inspection is working quite effective, because it uncovers many errors and thus the error costs are on a low level. After a detailed analysis it was discovered that the actual picking quality is currently right of the optimum (see Figure 5).

Cause and Effect Analysis

The cause-and-effect analysis uses Ishikawa diagrams to identify possible causes of certain problems or conditions (Ishikawa, 1991). In the case of picking, these diagrams are used to visualize causes for picking failures. Due to different causes, the failures are addressed in separate diagrams. The contents of both diagrams were created by the project team in a three-step process: Many possible causes were collected in a literature review. Applicable causes were selected based on observations by the project team and subsequently visualized. Figure 6 shows the cause-and-effect analysis for quantity failures.

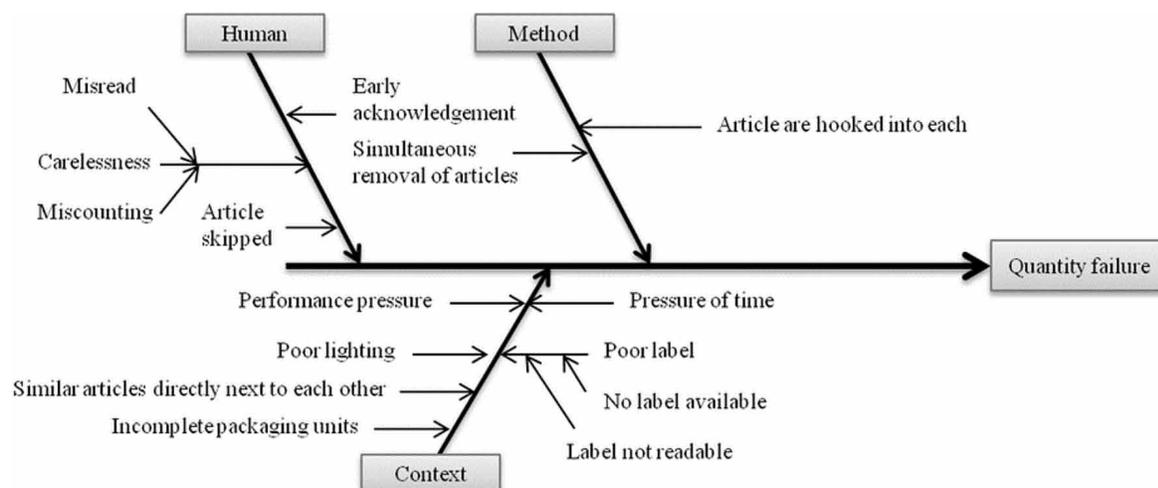
In the diagram, it becomes obvious that human mistakes as well as the picking method are the major causes for failures. In addition, time and performance pressure, poor lighting, and unreadable labels can result in wrong picking orders. To avoid picking failures, it is necessary to reduce or even eliminate sources for errors. In a nutshell, the cause-and-effect analysis provides a good overview for identifying possible actions.

Process Optimization and Best Practices

Returning to the visualization of the optimal quality, it was recommended in the case study to decline the prevention and failure costs. This would result in a shift of the affected cost curve downward. Figure 7 shows the positive consequences: The best quality shifts to the right that is at a higher quality. At the same time a decreasing of overall costs results (ΔC).

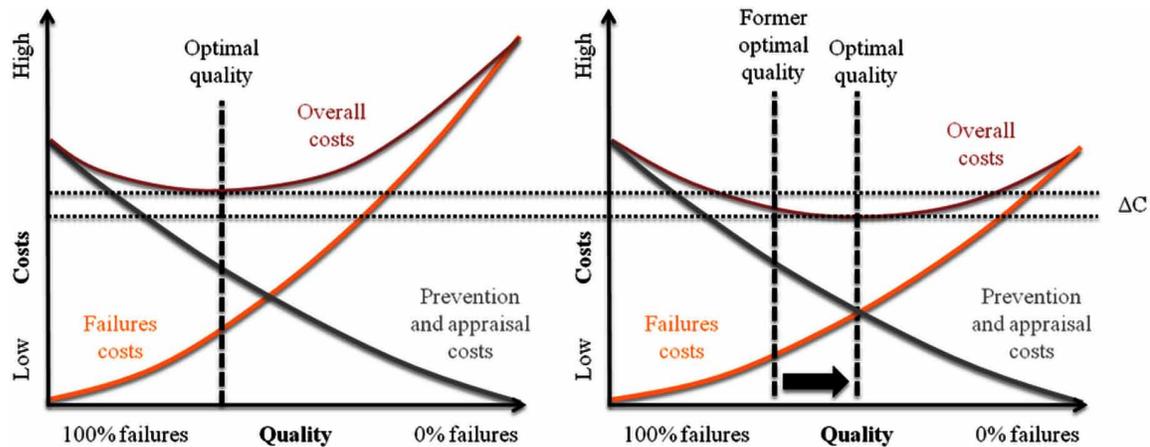
Figure 6. Cause-and-effect diagram for quantity errors

Own illustration based on Crostack et al. (2007); Günthner, & Rammelmeier (2012); Lolling (2003)



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Figure 7. Shift of the prevention and appraisal costs curve



To ensure a clear representation in this contribution, possible initiatives which were partly implemented by the project team are divided into the categories by Rammelmeier, Galka & Günthner (2012): *Technological initiatives*, *process re-design possibilities* and *organizational measures* will be outlined.

Usage of Technology

In the context of failure prevention by pickers, some technical initiatives are known to help the pickers in *avoiding errors* by intuitive and structured information provision (Crostack et al., 2010):

- The use of paper-based pick lists is the least technically supported form of information provision. The picker gets on such a list all necessary information regarding the articles to be picked (e.g., item name and number). After picking, the employee can manually acknowledge his work on the paper (Brynzer & Johansson, 1995).
- Due to the fact that stationary data terminals are generally used almost exclusively in goods-to-man order picking (ten Hompel et al., 2011), mobile data terminals are more and more used. In contrast to the stationary solutions, mobile data terminals can be operated both online as well as offline (ten Hompel et al., 2011). Since today's mobile data connections are technically mature, such terminals can be implemented easily (e.g., using Wireless Local Area Network, WLAN). This enables the following solutions:
 - **Pick by Light:** In this case, the picker receives all relevant information on small displays above or below the storage compartment. Using this device, he/she can acknowledge the particular position and can perform any corrections (Reif, Günthner, Schwerdtfeger, & Klinker, 2010). A key advantage of this system is the direct connection to the Enterprise Resource Planning (ERP) system (ten Hompel et al., 2011).
 - **Pick by Voice:** This guided picking is realized via voice input using a headset (Martin, 2011). A major advantage of this approach is the fact that the commissioner has both hands available while picking (ten Hompel et al., 2011).

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- **Pick by Vision:** This is a relatively new approach. With the help of augmented reality, the picker can see required information in the actual situational where he/she needs assistance (Günthner, & Rammelmeier, 2012). For example, a virtual arrow can be shown in the real corridor to guide the picker the way to the next compartment (Schwerdtfeger et al., 2009).

In addition to the preventive actions the following typical technical initiatives for *failure detection* by pickers are known:

- The easiest way to test is the visual inspection. The review of picking items occurs without using any technical support (Crostack et al., 2007).
- With the help of article scans, picked orders can be checked for accuracy. In this case, items are clearly identified with the help of an electro-optic device (e.g., barcode scanner) (Crostack et al., 2010). Articles can either be scanned mobile (using a hand scanner the picker carries with him/her) or with a stationary device (e.g., scan at the outgoing inspection) (Baumann, 2013).
- The use of a weighing system is a further development of subsequent tests. The weighting of orders checks if all units were correctly picked. Again, this can be realized either mobile or stationary (Crostack et al., 2010). For mobile weighing systems, for example, weighting hand-lifts trucks are able to weight their loading with the exactness of just a few grams (RAVAS, 2013).
- Another concept uses the radio-frequency identification technology (RFID). Since in nowadays, it is usually not possible to provide each individual package with an RFID tag due to cost reasons, the use of an RFID glove might be a new possibility. Using this glove, the RFID tags are placed on the storage compartments (Wölfler, & Günthner, 2011). Thus, each handle into the shelf compartment can be identified and counted (Günthner, & Rammelmeier, 2012).

Process Re-Design

Due to a permanent high performance in the logistics value chains, it was impossible in the case study to radically re-design the picking process. The following best practices, which require only an incremental change in the process, were discussed and partly simulated:

- Using suitable to-bin strategies can help to avoid picking errors. Certain rules should be followed to ensure that products are systematically assigned to specific storage areas (de Koster et al., 2007). De Koster et al. (2007) states that process managers should simulate which of the following strategies is most suitable: *random storage* (newly arrived items randomly assigned to be free storage compartments), *closest open location* (warehouse staff chooses the compartment next to them), *dedicated storage* (each article has a fixed allocated storage compartment) and *full turn over storage* (articles will be assigned a storage compartment depending on their turnover).
- An ergonomic workplace design can also have a positive effect on performance of employees, which in turn can reduce picking errors (ten Hompel et al., 2011). The physical burden of employees is especially high in processes with a high share of manual picking (Günthner & Walch, 2010).
- A good design of pick lists can also avoid picking failures. Lolling (2003) gives the following recommendations for the design of a pick list: Prevention of redundant information, highlighting

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of important information (e.g., font size or colour), usage of lines and fields for a structured visualization, separation of longer strings (e.g., long location number), insurance of readability and usage of checkboxes for each item (Lolling, 2003).

- Ensuring robust processes can be reached by adequate training of pickers. Usually, trainings should be offered to new employees, to available employees when processes were changed and to employees with a significant failure rate.

Organizational and Human Aspects

The analysis has shown that in the case of manual picking not only the procedures, but also in particular the picker can be a significant source of error. The following soft approaches are possible to positively influence the picking staff:

- Extrinsic motivation is given when the picker performs an action to obtain a separate and independent advantage (Ryan & Deci, 2000). This can, for example, realized by a monetary reward. In the logistics, companies use mainly additional salary and adjustments in working times to increase motivation (Hense et al., 2013; Pfohl, 2004).
- Intrinsic motivation addresses the organization of work or working structure as an important part to increase performance on the job (Pfohl, 2004). Examples are praise, recognition, and a pleasant working atmosphere.
- New approaches such as Gamification refer to the use of video game elements in areas of the real world in order to increase the motivation and performance (Deterding & Dixon, 2011). Gamification is a relatively new concept, but can be used in various areas (including health/fitness, e-commerce and e-learning) (Banister, 2010; Geere, 2010; Savage, 2012). Hense et al. (2013) see especially potential in the intra-logistics when picking is designed like a game in an augmented reality.

RESULTS

In order to determine which of the best practices described above are most suitable in the case study, the following criteria were used by the project team: Necessary investment, possible performance improvement, potential impact on the picking quality, necessary process adjustments and technical maturity of the systems.

The conclusion of the project team was to retain the paper-based pick lists. However, the design of the lists can be improved so that they can be read quickly by pickers. Furthermore, the use of electronic lift trucks with integrated weighting systems was simulated. Since sometimes very small items needed to be picked, it was important to test whether the correct number of picked articles can be controlled in the case of very light objects.

The re-designed process is as such that the picker starts each job receiving an optimized pick list. On this sheet of paper all items to be picked are listed in an optimized order reflecting the fastest way through the warehouse. After the removal of an item from the compartment, the picker puts it on the new lift truck. The lift truck then measures the newly added weight and compares it to the data stored in the ERP system.

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There is a match, meaning that the expected weight is the same with the truck measurement. An integrated display shows a signal that the picker can go to the next item on the list. If the weight (including an item-based tolerance) is not correct, the picker has to check his/her work. Missing weight is a sign of less (quantity failure) or missing articles (omission failure) or too little packaging (which, for example, can lead to condition failures). Too much weight indicates that too many items were picked or incorrect packaging material was used.

Since the lift truck is able to weight in the run-time, the error can be corrected easily and trucks indicate immediately when the weight is fine. Since there may be inaccuracies (e.g., if many units of one item are to be picked, other packaging with different weights are necessary), the picker can also manually override the error and continue with his/her list.

With this new process flow and with innovative technical support in picking process, the final inspection could be completely eliminated without decreasing the picking quality. This means that no further control after picking (see Figure 5) is needed. This means, in turn, that two workers per shift can be reduced and €105,000 can be saved per shift while the picking quality remains the same.

Although many technical equipment needed to be installed, a lot of interfaces would occur and numerous adaptations would be necessary (e.g., wireless equipment in all areas of the warehouse, acquisition of weighing information, etc.) the project team could calculate a return of invest after just a half year.

FUTURE RESEARCH DIRECTIONS

The investigations and insights from the case study provide ample evidences that several classical and modern approaches can be used to optimize picking processes. SCM managers can use the list provided as a starting point to get familiar with these ideas. In a second step, managers should evaluate each approach and should decide which aspects are most suitable for their scenario. Each solution presented has specific technical (e.g. configuration of the picking system) and organizational (e.g., design of the picking workflow) requirements which should be investigated. Researchers can use the presented compilation of aspects to develop recommendations, which approaches are appropriate in which picking situation.

CONCLUSION

The aim of this contribution was to demonstrate the importance of picking within the SCM value chain. SCM managers must understand the importance of picking because trends like the usage of technology for transaction and internal processes result in more requirements for logistics services to end consumers. At the same time, the implementation of best practices can reduce this cost-intensive part of SCM. The presented basics on picking processes also indicate that this SCM step has a very huge impact on customer satisfaction. There are numerous technical, organizational and soft best practices available to improve the quality and to reduce costs. Some of the presented approaches are in line with traditional and known developments (e.g., the design of process roles), but others make use of modern technology (e.g., the intensive usage of data and new software tools).

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The illustrative case study could show an example how savings can be made by introducing a new technology. The picking process was analyzed in depth focusing on cost and quality based on the strategic targets of the process. The presented procedure can be used by practitioners for own process analysis and the exemplary best practices are intended to serve as food for thought.

REFERENCES

- Banister, J. (2010). gCommerce: The Gamification of eCommerce. *Interpret - New Media and Technology Market Research Company*. Retrieved from <http://www.interpretllc.com/new-media-measure-interpretations.php?rid=49>
- Boysen, N., Emde, S., Hoeck, M., & Kauderer, M. (2015). Part logistics in the automotive industry: Decision problems, literature review and research agenda. *European Journal of Operational Research*, 242(1), 107–120. doi:10.1016/j.ejor.2014.09.065
- Brynzér, H., & Johansson, M. I. (1996). Storage location assignment: Using the product structure to reduce order picking times. *International Journal of Production Economics*, 46(47), 595–603. doi:10.1016/0925-5273(94)00091-3
- Crostack, H.-A., ten Hompel, M., Zellerhoff, J., Pelka, M., Mathis, J., & Strothotte, D. (2010). Strategien für die flexible auftragsweise Kommissionierung mit integrierter Prüfung mit dem Ziel einer hohen Kapazitätsauslastung eingesetzter Ressourcen. *Endbericht AiF-Vorhaben*, 15811.
- De Koster, R., Le-Duc, T., & Roodbergen, K. J. (2007). Design and control of warehouse order picking: A literature review. *European Journal of Operational Research*, 182(2), 481–501. doi:10.1016/j.ejor.2006.07.009
- Deterding, S., & Dixon, D. (2011). From Game Design Elements to Gamefulness : Defining Gamification. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). doi:10.1145/2181037.2181040
- Geere, D. (2010). Health Month is a self-improvement RPG. *Wired UK*. Retrieved from <http://www.wired.co.uk/news/archive/2010-09/07/health-month-rpg>
- Goetschalkx, M., & Ashayeri, J. (1989). Classification and Design of Order Picking. *Logistics Information Management*, 2(2), 99–106.
- Gudehus, T. (2010). *Logistik*. Berlin, Germany: Springer. doi:10.1007/978-3-540-89389-9
- Günthner, W. A., Blomeyer, N., Reif, R., & Schedlbauer, M. (2009). *Pick-by-Vision: Augmented Reality unterstützte Kommissionierung*. Munich, Germany: TUM.
- Günthner, W. A., & Rammelmeier, T. (2012). Vermeidung von Kommissionierfehlern mit Pick-by-Vision. *Forschungsbericht AiF-Vorhaben*, 16398.
- Günthner, W. A., & Walch, D. (2010). Nachhaltige Ergonomie für die Logistik. *Logistik für Unternehmen*, 24(3/4), 44–47.

Picking with Impact

- Hellström, D., & Saghir, M. (2007). Packaging and logistics interactions in retail supply chains. *Packaging Technology and Science*, 20(3), 197–216. doi:10.1002/pts.754
- Hense, J., Klevers, M., Sailer, M., Horenburg, T., & Günthner, W. A. (2013). Using gamification to enhance staff motivation in logistics. *Proceedings of the 44th Conference of the International Simulation and Gaming Association* (pp. 1–8).
- Ishikawa, K. (1991). *Guide to quality control*. Clearwater, USA: Quality Resources.
- Jünemann, R. (1989). *Materialfluß und Logistik*. Berlin, Germany: Springer. doi:10.1007/978-3-662-08532-5
- Kazaz, A., Talat Birgonul, M., & Ulubeyli, S. (2005). Cost-based analysis of quality in developing countries: A case study of building projects. *Building and Environment*, 40(10), 1356–1365. doi:10.1016/j.buildenv.2004.11.010
- Klaus, B. (1996). *Kommissioniersystem, Grundlagen und Systemfindung. Kommissionierung heute - Warum Outsourcing „in“ ist*. Düsseldorf, Germany: VDI.
- Lederer, M., & Schott, P. (2012). *IT-basiertes Transparenzmanagement für die Analyse von Geschäftsprozessen*. Nuremberg, Germany: University of Erlangen-Nuremberg Chair for Information Systems.
- Lederer, M., Schott, P., Huber, S., & Kurz, M. (2013). Strategic Business Process Analysis: A Procedure Model to Align Business Strategy with Business Process Analysis Methods. *Proceedings of the 5th International Conference S-BPM ONE 2013 Proceedings*, Deggendorf, Germany (pp. 247-263). doi:10.1007/978-3-642-36754-0_16
- Liu, J. P. (2007). Case study of picking method selection for cosmetic broken-case picking operation. *Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 357–361). doi:10.1109/IEEM.2007.4419211
- Lolling, A. (2003). *Analyse der menschlichen Zuverlässigkeit bei Kommissioniertätigkeiten* [Dissertation]. Technische Universität München.
- Menk, J. (1999). *Beitrag zur Planung qualitätsfähiger Kommissioniersysteme - ein humanorientierter Ansatz* [Dissertation]. Technische Universität Dortmund, Germany.
- Mohandas, V. P., & Sankaranarayanan, S. R. (2009). Cost of Quality Analysis: Driving Bottom-line Performance. *International Journal of Strategic Cost Management*, 3(2), 1–8.
- Pfohl, H. C. (2004). *Logistikmanagement – Konzeption und Funktionen*. Berlin, Germany: Springer.
- Plunkett, J. J., & Dale, B. G. (1988). Quality costs: A critique of some 'economic cost of quality' models. *International Journal of Production Research*, 26(11), 1713–1726. doi:10.1080/00207548808947986
- Rammelmeier, T., Galka, S., & Günthner, W. A. (2012). *Fehlervermeidung in der Kommissionierung* (Vol. 2012). Logistics Journal Proceedings.
- RAVAS. (2013). *RAVAS-6100 Hubwaage Produktblatt*. Retrieved from <http://www.ravas.com/images/stories/latest/ts-spr-ravas-spr-web-ravas-6100-de-eu-latest.pdf>

Picking with Impact

Reif, R., Günthner, W. A., Schwerdtfeger, B., & Klinker, G. (2010). Evaluation of an Augmented Reality Supported Picking System Under Practical Conditions. *Computer Graphics Forum*, 29(1), 2–12. doi:10.1111/j.1467-8659.2009.01538.x

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25(1), 54–67. doi:10.1006/ceps.1999.1020 PMID:10620381

Savage, N. (2012). Gaining wisdom from crowds. *Communications of the ACM*, 55(3), 13. doi:10.1145/2093548.2093553

Schwerdtfeger, B., Reif, R., Günthner, W. A., Klinker, G., Hamacher, D., Schega, L., . . . Tumler, J. (2009). Pick-by-Vision: A first stress test. *Proceedings of the 2009 8th IEEE International Symposium on Mixed and Augmented Reality* (pp. 115–124). doi:10.1109/ISMAR.2009.5336484

Taljanovic, K., Salihbegovic, A., & Pandzo, A. (2012). A Fast Manual Picking of Small Parts High Volume Orders. *Journal of Communication and Computer*, 9, 1097–1103.

ten Hompel, M., Sadowsky, V., & Beck, M. (2011). *Kommissionierung - Materialflusssysteme 2: Planung und Berechnung der Kommissionierung in der Logistik*. Heidelberg, Germany: Springer. doi:10.1007/978-3-540-29940-0

VDI. (1994). *Norm 3590*. Berlin, Germany: Beuth.

VDI. (2003). *Norm 4405*. Berlin, Germany: Beuth.

Wölfle, M., & Günthner, W. A. (2011). Wearable RFID in order picking systems. *7th European Workshop on Smart Objects: Systems, Technologies and Applications* (pp. 1-6).

Woods, T. (2013). Mis-Picks Cost Businesses Nearly £242,000 per year (Press Release). *Honeywell*. Retrieved from http://www.intermec.co.uk/about_us/newsroom/press_releases/DC3-1-2013.aspx

ADDITIONAL READING

De Koster, R., Le-Duc, T., & Roodbergen, K. J. (2007). Design and control of warehouse order picking: A literature review. *European Journal of Operational Research*, 182(2), 481–501. doi:10.1016/j.ejor.2006.07.009

Klinker, G., & Schwerdtfeger, B. (2008). Supporting order picking with Augmented Reality. *Proceedings of the 7th IEEE/ACM International Symposium on Mixed and Augmented Reality* (pp. 91-94)

Shena, C. W., & Chou, C. C. (2010). Business process re-engineering in the logistics industry: A study of implementation, success factors, and performance. *Enterprise Information Systems*, 4(1), 61–78. doi:10.1080/17517570903154567

Wölfle, M., & Günthner, W. A. (2011). Wearable RFID in order picking systems. *Proceedings of the 7th European Workshop on Smart Objects: Systems, Technologies and Applications* (pp. 1-6).

*Picking with Impact***KEY TERMS AND DEFINITIONS**

Business Process Cost Analysis: The process cost analysis provides the opportunity to look at the total cost of workflows. Moreover it can identify cost drivers.

Cause-and-Effect Analysis: The cause-and-effect analysis uses Ishikawa diagrams to identify possible causes of certain problems or conditions.

Picking Process: Business workflow, which has the general target to arrange subsets of goods (e.g., of a packet) based on requests (e.g., orders) from a total amount of goods (e.g., an assortment).

Process Re-Engineering: New design of business processes (e.g. picking workflows) in order to better fulfill given targets (e.g. throughput time).

Quality Cost Analysis: The quality cost analysis makes it possible to identify the consequences of poor output quality.

ENDNOTES

- ¹ For confidentiality reasons, the name of the company cannot be given. The case study is anonymized and some confidential parts were changed.

Chapter 28

Information and Communications Technology (ICT) and the Supply Chain

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ABSTRACT

Information and communications technology (ICT) is an integral part of supply chain management (SCM) (Anderson, Britt, & Favre, 2007; Subramani, 2004). ICT supports SCM by enhancing supply chain efficiency, effectiveness and competitive advantage at strategic, tactical and operational management levels. Derived from extant literature on the application of ICT in SCM and ICT infrastructure sources, this chapter explores the significance of ICT in the business of SCM and describes the various ICT infrastructures deployed in aid of supply chain collaboration, integration and connectivity. While most related studies focus on organisational perspectives of ICT and SCM like benefits (Auramo, Kauremaa, & Tanskanen, 2005b), buyer-supplier relationships (Bakos & Brynjolfsson, 1993) and so on; the chapter presents a technological viewpoint of ICT and SCM. The chapter explores the function of ICT in SCM and proposes a classification framework of ICT in SCM.

INTRODUCTION

Globalisation, increased competition, and access to new [emerging] markets are contributory factors to the integration of business activities and practices as well as the need for effective and efficient supply chains and supply chain management (SCM) (Stevens, 1989). These sought after gains are a consequence of strategies and techniques that shorten product cycles while managing uncertainties and complexities (Davis, 1993). The application of information and communication technology (ICT) in business has evolved from specialist-manned mainframe systems restricted to computer rooms to smartphone and tablet users operating everywhere; automation of business processes to organisational transformation and value creation; intra-organisational systems to inter-organisational systems, and so forth. These de-

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velopments, proponents of the information age or digital economy, are gradually changing businesses, work activities, people and products and services.

In addition, the adoption of ICT is presumed to enhance effectiveness, efficiency, and competitive advantage, thus playing a significant role in business. Derived from extant literature on the application of ICT in SCM and ICT infrastructure sources, this chapter explores the significance of ICT in the business of SCM and describes the various ICT infrastructures deployed in aid of supply chain collaboration, integration, and connectivity. The chapter proposes a classification framework of ICT infrastructure in SCM, and is especially useful for supply chain managers and executives who lack incisive knowledge of the capabilities of ICT.

The current literature of ICT in SCM is somewhat fragmented and diverse. Some studies provide a broad understanding of ICT in SCM (Auramo, Inkiläinen, & Kauremaa, 2005a; Gunasekaran & Ngai, 2004), benefits (Auramo, Kauremaa, & Tanskanen, 2005b), importance (Moharana, Murty, Senapati, & Khuntia, 2011), planning requirements (Holland, Lockett, & Blackman, 1992). Other address ICT roles in buyer-supplier relationships (Bakos & Brynjolfsson, 1993; Chae, Yen, & Sheu, 2005; Subramani, 2004); specific supply chain functions (Helo & Szekely, 2005); perceived benefits or impacts using specific ICT (Dedrick, Xu, & Zhu, 2008; Subramani, 2004). Studies also address information sharing and flow strategies (Vanpoucke, Boyer, & Vereecke, 2009), sharing practices (Singh, 1996; Zhou & Benton, 2007); sharing impacts in specific SC activities like inventory management and collaborative planning (Cachon & Fisher, 2000; Sherman, 1998).

Nair et al. (2009) present a narrative catalogue of ICT tools; McDonnell et al.'s (2004) review of the role of ICT focuses on functional and enterprise applications; Helo and Szekely (2005) focus on logistics information systems. The limited empirical value and frequency of innovations and change makes studies addressing ICT infrastructure scarce; when available, such empirical studies evaluate organisational aspects of a particular technology in a particular setting or supply chain activity. The scarcity of comprehensive studies on ICT infrastructure or technological capabilities motivated this chapter which takes an all-inclusive view of ICT capabilities in SCM alongside a catalogue of related ICT infrastructure. The chapter is presented in four parts commencing with a brief background introduction to supply chain and SCM. The role of ICT in supply chain collaboration, integration and connectivity are discussed next. This is followed by a catalog of ICT infrastructure deployed towards collaboration, integration and connectivity applications alongside Internet applications in SCM. The section closes with a classification framework of ICT in SCM. The conclusion is preceded by a preview of emergent ICT developments.

SUPPLY CHAIN MANAGEMENT

Supply Chain

As a business environment, the supply chain is “the connected series of activities which is concerned with planning, coordinating, and controlling material, parts, and finished goods from suppliers to customers” (Stevens, 1989) that comprises of material, information, and financial flows (Sweeney, 2006). This unidirectional flow of supply chain activities is refuted by the service-dominant logic (SDL) where producers and consumers co-create value (Vargo, Maglio, & Akaka, 2008). Thus, the alternative definition, “a network of multiple businesses and relationships” (Lambert, Cooper, & Pagh, 1998), may be more appropriate. While Lambert’s definition categorises businesses as supply chain participants, Mentzer’s

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(2001) definition – “a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer” – supports individual participation and bi-directional flows. The definitions describe the multi-entity, multi-activity and multidirectional flows associated with supply chains and testifies to their diversity, complexity and uniqueness (Lambert & Cooper, 2000).

Supply Chain Management

This relationship between numerous business activities and multiple participants warrants effective coordination that results in outcomes such as customer satisfaction, competitive advantage, profitability and cost savings (Fawcett, Magnan, & McCarter, 2008; Mentzer et al., 2001). This coordination, known as supply chain management (SCM), can be defined as “the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders“ (Lambert & Cooper, 2000). It is also the systematic and strategic coordination of the traditional business functions and tactics across various business functions within a particular company and across businesses within the supply chain, to improve the long-term performance of various stakeholders and supply chain as a whole (Mentzer et al., 2001).

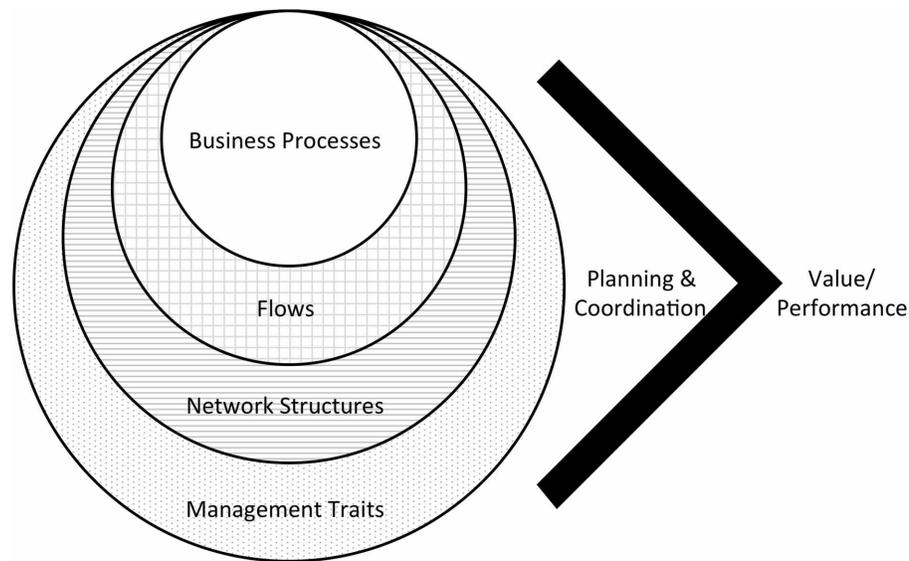
Case study analyses of supply chains within diverse organisations identified supply chain components: the network structure, business processes and management traits (Cooper & Lambert, 1997; Lambert et al., 1998). The network structure comprises supply chain members or participants. A simple network structure identifies members directly involved in the upstream or downstream flows and a more detailed or extended structure includes the suppliers’ supplier and/or customers’ customer. A complex structure identifies all participants in the downstream and upstream flows (Mentzer et al., 2001). The business processes are the key internal activities fulfilled by supply chain members such as order fulfillment, customer service, product development and so forth.

Management traits refer to the physical (technical) and managerial (behavioral) capacities that guide and support integration of business processes. Supply chain components and scope of SCM illustrated in Figure 1 show that the combination of components enhance planning and coordination that lead to value or performance enhancements.

The practice of SCM to attain impacts discussed earlier requires the integration of business processes, information sharing and organisational connectivity, all facilitated by information and communications technology (ICT).

ICT AND SUPPLY CHAIN MANAGEMENT (SCM)

ICT is comprised of hardware, software and communications that facilitate the capture, transformation, storage, transfer, and application of information (Potter, 2005). Some perceived benefits of ICT deployments include cost reductions, productivity, efficiency, and competitive advantage. ICT is a core component of effective SCMs; potential impacts include revenue growth, asset utilisation and cost reduction (Cooper & Lambert, 1997; Fawcett et al., 2008; Fawcett, Osterhaus, Magnan, Brau, & McCarter, 2007). In SCM, ICT is a mechanism for information sharing and exchange, integrating business activities of supply chain members (inter- and intra-organisation) and connecting supply chains (Singh, 1996; Zhou & Benton, 2007). Hence, supporting key SCM tenets: collaboration, process integration, and connectivity.

Information and Communications Technology (ICT) and the Supply Chain*Figure 1. Scope of supply chain management***Information Sharing**

The exchange of information in the supply chain enhances information flow, (Zhou & Benton, 2007), efficiency, and cost and inventory reductions (Lee, So, & Tang, 2000). While the benefits of sharing demand information with manufacturers has proven difficult to quantify, the value of sharing supplier sales information is known to counter the bullwhip effect and demand distortions (Lee, Padmanabhan, & Whang, 2004). Collaborative planning, forecasting and replenishment (CPFR) is a sharing practice that combines retailer replenishment and category management with supplier forecasting and replenishment (Holmström, Främling, Kaipia, & Saranen, 2002). The SC definitions each recognise information as one of the components shared among supply chain members. Information representing different facts about supply chain activities is characterised by content and quality, purpose and medium (Singh, 1996; Vanpoucke et al., 2009; Zhou & Benton, 2007).

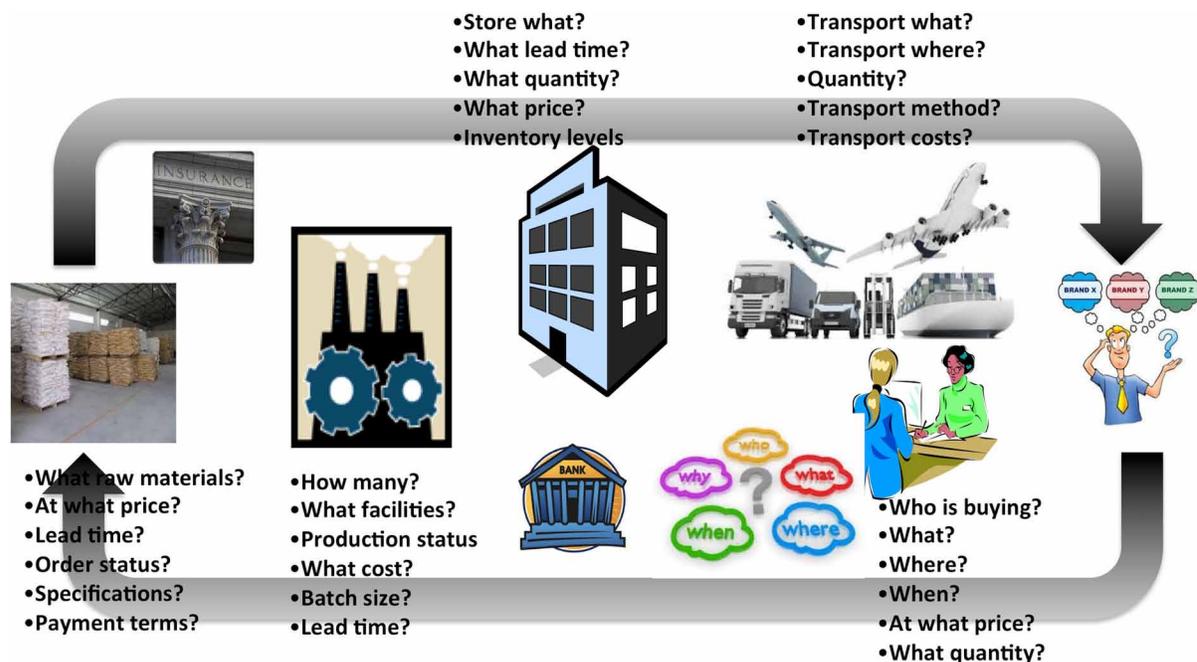
Characteristics

- Content and Quality:** Content represents the actual information in the supply chain. This includes information about demand (sales), supply (orders), shipments, schedules and returns. Demand information flows convey sales forecasts to upstream members. Supply flows convey order forecasts downstream. Other information amongst members include shipment information, production and order schedules and states and returns information. Information is further characterised by quality attributes that evaluate the degree to which recipients' needs are satisfied. Information quality is expressed by attributes such as accuracy, timeliness, completeness, currency and so on (Bailey & Pearson, 1983; Davis, 1993; Singh, 1996; Vanpoucke et al., 2009). As information moves through the supply chain, its timing and quality is distorted by errors aggregated as it flows to the end of the supply chain.

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- Purpose:** This addresses the usefulness of information to people; aptly summarised by “people use information to do things” (Singh, 1996, p. 30). In addition, for information to be useful, it should be accurate, timely, and valid (Davis, 1993).
- Medium:** The medium through which information is exchanged may be manual, semi-automatic and automatic (Singh, 1996). Manual exchange methods involve physical transmission, for example, by telephone, whilst intermediate (semiautomatic) exchange mechanisms use tools such as email. Automatic methods use information and communications technologies (ICT) like networks; electronic data interchange (EDI) and integrated software applications to facilitate inter-organisational information transmission and capture. Besides manual and semiautomatic methods being slower and involving data re-entry, they are also prone to errors that compromise quality. Semiautomatic and automatic ICT tools are utilised for sharing voluminous and diverse information sets among supply chain partners. Authorised users maintain data integrity through controls and other mechanisms that ensure the information gets to the right place and is accessible. The information view of the supply chain depicted in Figure 2 highlights supply chain members, content, and bi-directional flows that enhance inter-organisational collaboration (Lambert & Cooper, 2000).
- Visibility:** Information visibility is an information characteristic that eliminates supply chain barriers by sharing information about material movements through the supply chain (Delen, Hardgrade, & Sharda, 2007). Information visibility enhances inventory management and asset utilisation and is supported by material identification and tracking systems like radio frequency identification (RFID).

Figure 2. Information in the supply chain



Information and Communications Technology (ICT) and the Supply Chain**Process Integration**

The integration of supply chain partners is a strategic and sustained by shared objectives that warrant inter-organisational co-operation and collaboration. At the operational level, integration seeks transactional efficiencies across the supply chain. Supply chain business processes are the key activities conducted by members that produce value. Summary descriptions of the eight core processes identified by the Global Supply Chain Management Forum are presented in Table 1 (Cooper & Lambert, 1997; Croxton, Garcia-Dastugue, Lambert, & Rogers, 2001; Lambert et al., 1998).

Supply Chain Processes

Business processes within the supply chain are independent and limited to a functional unit or organisation. Process integration is a concept that takes a holistic view (end-to-end) of the entire process in a bid to enhance interactions across functions or entities. The integration of supply chain activities within and across organisations develops intra- and inter-organisational systems that are facilitated by ICT. These ICTs support strategic, tactical, or operational work activities such as planning, transaction execution or processing, decision support and collaboration and coordination (Anderson et al., 2007; Auramo, Inkiläinen, & Kauremaa, 2005a; Auramo, Kauremaa, & Tanskanen, 2005b). An alternative proposition based on IT utility categorises SCM ICT as either for exploitation (ITExploit) or exploration (ITExplore) purposes (Subramani, 2004). ITExploit uses facilitate the execution of structured process akin to operational and some tactical work activities. ITExplore uses supports the execution of unstructured processes conducted by strategic-level managers. Exploratory uses are unpredictable and involve the application of information for value addition (Potter, 2005).

Table 1. Supply chain processes

| Business Process | Description |
|---|---|
| Customer Relationship Management | Structures and processes through which customer relationships will be developed and maintained. |
| Customer Service Management | Frontline interface to customers ensuring adherence to service terms defined in product service agreements (PSAs). Also includes the provision of responses to customer enquiries such as product delivery and support. |
| Demand Management | Match customer needs with supplier firm capabilities by collaboratively synchronising demand forecasts with production, procurement and distribution activities. |
| Order Fulfillment | Supports the ability to meet customer requirements through the integration of manufacturing, logistics and marketing functions. |
| Manufacturing Flow | Production of products with sufficient flexibility to meet current and future market needs. |
| Supplier Relationship | Define and manage supplier interactions and PSAs. |
| Product Development and Commercialisation | Management of the product development lifecycle that ensures shorter time to market cycles and the launch of competitive products. |
| Returns Management | Management feedback used to improve products and supply chain processes. |

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Connectivity

Connectivity is an information sharing dimension that impacts supply chain performance (Fawcett et al., 2007). With respect to information, connectivity refers to the interconnectedness of two or more entities (businesses or individuals) using data communication networks. The perspectives presented in demonstrate the importance of ICT in SCM. The following paragraphs provide detailed descriptions of the various ICT infrastructures to support SC coordination and efficiency.

ICT INFRASTRUCTURE FOR SUPPLY CHAIN TRANSFORMATION

Process Integration

The ICT infrastructures deployed to enhance process integration are classified as software. These are complex applications that comprise business logic, databases, controls, etc. In supply chain integration, software applications automate business processes that enhance work at the strategic, tactical and operational levels.

Process-Driven Applications

Also known as point solutions, process-driven supply chain applications automate internal business activities – plan, buy/source, make/convert and move/deliver/sell (Council of Supply Chain Management Professionals, 2013; McDonnell et al., 2004).

Planning

Planning systems automate supply chain planning and coordination activities. These systems are essentially forecasting tools enhance profitability through improved inventory and revenue management techniques across multiple dimensions (product, channel, region, and so on). Product lifecycle management systems support all product development lifecycle activities from product conception to retirement across the engineering, sales and production and service functions.

Procurement

Procurement solutions support buy or source activities from need identification to payment processing and related decisions such as product, quantity, price, and so forth. Order processing or fulfillment systems support suppliers or vendors in processing customer orders and the order lifecycle from receipt to delivery. Supplier relationship management (SRM) systems manage the interactions between an organisation and its numerous suppliers with the view to improving buy processes and reducing costs. SRM applications also support supplier segmentation and differentiation criteria.

Production

Manufacturing information systems aid manufacturing or production functions to meet stock demands or specialised orders and related decisions such as product, quantity, price, and so forth. Materials re-

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quirements planning (MRP) supports the planning of materials essential for the manufacturing process. Manufacturing resource planning (MRP II) is an MRP evolution that integrates the planning functionality with production scheduling and floor operations. Manufacturing execution systems (MES) are control systems that manage and monitor manufacturing work on the factory floor. MES improve manufacturing productivity by coordinating and tracking all manufacturing components - materials, equipment, personnel, instructions and specifications and production facilities - in real-time (O'Brien, 2006). Computer-aided manufacturing (CAM) aids manufacturing execution with programmatic support of manufacturing instructions; while computer-aided engineering (CAE) supports manufacturing design processes with product design analyses and improvement techniques.

Distribution

Distribution solutions support materials movement and logistics functions including storage and transportation process activities and related decisions such as what to store or transport, price, location, transport method, and so forth. Inventory management systems that ensure raw materials and finished goods inventory life cycles are monitored from point of purchase to production and production to sale respectively. Warehouse management systems (WMS) support warehousing activities and processes like goods receipt, storage (cutaway), picking, etc. (Council of Supply Chain Management Professionals, 2013; Nair et al., 2009). Transportation management systems (TMS) optimise transportation management and related activities such as shipping management, shipment scheduling, documentation and third party logistics (Council of Supply Chain Management Professionals, 2013).

Sales

Sales solutions support sell activities from point of order to cash receipt and associated decisions such as the buyer, product, quantity, price, and so forth. Along with order fulfillment systems used by vendors for sales order processing (SOP), customer relationship management (CRM) systems which encompass the strategies, technologies and processes employed by organisations to manage customer relationships and interactions. Customer service management (CSM) systems that support supply chain companies in the provision and management of customer service. CSMS also support customer satisfaction initiatives by ensuring the effective management of customer problems and complaints using maintenance tickets and escalation procedures, and so forth.

Integrated Applications

While point applications focused on individual supply chain activities, the integration of multiple supply chain functions using enterprise resource planning (ERP) or supply chain management (SCM) systems are common within the enterprise and across enterprises. Supply chain applications date back to the 1960s where inventory cost reductions led to materials resource planning (MRP) systems for sourcing manufacturing materials. The first process integration, manufacturing resource planning (MRPII), was introduced in the 1970s.

MRPII included the coordination of the entire production process and information exchange amongst manufacturers and their suppliers. Further integration in the 1980s combined distribution activities through sales order processing (SOP) function. By the 1990s back-office enterprise functions like finance

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and personnel management were introduced through enterprise resource planning (ERP) systems. By the 2000s, further integration beyond the enterprise (suppliers and customers), produced supplier and customer relationship and service management systems (Figure 3).

Enterprise Systems (ERP)

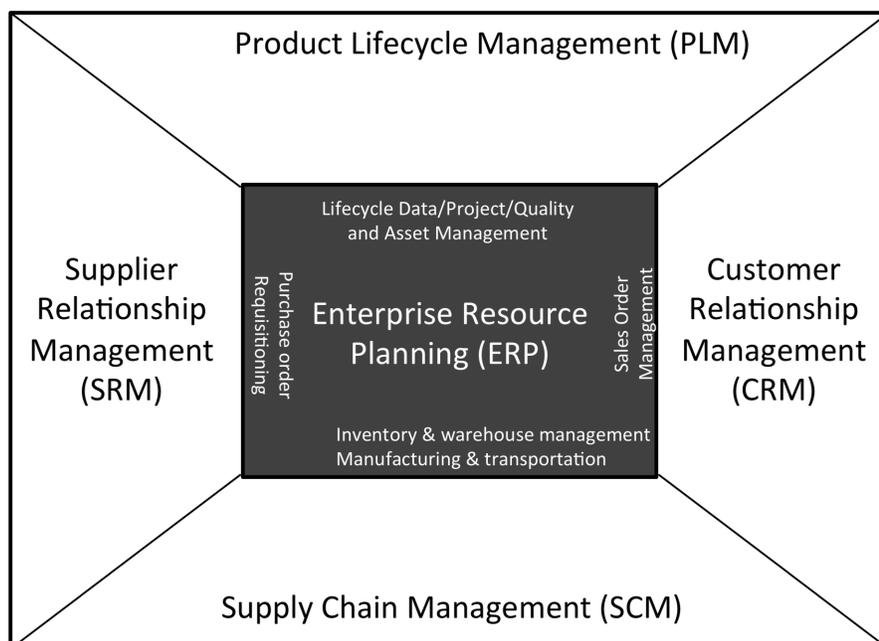
ERP systems integrate the business activities and interactions of an organisation and her enterprise partners like customers, suppliers, distributors, and so on. Although ERP solutions can be implemented across industries, application vendors also provide vertical solutions tailored to meet specific industries needs. The MySAP ERP illustration (see Figure 4) shows ERP systems support core supply chain activities like procurement and logistics execution and product development and manufacturing execution and back office operations like financial management and human capital management. Since their introduction in the early 1970s, the ERP market has been and is still dominated by SAP. Table 2 highlights top ERP vendors, products and respective market share positions (Columbus, 2014).

Supply Chain Management Systems (SCMS)

Unlike ERPs, supply chain management systems (SCMS) specifically focus on supply chain activities within organisations. They integrate core supply chain business activities - planning, execution and co-ordination (see Figure 5). SCMS are tailored to satisfy the needs of specific industries, leading vendors support industry-specific supply chains. Table 3 presents top SCMS vendors, products and respective market share positions (Gartner Inc, 2014).

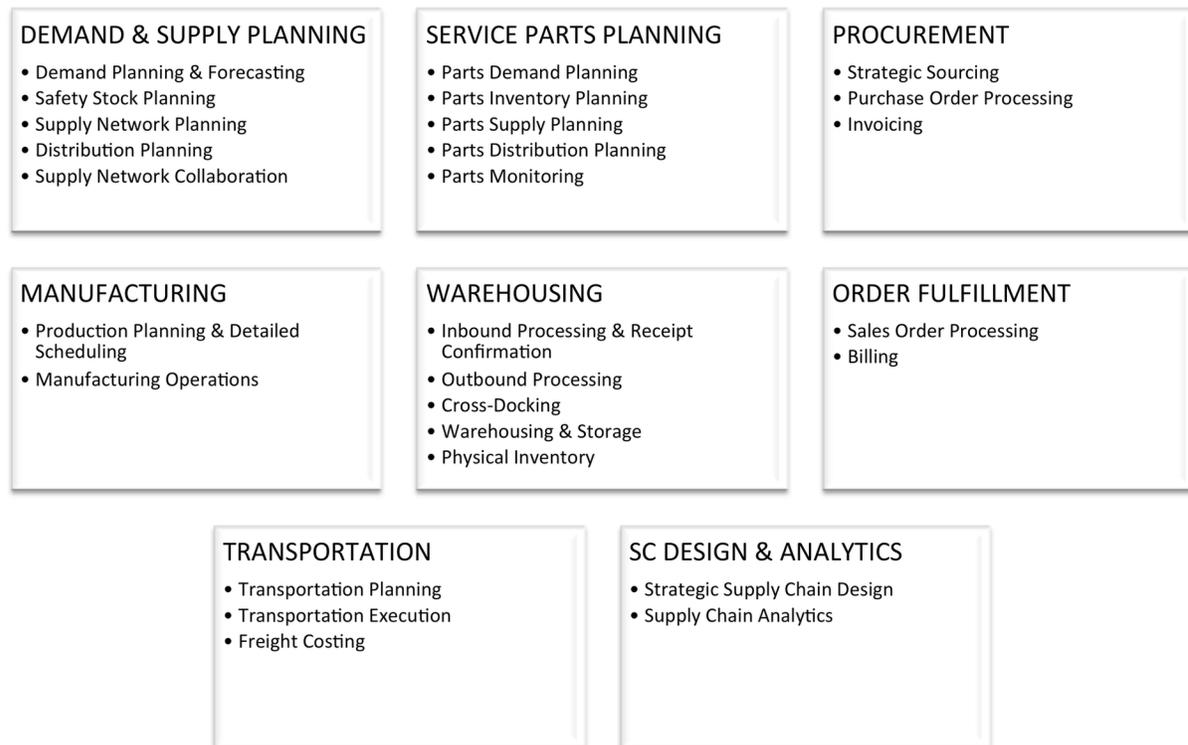
The numbers of vendors and products detailed in Table 2 and Table 3 is indicative of a bias for enterprise systems that are applicable to a larger majority of supply chain members. In addition to supply

Figure 4. MySAP ERP solutions map



Information and Communications Technology (ICT) and the Supply Chain*Table 2. ERP vendors and market share*

| Vendor | Product(s) | 2013 Market Share (%) |
|------------|---|-----------------------|
| SAP | MySAP Business Suite, Business One, Hana | 24% |
| Oracle | Oracle ERP, Cloud Solutions, JD Edwards Enterprise One | 12% |
| Sage Group | Sage 200 (Online), Sage 200, Sage ERP X3, Sage 300 ERP, Sage ERP 1000 | 6% |
| Infor | Infor VISUAL, Infor LN, Infor Distribution A+, Infor M3 | 6% |
| Microsoft | Microsoft Dynamics GP | 5% |
| Others | Including Maximo (IBM), IFS ERP (IFS), Totvs ERP (Totvs), NC Group Management Solution (Yonyou) and many more | 47% |

Figure 5. MySAP SCM solutions map*Table 3. SCMS vendors and market share*

| Vendor | Product(s) | 2013 Market Share (%) |
|----------------------|---|-----------------------|
| SAP | SAP Supply Chain Solutions | 23.9% |
| Oracle | Oracle SCM, Cloud Solutions | 16.3% |
| JDA Software | JDA Supply Chain Now | 5% |
| Manhattan Associates | Manhattan SCOPE | 1.9% |
| Epicor | Epicor Supply Chain Management | 1.8% |
| Others | IFS Applications (IFS), Totvs ERP (Totvs), Infor Lawson Supply Chain Management (Infor), Kewill MOVE Platform (Kewill), and many more | 51.1% |

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chain automation, the adoption of functional applications digitises information for electronic transmission (sharing). The successful implementation of software applications does not connote supply chain integration. Integration occurs at two-levels: intra-and inter-organisation. Intra-organisation integration is supported when an organisation implements a complete enterprise system for all SC activities or consolidates disparate point systems to function in tandem. Based on cooperation arrangements, inter-organisational integration is supported by the consolidation of similar or dissimilar systems (point or enterprise).

Complementary Systems

While the specialised applications solutions support key supply chain business processes, complementary applications that support supply chain automation, collaboration, coordination, planning, and decision-making are also employed in SCM.

Workflow

Workflow application systems support end-to-end business process automation. Workflow systems offer process flexibility as opposed to flows embedded in enterprise or point systems. Workflow engines embed organisational roles and structures, policies, and business rules to support the flow and execution of work activities.

Collaborative Planning, Forecasting Replenishment (CPFR)

CPFR is a supply chain concept that enhances supplier and retailer integration. CPFR aids supply chain visibility through collaborative inventory management and replenishment. Using CPFR, suppliers have access to retail point of sales (POS) and constantly monitor sales and automatically generate replenishment orders.

Decision Support

Decision support systems (DSS) support organisational decision-making and problem solving. Davis (1993) highlights the importance of DSS in the modeling of uncertainty in the supply chain using statistical modeling techniques. DSS comprise of at least two components – data and analytical tools. Data for analytical purposes may originate from existing operational systems or sourced independently, transformed and stored in a central repository known as a data warehouse (DW) for analysis using access and analytical tools. According to Davenport and Harris (2007), higher degrees of business analytics return higher the competitive benefits. They define the range of analytical methods for decision analysis that vary from simple reporting systems to complex forecasting and optimisation techniques. The analytical tools usually support one or more methods by explaining current or past issues, highlighting trends and patterns or predicting future events.

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Software Agents

“An agent is an autonomous, goal-oriented software process that operates asynchronously, communicating and coordinating with other agents” (Fox, Barbuceanu, & Teigen, 2000, p. 166). Software agents act on behalf of human users in the performance of tasks like problem solving reduce production and distribution costs, improve inventory planning and equipment order scheduling (Nair et al., 2009). SCM agent categories include order acquisition agent, logistics agent, transportation agent, scheduling agent, and dispatching agent (Fox et al., 2000).

Information Sharing

Semi-automatic and automatic information transfer among supply chain members is facilitated by communications systems and supported by hardware devices and software applications.

Communication and Groupware Systems

Communication systems such as electronic mail and file transfer protocol (FTP) support the asynchronous exchange of information. Groupware systems are collaborative systems that support real-time exchange of ideas and information amongst teams. Groupware solutions include message boards, chat and other communications tools, scheduling and document sharing.

Electronic Data Interchange (EDI)

Designed in the 1970s, electronic data interchange (EDI) is a specialised inter-organisational system that combines the communications network with structured business-to-business data exchange (Holland et al., 1992; Nair et al., 2009). Along with the communications interface between supply chain partners, EDI supports the secured structured exchange of standard data such as purchase orders, invoices and the like. For example, in the purchase of automobile raw materials, Chrysler motor company uses EDI to communicate orders with suppliers. Information sharing concepts that commenced with EDI have evolved; revolutionising material identification and visibility across supply chains. The availability of information aids the coordination of supply chain activities as well as planning and decision-making.

Tracking Systems

Visibility of materials in the supply chain has been enhanced through tracking systems and services. In business-to-business (B2B) transactions, tracking applications in warehouse and distribution enhance inventory management and reduce losses. In business-to-consumer (B2C) environments, tracing the movement of goods enhances customer service.

Material Identification Systems

Identification systems such as barcodes support the movement of materials in the supply chain. Barcodes are printed machine-readable code patterns comprising of vertical parallel lines of varying widths. Designed to automate the supermarket checkout, barcodes also aid inventory management in retail environments.

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GS1, a not-for-profit agency with a membership of more than 2 million companies in over 110 countries, is responsible for the management of identification and capture standards such as barcode assignments.

Barcodes, developed to ease supermarket data processing, were adopted in April 1973, following numerous research and development iterations. The first barcode standard, Universal Product Code (UPC) is a 12-digit code comprising of two 6-digit halves containing manufacturer and product information. Barcode formats and applications have evolved and extended beyond the supermarket. For example, the 13-digit European article numbering (EAN) system is a refinement of UPC; industrial codes printed on corrugated packaging are now used in warehouse environments.

In spite of the widespread application of barcodes, their storage limitations have contributed to the evolution of alternative systems. 2D matrix or quick response (QR) codes are data-embedded machine-readable optical codes with higher storage capabilities.

Originally developed for the automobile industry, QR codes are gaining popularity and acceptance in marketing applications. Radio-frequency identification (RFID) tags are another alternative identification system capable of storing more information than barcodes (Nair et al., 2009). Unlike printed barcode labels read by scanners within a specific line of sight, RFID tags are classified as smart because they transmit information wirelessly (radio frequency) over communication networks. RFID tags require an energy source upon which classification is dependent. RFID tags are passive, active or battery-assisted passive. Active tags are installed with batteries and transmit periodically; battery-assisted passive (BAP) tags contain a battery that is made active when an RFID reader is detected; passive tags do not have any energy source.

Data Collection Systems

Barcode scanners read data stored in barcode patterns. Barcode readers are available in pen, handheld and flatbed formats. Barcode readers deployed at the point of sale (POS) are usually connected to computer systems and specialised retail software applications. A specialised handheld device comprising of a barcode scanner with data storage and transmission capabilities supports inventory and warehouse management applications. The data captured using the barcode scanner is either transmitted in real-time (using wireless connectivity) or in batch mode (from a network accessible dock).

Higher-end devices known as handheld computers, embedded with barcode scanning, data storage, communications and digital signature capture capabilities that support mobile field work and reduces the need for data re-entry. Imaging scanners on mobile devices are used to read 2D Matrix or QR codes. RFID readers are classified by the interrogation (radio signal receipt) system that may be passive reader active tag (PRAT), active reader passive tag (ARPT), or active reader active tag (ARAT).

Connectivity

Communications systems enhance information and material visibility (locations) through data communication networks and global positioning systems (GPS).

Data Communications Networks

Data communication systems or networks facilitate information flow and exchange and are the bedrock of supply chain integration and collaboration within the internal organisation and across the extended

Information and Communications Technology (ICT) and the Supply Chain*Table 4. Communications network characteristics*

| System | Geographic Expanse | Technologies | |
|---------------------------------|-----------------------|--|--|
| | | Wired | Wireless |
| Global area network (GAN) | International | Undersea fiber optic cable | Satellite |
| Wide area network (WAN) | Inter-city | Fiber optic cable | Satellite, Cellular (radio frequency), Microwave |
| Metropolitan area network (MAN) | Intra-city metropolis | Fiber optic cable, digital subscriber line (DSL) | Satellite, Cellular, Microwave |
| Local area network (LAN) | Location | Ethernet (twisted pair cable) | Wi-Fi |
| Personal area network (PAN) | Personal devices | USB Computer Cable | Bluetooth, Wi-Fi |

enterprise. These networks that provide connectivity between computer systems are characterised by the range (geography), medium (technology) and speed (bandwidth) and can be deployed in closed or open settings within an organisation or across organisations. Table 4 illustrates the network characteristics, identifying systems by geographic reach and wired and wireless technologies.

Global Positioning Systems (GPS)

Global positioning systems (GPS) are satellite-based navigation systems that provide near accurate locations of materials embedded with GPS receivers such as smartphones and vehicles. GPS device capabilities include mapping, navigation, traffic congestion and more. Logistics providers use them to optimise delivery efficiency as they aid navigation and routing of supply chain deliveries. Connectivity is foundational to information sharing and supply chain integration. The availability of connectivity systems facilitates semiautomatic and automatic information exchange and intra- and inter-organisational integration.

Supply Chain and the Internet

The Internet, INTERNational NETwork, supports information dissemination, communication and data transfer services. In the contexts of supply chain management, the Internet supports core supply chain management tenets – collaboration, process integration and connectivity. The interconnectedness the Internet brings to supply chains reduces transaction costs and simplifies business processes whilst providing access to new markets and organisation integration. In B2C contexts, the Internet enhances customer interactivity, while in B2B contexts supports coordination and customer relationship management (Graham & Hardaker, 2000).

Internet EDI

From the communications perspective, the implementation time and costs associated with the deployment of EDI solutions has resulted in the adoption of the Internet as a communications platform between supply chain partners (Lancioni, Smith, & Oliva, 2000) and the subsequent launch of Internet EDI. Internet EDI brings the data exchange features of EDI using the Internet as the communications network instead of the atypical dedicated value added network (VAN).

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E-Supply Chain Applications

E-supply chain refers to supply chain processes and activities managed with web-based technologies. E-supply chains enhance supply chain collaboration using intra- and inter-organisation networks known as intranets or extranets respectively. Other relevant application technologies include workflow systems, groupware and corporate portals. The application of the Internet in supply chain business activities are summarised alongside benefits in Table 5 (Lancioni et al., 2000).

Internet Type Networks

Internet-style services and communications systems for use within the internal organisation (intranet) and amongst a closed group of partners (extranet) have also evolved to enhance supply chain communication and collaboration and e-supply chains.

Table 5. The Internet and supply chain management

| SC Activity | Internet Application | Benefits |
|----------------------------------|---|---|
| Collaborative Manufacturing | Group-based production scheduling Computer-aided engineering/design | Reduces production costs, time to market |
| Procurement | Vendor communications Price checks Catalog purchases | Reduce paperwork flows Reduce order-cycle time |
| Supplier Relationship Management | Raw material stock monitoring Purchases and price checks Delivery monitoring | Improve vendor performance Reduce purchasing costs Supports strategic vendor alliances Effective service contract performance monitoring |
| Production Scheduling | Coordinate schedules amongst production partners/ vendors | Minimise production scheduling difficulties Improves communications Improves sales forecasting accuracy |
| Transport Management | Monitoring materials movements - pickups and drop offs Tracking shipments Claims reporting and processing | Reliable shipping performance Eases claims handling |
| Inventory Management | Stock-level (stock-outs) communications/notifications Order shipment delays | Proactive inventory management - lower stock levels, high level of customer service |
| Order Fulfillment/Processing | Order placement Order status monitoring Vendor price checking | Reduce order-cycle time Reduce error rates Improves order accuracy |
| Customer Service | Customer complaints management Customer notifications Technical support | Reduced service response times Resolution of customer problems Enhanced customer communications 24/7/365 operations |
| Customer Relationship | Product sales and marketing | Improved customer satisfaction Increased likelihood of repurchase and loyalty |
| Returns | Managing returns | Efficiency |

Information and Communications Technology (ICT) and the Supply Chain**XML Information Exchange**

XML or eXtensible Markup Language is an Internet-based data exchange standard. As a markup language, the information to be exchanged is embedded within the XML text using specialised and extensible markup tags. Unlike EDI that requires dedicated communications links and software, XMLs open standard and the information highway make it accessible to a larger body of users. In the supply chain, XML is used to process transactions in e-procurement applications or online marketplaces.

Virtual Private Networks (VPN)

The openness of the Internet has inhibited its by corporate entities who demarcate systems as either internal or external. In this era of mobility, organisations are deploying virtual private networks (VPN) to extend private corporate networks over the Internet. VPNs permit authorised users access to systems on internal networks without compromising system security. The Internet provides alternative connectivity infrastructure to traditional connectivity networks. In addition, the Internet is championing other supply chain functions like process integration and information sharing. The availability of multiple services online is transforming ICT infrastructure costs from capital to operating.

The framework classifying ICT in the supply chain (see Figure 6) shows supply chain objectives and the roles played by ICT alongside the diverse supporting ICT infrastructures, illustrating multi-functional and multi-level support ICT provides.

Figure 6. Classification framework of ICT in SCM

| SC Coordination | SC Collaboration | SC Connectivity |
|--|-----------------------------------|---|
| Business process integration | Information Sharing | Networks |
| Process-driven applications | Communication & groupware systems | Data communications networks |
| Integrated/enterprise applications | XML information exchange | Global positioning systems (GPS) |
| Workflow applications | | Internet-type networks (Intranet, Extranet) |
| Decision Support Systems (DSS) | | Virtual private networks (VPN) |
| Software agents | | |
| E-Supply Chain Applications | | |
| Tracking Services | | |
| Collaborative Planning, Forecasting and Replenishment (CPFR) | | |
| Data collection systems | | |
| Material identification systems | | |
| Internet EDI | | |
| Electronic Data Interchange (EDI) | | |

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FUTURE TRENDS

The future of ICT in SCM is continuously evolving with more advanced systems like Amazon's Prime Air, Apple's iBeacon, cloud computing, and the Internet of Things (IoT). Amazon Prime Air, a service aimed to deliver packages to customer homes within 30 minutes, plans to use drones to transport packages weighing less than five pounds. As Amazon awaits regulatory approval, China's Alibaba has commenced delivery trials. The Apple iBeacon technology is an indoor proximity system, which uses smartphones to notify customers in the proximity of an iBeacon. Beacons, also known as indoor GPS, are being deployed in retail environments to measure shopper behaviors and distribute coupons; for hotel check-in and indoor navigation, to name a few.

Cloud computing solutions like infrastructure as a service (IaaS) support the transition of large IT project costs from capital to operational; platform as a service (PaaS) applications support the introduction of new business solutions without increasing overheads and maintenance costs; software as a service (SaaS) applications support the access of software applications within and outside the enterprise. In this era, applications vendors are also offering cloud solutions (SaaS) in addition to on-premise installations. IoT is an emergent concept that supports the interconnectedness of everyday objects like refrigerators, taps, thermostats, clothing and so on using software agents. In the supply chain, examples of IoT will increase the number of supply chain participants and information flow as well as improve demand management and logistics. Thus, IoT will force the supply chain product cycle to perform more efficiently by reducing cycle time and cost. These developments will ultimately result in additional Internet applications and an extension of Table 5.

CONCLUSION

The significance of ICT in SCM is demonstrated by the catalogue of ICT infrastructure supporting diverse aspects of SCM and the development of intra- and inter-organisational systems. ICT is an integral part of SCM playing an active role across management and functional capacities using diverse infrastructure. Although ICT infrastructure benefits ultimately aim to enhance collaboration, integration and connectivity, generating reduced cycle times and costs. Auramo et al.'s (2005b) study identified additional operational benefits - improve customer service, efficiency, information quality and supply network agility.

Barriers resulting from inter-firm rivalry delimit the attainment of strategic benefits capable of increasing competitive advantage and business value or managerial complexities are resolved (Fawcett et al., 2008). These are the more difficult to assess managerial traits (Cooper & Lambert, 1997) that require the development of inter-organisational trust systems that enhance open information sharing and collaborative information systems management practices (Auramo, Kauremaa, & Tanskanen, 2005b; Fawcett et al., 2008).

However, it is worth noting that the abundance of ICT infrastructure for SCM functions and objectives do not connote efficiency. The realisation of benefits (strategic or operational) are not certain; but dependent on information systems development, management, use practices embedded in Cooper and Lambert's (Cooper & Lambert, 1997), is common in ICT implementations. Finally, strategic value is realised when ICT deployments surpass operational or transactional uses (ITExploit) and include analytical systems for tactical and strategic management purposes (ITExplore) (Anderson et al., 2007; Subramani, 2004). In summary, supply chain organisations desirous of strategic ICT value must ensure

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the presence of ICT deployments across management functions, inter-organisational trust, management traits and information systems management practices.

REFERENCES

- Anderson, D. L., Britt, F. F., & Favre, D. J. (2007). The 7 principles of supply chain management. *Supply Chain Management Review*.
- Auramo, J., Inkiläinen, A., & Kauremaa, J. (2005a). The roles of information technology in supply chain management. Presented at the 17th Annual NOFOMA Conference.
- Auramo, J., Kauremaa, J., & Tanskanen, K. (2005b). Benefits of IT in supply chain management – an explorative study of progressive companies. *International Journal of Physical Distribution & Logistics Management*, 35(2), 82–100. doi:10.1108/09600030510590282
- Bailey, J. E., & Pearson, S. W. (1983). Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science*, 29(5), 530–545. doi:10.1287/mnsc.29.5.530
- Bakos, Y. J., & Brynjolfsson, E. (1993). From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships. *Journal of Organizational Computing and Electronic Commerce*, 3(3), 301–328. doi:10.1080/10919399309540206
- Cachon, G. P., & Fisher, M. (2000). Supply Chain Inventory Management and the Value of Shared Information. *Management Science*, 46(8), 1032–1048. doi:10.1287/mnsc.46.8.1032.12029
- Chae, B., Yen, H. J. R., & Sheu, C. (2005). Information Technology and Supply Chain Collaboration: Moderating Effects of Existing Relationships between Partners. *IEEE Transactions on Engineering Management*, 52(4), 440–448. doi:10.1109/TEM.2005.856570
- Columbus, L. (2014, May 12). Gartner's ERP Market Share Update Shows The Future Of Cloud ERP Is Now. *Forbes*. Retrieved from <http://www.forbes.com/sites/louiscolombus/2014/05/12/gartners-erp-market-share-update-shows-the-future-of-cloud-erp-is-now/>
- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *The International Journal of Logistics Management*, 8(1), 1–14. doi:10.1108/09574099710805556
- Council of Supply Chain Management Professionals. (2013, August). Supply Chain Management Terms and Glossary. *Cscmp.org*. Retrieved from http://cscmp.org/sites/default/files/user_uploads/resources/downloads/glossary-2013.pdf
- Croxtan, K. L., Garcia-Dastugue, S. J., Lambert, D. M., & Rogers, D. S. (2001). The Supply Chain Management Processes. *The International Journal of Logistics Management*, 12(2), 13–36. doi:10.1108/09574090110806271
- Davenport, T. H., & Harris, J. G. (2007). *Competing with Analytics: the new science of winning*. Boston: Harvard Business Press.
- Davis, T. (1993). Effective supply chain management. *Sloan Management Review*.

Information and Communications Technology (ICT) and the Supply Chain

- Dedrick, J., Xu, S. X., & Zhu, K. X. (2008). How Does Information Technology Shape Supply-Chain Structure? Evidence on the Number of Suppliers. *Journal of Management Information Systems*, 25(2), 41–72. doi:10.2753/MIS0742-1222250203
- Delen, D., Hardgrade, B. C., & Sharda, R. (2007). RFID for Better Supply-Chain Management through Enhanced Information Visibility. *Production and Operations Management*, 16(5), 613–624. doi:10.1111/j.1937-5956.2007.tb00284.x
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: an International Journal*, 13(1), 35–48. doi:10.1108/13598540810850300
- Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. (2007). Information Sharing and Supply Chain Performance: The Role of Connectivity and Willingness. *Supply Chain Management: an International Journal*, 12(5), 358–368. doi:10.1108/13598540710776935
- Fox, M. S., Barbuceanu, M., & Teigen, R. (2000). Agent-Oriented Supply-Chain Management. *International Journal of Flexible Manufacturing Systems*, 12(2-3), 165–188. doi:10.1023/A:1008195614074
- Gartner Inc. (2014, May 12). Gartner Says Worldwide Supply Chain Management and Procurement Software Market Grew 7.3 Percent in 2013. *Gartner*. Stamford, CN. Retrieved from <http://www.gartner.com/newsroom/id/2735618>
- Graham, G., & Hardaker, G. (2000). Supply-chain management across the Internet. *International Journal of Physical Distribution & Logistics Management*, 30(3/4), 286–295. doi:10.1108/09600030010326055
- Gunasekaran, A., & Ngai, E. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), 269–295. doi:10.1016/j.ejor.2003.08.016
- Helo, P., & Szekely, B. (2005). Logistics information systems: An analysis of software solutions for supply chain co-ordination. *Industrial Management & Data Systems*, 105(1), 5–18. doi:10.1108/02635570510575153
- Holland, C., Lockett, G., & Blackman, I. (1992). Planning for Electronic Data Interchange. *Strategic Management Journal*, 13(7), 539–550. doi:10.1002/smj.4250130706
- Holmström, J., Främling, K., Kaipia, R., & Saranen, J. (2002). Collaborative planning forecasting and replenishment: New solutions needed for mass collaboration. *Supply Chain Management: an International Journal*, 7(3), 136–145. doi:10.1108/13598540210436595
- Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29(1), 65–83. doi:10.1016/S0019-8501(99)00113-3
- Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply Chain Management: Implementation Issues and Research Opportunities. *The International Journal of Logistics Management*, 9(2), 1–20. doi:10.1108/09574099810805807
- Lancioni, R. A., Smith, M. F., & Oliva, T. A. (2000). The role of the Internet in supply chain management. *Industrial Marketing Management*, 29(1), 45–56. doi:10.1016/S0019-8501(99)00111-X

Information and Communications Technology (ICT) and the Supply Chain

- Lee, H. L., Padmanabhan, V., & Whang, S. (2004). Information distortion in a supply chain: the bullwhip effect. *Management Science*, 50(12 Supplement), 1875–1886. doi:10.1287/mnsc.1040.0266
- Lee, H. L., So, K. C., & Tang, C. S. (2000). The Value of Information Sharing in a Two-Level Supply Chain. *Management Science*, 46(5), 626–643. doi:10.1287/mnsc.46.5.626.12047
- McDonnell, R., Sweeney, E., & Kenny, J. (2004). The role of information technology in the supply chain. *Logistics Solutions, the Journal of the National Institute for Transport and Logistics*, 7(1), 13–16.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). DEFINING SUPPLY CHAIN MANAGEMENT. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Moharana, H. S., Murty, J. S., Senapati, S. K., & Khuntia, K. (2011). Importance of Information Technology for Effective Supply Chain Management. *International Journal of Modern Engineering Research*, 1(2), 747–751.
- Nair, P. R., Raju, V., & Anbuudayashankar, S. P. (2009). Overview of Information Technology Tools for Supply Chain Management. *CSI Communications*, 33(9), 20–27.
- O'Brien, J. A. (2006). *Management Information Systems* (4th ed.). New York: McGraw Hill.
- Potter, F. (2005, January). The Informing Framework. *Strategic Finance Magazine*, 25–31.
- Sherman, R. J. (1998). Collaborative Planning, Forecasting & Replenishment (CPFR): Realizing the Promise of Efficient Consumer Response through Collaborative Technology. *Journal of Marketing Theory and Practice*, 6(4), 6–9. doi:10.2307/40469932?ref=no-x-route:9763fcd626c965e59e9abc17783faa9b
- Singh, J. (1996). The importance of information flow within the supply chain. *Logistics Information Management*, 9(4), 28–30. doi:10.1108/09576059610123132
- Stevens, G. C. (1989). Integrating the Supply Chain. *International Journal of Physical Distribution & Logistics Management*, 19(8), 3–8. doi:10.1108/EUM00000000000329
- Subramani, M. (2004). How do Suppliers Benefit from Information Technology Use in Supply Chain Relationships. *Management Information Systems Quarterly*, 28(1), 45–73.
- Sweeney, E. (2006). Managing Information Flows: the Key to Effective Supply Chain Integration. *Logistics Solutions, the Journal of the National Institute for Transport and Logistics*, 9(3), 18–21.
- Vanpoucke, E., Boyer, K. K., & Vereecke, A. (2009). Supply chain information flow strategies: An empirical taxonomy. *International Journal of Operations & Production Management*, 29(12), 1213–1241. doi:10.1108/01443570911005974
- Vargo, S. L., Maglio, P. P., & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, 26(3), 145–152. doi:10.1016/j.emj.2008.04.003
- Zhou, H., & Benton, W. Jr. (2007). Supply chain practice and information sharing. *Journal of Operations Management*, 25(6), 1348–1365. doi:10.1016/j.jom.2007.01.009

Chapter 29

Supply Chain Risk Management: A Review of the Literature

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ABSTRACT

The importance of supply chain management (SCM) has been increasing recently and the concept of supply chain risk management (SCRM) has been gradually expanded. Since the concept of risk and uncertainty permeates all organizational functions, risk management would seem to be a crucial step towards safeguarding a company's competitive advantage. In the case of modern supply chains, which are composed of complex relationships necessitated by competitive pressures such as outsourcing and globalization, understanding and implementing risk management processes and initiatives at various levels of the chain is essential (Peck, 2006). The purpose of this chapter is to conduct an extensive and structured review of the supply chain risk management (SCRM) literature in order to understand the importance of the risk management concept in the context of organizational supply chains, identify gaps, and suggest future research areas in this important and growing field.

INTRODUCTION

Earthquakes, hurricanes, floods, fires, strikes, terrorist attacks, political crackdowns, economic downturns, and epidemics are examples of events and incidents that may tremendously disrupt any supply chain. Obviously, these events coupled with supply chain's inherent operational risks constitute the potential and current risks and uncertainties for Supply Chains (SCs). The impact of these disruptions in both the short and the long term will definitely threaten the continuity of businesses. The cases cited most often in regard to ineffective supply chain risk management (SCRM) are Ericsson's huge 400 million Euro loss due to fire at its semiconductor sub-supplier plant, interruption of freight at US borders in the aftermath of the September 11 tragedy, and the Asian financial crisis and consequent crises and bankruptcy of many businesses in the 1990s. Boeing, Pfizer, and Cisco are other examples of businesses that have suffered unexpected losses of more than US\$2 billion each as a result of ineffective SCRM decisions (Hult, Craighead, & Ketchen, 2010).

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Supply Chain Risk Management

Given the ascending nature of disasters and increasingly complex network of relationships among buyers and suppliers, the main objective of this chapter is to help the reader to better understand the importance of managing risk in supply chains by exploring the concepts of risk and risk management in general, implications of risk in supply chains, and risk management steps and risk sources in network environments.

RISK AND RISK MANAGEMENT

Risk

Risk is a multidimensional construct of which a single definition may not be appropriate in all circumstances (Zsidisin, 2003). The word may originate from the early Italian word *risicare* (Bernstein, 1996), the Arabic word *risq*, or the classical Greek word *risicum* (Norrman & Lindroth, 2004; Paulsson, 2007). However, different people have different understandings of risk depending on their risk perception (Khan & Burnes, 2007). Historically, the study of risk can be traced as far back as the seventeenth century when famous mathematicians Blaise Pascal and Pierre de Fermat attempted to apply mathematics to gambling. However, over the years with advancement in technology and movement toward globalization, views of risk have changed tremendously (Khan & Burnes, 2007).

Bernstein (1996) states that “the actions we dare to take, which depend on how free we are to make choices, are what the story of risk is all about” (p. 8). Explicit in this explanation is the important aspect of choice, and implicit is the notion of positive and negative aspects of risk. While the negative connotations of risk pervade the thinking and feeling of most managers (March & Shapira, 1987), some scholars stress the dichotomy of risk (Moore, 1983; Waters, 2007). However, when it comes to an organization’s perception of risk, again the negative implications – primarily caused by technological advancements – override the positive (March & Shapira, 1987).

Risk Definitions

Risk is a difficult concept to define and could have different meanings depending on the area of research (Zhao, Huo, Sun, & Zhao, 2013; Wagner & Bode, 2008). Several important studies examine the concept of risk, including seminal works by Baird and Thomas (1990), Yates and Stone (1992), and March and Shapira (1987). However, the definition of risk most often cited in supply chain literature is that of March and Shapira (1987): “the variance in the probability distribution of outcomes, their likelihood and their subjective values” (p. 1404).

Based on classical decision theory, discussions about risk are instigated where it is considered to be a part of management, insurance, environmental, and psychological studies (Brindley & Ritchie, 2004; Peck, 2006). For example, Sitkin and Pablo (1992) define risk as “the extent to which there is uncertainty about whether potentially significant and/or disappointing outcomes of decisions will be realized” (p. 10). In the same vein, Peck (2006) states that “risk is the possible upside and downside of a single rational and quantifiable (financial) decision, usually illustrated with examples from gambling” (p.130).

Moreover, MacCrimmon and Wehrung (1986) consider risk to be comprised of three components: magnitude of loss, chance of loss, and potential exposure to loss. Similarly, Yates and Stone (1992)

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maintain that risk involves potential losses, significance of losses, and uncertainty associated with losses. Mitchell (1995) also states that the concept of risk takes into account various types of loss, where the risk of any type of loss is a product of the probability of that loss, $P(\text{Loss})$, and the significance of that loss, $I(\text{Loss})$, for the organization. That is, $\text{Risk} = P(\text{Loss}) * I(\text{Loss})$.

However, Kaplan and Garrick (1981) and Kaplan (1997) give an operational definition of risk which clearly divides the concept of risk into more detailed elements (Paulsson, 2007). They argue that answers to three questions (a so-called “set of triplets”) will constitute the risk analysis. These questions are: “1 – What can happen?; 2 – How likely is that to happen?; and 3 – If it does happen, what are the consequences?” (Kaplan, 1997, p. 408).

Risk vs. Uncertainty

Though risk and uncertainty are linked, they differ in terms of measurability. According to Knight (1921), risk is measurable and allows estimates to be made of the probabilities of outcomes, while uncertainty does not. In contrast, Vilko, Ritala, and Edelmann (2014) believe that uncertainty has a quantifiable (controllable and manageable) perspective that shows a kind of “basic uncertainty”, whereas “Knightian uncertainty” refers to immeasurable risks that cannot be quantified. Echoing Knight’s perspective, Waters (2007) states that “uncertainty means that we can list the events that might happen in the future, but have no idea about which will actually happen or their relative likelihoods” while “risk means that we can list the events that might happen in the future, and can give each a probability” (p.18). In contrast, Yates and Stone (1992) argue that “every conception of risk implies the uncertainty about the prospective outcome and if the probability of those outcomes is known, there is no risk” (p. 200).

Risk Perception

Managers are always making decisions that have short- and/or long-term impacts on the success or failure of their business. These decisions are generally determined by the managers’ risk perceptions of the available options. In fact, risk perception is contextualised through the decision maker’s attitude towards risk, his relevant prior experience, and the state of associated rewards and penalties (Chicken, 1996; Ritchie & Brindley, 2007). Moreover, researchers find that social values and trust have unique influence on people’s risk perception (Chicken, 1996). Indeed, trusting relationships create a less uncertain environment for transactions. This, in turn, impacts the risk aversion or preference of involved parties. *Table 1* shows the different states of trust versus risk.

Table 1. Trust versus risk

| Trust | Risk |
|---|---------------------|
| Knowing they will do what they said that they would | Fear of the unknown |
| Having faith | Unpredictable |
| A willingness to participate | Chance of failure |
| An understanding | Take advantage |
| Being predictable | Unprotected |

Source adapted from (Cousins, 2002)

Supply Chain Risk Management

Risk: Objective or Subjective Construct?

Whether risk is an objective attribute or a subjective phenomenon is an issue that has long been controversial (Yates & Stone, 1992; Bernstein, 1996). At least two major ideologies exist: the technico-scientific perspective which conceives risk as a physical attribute, and the socio-cultural perspective which perceives risk as a social construct (Bradbury, 1989; Lupton, 1999). Engineers and physical scientists tend to view risk from the technico-scientific approach (Royal Society, 1992). They believe that risk is a product of probability and severity (Lupton, 1999).

As Lupton (1999) highlights, the socio-cultural perspective considers social, cultural and contextual factors in which risk is realized and understood. In this regard, it aims to discern those aspects that technico-scientists have been criticized for ignoring. Bernstein (1996) brilliantly directs this debate to one fundamental question: To what extent will the past determine the future?

We cannot quantify the future, because it is unknown, but we have learned how to use numbers to scrutinize what happened in the past. But to what degree should we rely on the patterns of the past to tell us what the future will be like? Which matters more when facing a risk, the facts as we see them or our subjective belief in what lies hidden in the void of time? Is risk management a science or art? Can we even tell precisely where the diving line between the two approaches lies? (Khan & Burnes, 2007, p.200)

Although authors in SCRM perceive risk from different perspectives, the combination of subjective and objective approaches seems to give a much more realistic picture of the phenomenon.

Risk Management in General

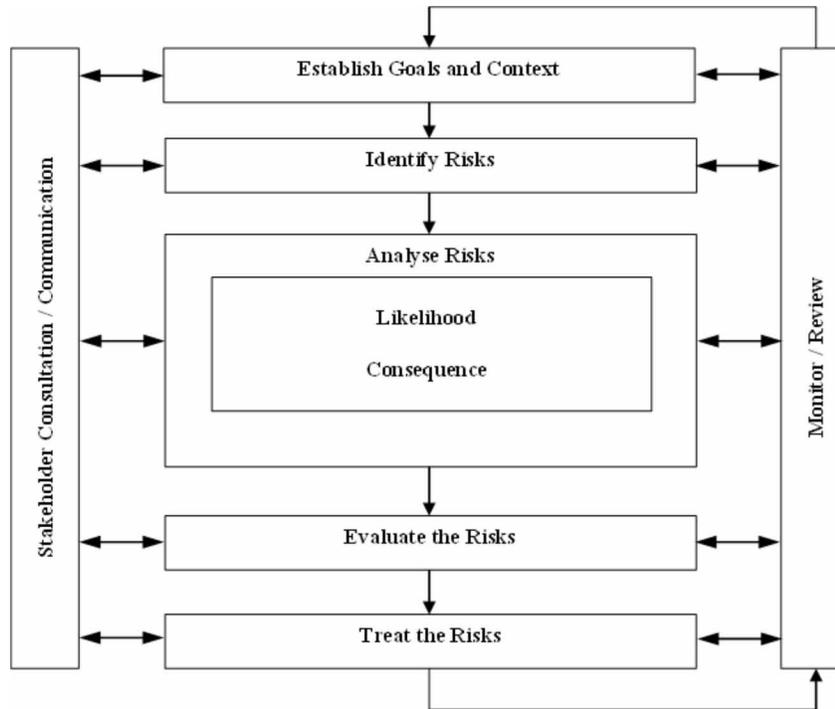
Risk management entails processes, components, and elements for risk treatment. Practically, this can be accomplished by reducing either the probability of occurrence, the severity of impact, or both (Norman & Lindroth, 2004; Vanany, Zailani, & Pujawan, 2009). The Royal Society (1992) defines risk management as “the process whereby decisions are made to accept a known or assessed risk and/or the implementation of actions to reduce the consequences or probability of occurrence” (p. 201).

The steps involved in a formal risk management process are: establishing goals and context, identifying risk, analysing risks, estimating risk level, evaluating the risks, and eventually treating the risk. The graphical representation of these steps is presented in *Figure 1*. The concept of risk and risk management appears to be borrowed by many disciplines, such as finance and economics. However, as this proposal is in the area of SCM, the next sections will deal with risk in supply chains and networks.

Supply Chain Risk Management (SCRM)

Supply Chain Risk

Although numerous studies examine risk management in a single organization, not all of their findings and practices can be applied in a supply chain risk context. This is because supply chains consist of at least three members (supplier, focal firm, and customer) (Mentzer, DeWitt, Keebler, Min, Nix, & Smith,

Supply Chain Risk Management*Figure 1. Risk Management Steps**Source adapted from Standards New Zealand, 2009*

2001); hence, focal firms must consider not only their own risk but also those of their partners (Jüttner, 2005). In fact, the greatest risks in supply chains are those that might disrupt the flows of materials, information and funds between upstream and downstream partners (Jüttner, 2005).

Supply chain risk is “the potential occurrence of an incident or failure to seize opportunities with inbound supply in which its outcomes result in a financial loss for the firm” (Zsidisin & Ellram, 2003, p. 397). This emphasizes the costly consequences of risk in SCs if that risk is not managed and alleviated. Supply chain risk can be viewed from both horizontal and vertical perspectives. The horizontal perspective, as discussed above, concerns the transition from a single organization view to a supply chain view, which also signals the holistic view of risk in supply chains (Svensson, 2004). The vertical perspective, on the other hand, views a supply chain as a multi-tiered structure that links value streams, organizations, industries and economies. Therefore, a new unit of analysis to study risk in supply chains seems to be relevant (i.e., a supply chain network) (Peck, 2006).

Interestingly, the lens of visibility of supply chain risks to the focal firm, in both horizontal and vertical perspectives, decreases as it goes to the second or third tier of suppliers or customers, or from an internal to an external firm environment (Harland, Brenchley, & Walker, 2003). In reality, supply chain risk is a very broad discipline and one should precisely define the scope and span of research in order to thoroughly investigate the topic. Researchers were particularly drawn to the topic of management and mitigation of supply chain risks after the September 11 attacks. In the next section, research developments within the area of SCRM are discussed.

Supply Chain Risk Management

Table 2. SCRM definitions

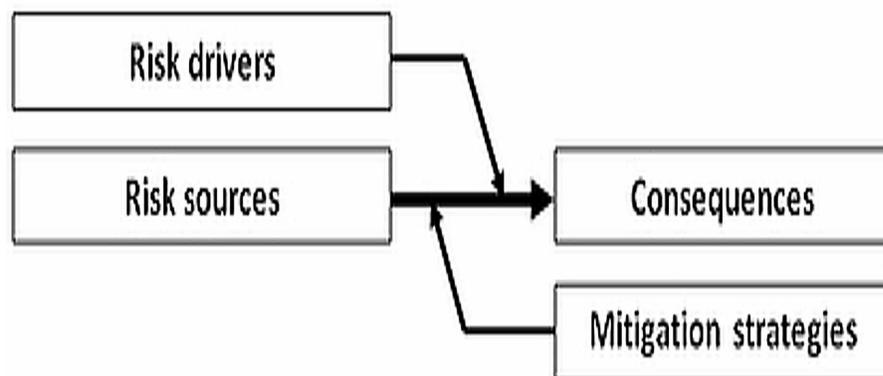
| Author(s) | Definition |
|---|---|
| Norrman & Jansson (2004) | “Supply chain risk management is to [collaborate] with partners in a supply chain apply risk management process tools to deal with risks and uncertainties cause by, or impacting on, logistics related activities or resources” |
| Jüttner, Peck, & Christopher (2003) | “The identification and management of risks for the supply chain, through a co-ordinated approach amongst supply chain members, to reduce supply chain vulnerability as a whole” |
| Faisal, Banwet, & Shankar (2007) Ghagde, Dani, and Kalawsky (2012) | “The process of risk mitigation achieved through collaboration, coordination and application of risk management tools among the partners, to ensure continuity coupled with long term profitability of the supply chain” “Supply chain risk management is a function that aims to identify the potential sources of risk, and to implement appropriate actions to avoid or contain supply chain vulnerability” |

Supply Chain Risk Management Definition

Though they may use different labels for stages in risk management, scholars tend to agree that risk management entails activities and actions to tackle and reduce risk. In the context of supply chains, Tang (2006) defined risk management as “the management of supply chain risks through coordination or collaboration among the supply chain partners so as to ensure profitability and continuity” (p. 453). Some other definitions of SCRM can be seen in *Table 2*.

Interestingly, the underlying factor in these definitions is the collaborative relationships between supply chain members in order to manage internal and external risk and uncertainty. Moreover, Jüttner, Peck, and Christopher (2003) distinguish four relevant constructs: SC risk sources, SC risk drivers, SC risk consequences, and SC risk mitigation strategies (*Figure 2*). They stress that the purpose of such taxonomy is twofold: 1 – to clearly define and probe the concept of SCRM; and 2 – to precisely synthesize the emergent themes and issues for future research in SCRM.

Figure 2. Basic Constructs of SCRM
Source adapted from Jüttner, et al., 2003



Supply Chain Risk Management

Risk Management Steps in Supply Chain

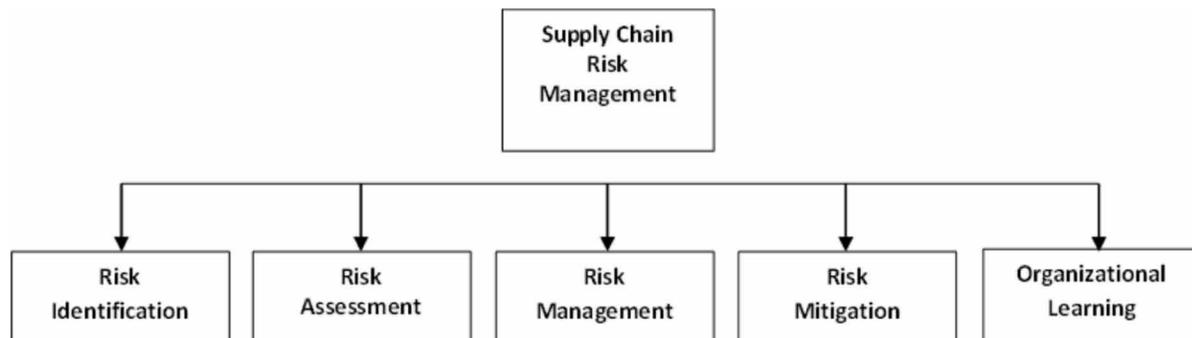
Basically, SCRM involves four main stages: risk identification and modeling, risk assessment (analysis, estimation), risk management, and risk mitigation and monitoring (evaluation) (Khan & Burnes, 2007; Norrman & Lindroth, 2004; Vanany et al., 2009; Waters, 2007; Zsidisin & Ritchie, 2008). The first step, risk identification, deals with comprehensive and structured identification of risk sources or triggers, and characterization of potential risks (Tummala & Schoenherr, 2011). In this step, the ultimate goal is to create a list of significant risks, their risk drivers and possible adversarial impacts to the supply chain. According to Waters (2007), risk identification is a critical stage in risk management as it creates a foundation for other steps.

Secondly, the likelihood of potential disruptive events and their resulting consequences is analyzed. The third stage consists of planning of strategies, scenarios and further judgment about their merits and demerits (Aloini, Dulmin, Mininno, & Ponticelli, 2012). Finally, monitoring of the solutions and their impact on business continuity and performance is performed (Zsidisin & Ritchie, 2008) (Figure 3). In 2008, Zsidisin and Ritchie added one more step to the above mentioned SCRM steps. The fifth step, organizational and personal learning including knowledge transfer, seeks to capture, analyze and spread lessons and experiences with other supply chain members (Rangel, Oliveira, & Leite, 2014).

The numerous tools and techniques for different risk management steps can be broadly categorized as qualitative, quantitative or control techniques. Similarly, in a study of seven manufacturing and aerospace companies, Zsidisin, Ellram, Carter, and Cavianto (2004) maintain that risk identification techniques fall into four categories: qualitative, quantitative, formal, and informal. Furthermore, Waters (2007) states there are various types of tools for identifying risk, including tools for analyzing past events (e.g., five whys, cause and effect diagram, Pareto analysis, checklists), tools to collect opinions (e.g., interviews, group meetings, Delphi method), and tools to analyze operations (e.g., process charts, process control, structured brainstorming).

Supply chain risk management should be holistic in approach and incorporate multiple views in order to avoid potential and actual risks. Therefore, it should rely not only on traditional methods such as forecasting, but also modern approaches such as scenario planning, expert panels and Delphi studies (Smallman, 1996).

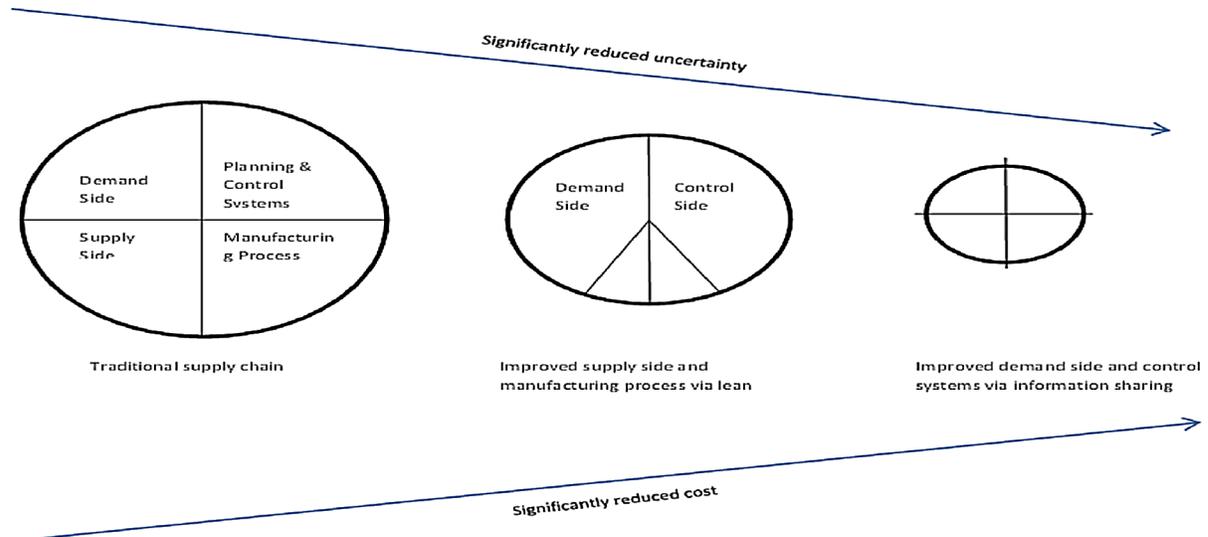
Figure 3. SCRM Stages
Source adapted from White, 1995; Rangel et al., 2014



Supply Chain Risk Management

Figure 4. Shrinking uncertainty circle for enhanced performance

Source adapted from Mason-Jones & Towill, 1998



Risk Sources in Supply Chain

The extant SCRM literature has proposed various ways of classifying risk sources (risk types), highlighting the diversity in approaches to the subject matter. Additionally, as many authors (Trkman & McCormack, 2009; Zsidisin, 2003) note, different industries and supply chains are exposed to different sets of risk sources. The classification cited most often originates from the work of Mason-Jones and Towill (1998) which examined the concept of shrinking the uncertainty circle in supply chains through reducing supply, demand, value-added process, and control mechanism uncertainties (Figure 4).

Christopher and Peck (2004) add a new dimension of environmental risk to the uncertainty circle and suggest three risk categories, each with its own subdivisions: internal to the firm (process, control), external to the firm but internal to the SC network (demand, supply), and external to the SC network (environment). Internal risk arises from risks in operations, such as problems in IT system quality or general disruptions to internally owned or managed assets and functioning infrastructure (Christopher & Peck, 2004), or from risks relating to managers' decisions, such as incorrect order or batch size, safety stock policies and delivery schedules.

The next category, risk external to the firm but internal to SC, arises from reliability issues, availability of material, lead times, delivery and quality of suppliers as well as volatility in customer demand, order processing and payments. Generally, supply and demand risk sources are any that pose risks to SC flows (information, product/service, financial, and materials) from upstream to downstream (Christopher & Peck, 2004). Finally, external risk arises from interactions between the supply chain and the environment, such as legislation, natural disasters, wars, and epidemics (Waters, 2007).

Jüttner et al. (2003) propose three sets of risk sources: environmental risks, organizational risks, and network risk. Environmental risk sources are defined as any type of uncertainties arising from the interaction of supply chain and environment, such as accidents, socio-political actions and acts of God; organizational risk sources are any type of risk sources within the boundary of supply chain members,

Supply Chain Risk Management

such as labor strike, production glitches, and conflict with Information Technology (IT) systems; and network risk sources are those that arise from interactions between members of a supply chain.

Furthermore, Jüttner (2005) distinguishes between environmental, supply and demand risk sources on one side and process and control risk sources on the other. She remarks that environmental risks are external, and supply and demand risks are internal to supply chains. Her definition of environmental risk sources comprises any external uncertainty, including political, natural and social uncertainties. Zsidisin, Panelli, and Upton (2000) define supply risk as “the transpiration of significant and/or disappointing failures with inbound goods and services” (p. 187), while Svensson (2002) defines demand risk as risk associated with outbound logistics flows. Apparently, these sources of risk overlap as environmental risk can itself cause supply or demand risk.

Jüttner (2005) further explains that process and control risks can act as amplifiers or absorbers of the effects of risk in the SC. Based on her definition, process (as a source of risk) refers to “the design and implementation of processes within and between the entities in the supply chain” (p. 123) and control risk maintains its prior definition “assumptions, rules, systems, and procedures that govern how an organization exerts control over the processes” (Christopher & Peck, 2004, p. 10). The overarching idea in this updated version of risk classification is a network view of the risk as relationships or links that connects supply chain members.

According to Waters (2007), risk sources can be categorized based on flows of materials, funds, and information in a supply chain. In turn, the ways these flows are organized will create another source of risk. Therefore, four sources of risk are identified: physical risk, financial risk, information risk, and organizational risk (see *Table 3*).

Norrman & Lindroth (2004) argue that taking only business risks (e.g., financial, legal, currency) is not sufficient when the supply chain perspective is of interest. They also note the importance of a holistic view including all parties in the chain and dedicating more attention to operations-related logistics and SCM activities. In fact, they categorize risk sources as operational accidents, operational catastrophes, and strategic uncertainty. Operational accidents (e.g. truck accidents) have more probability and less impact, while operational catastrophes (e.g. earthquake) are vice versa. Authors maintain that strategic uncertainties are more unknown and therefore hard to tackle.

Table 3. Risk sources based on various flows

| Risk Source | Include Risk To | Appeared As |
|---|---|---|
| Physical risk (movement & storage of materials) | transport, storage, delivery, material movement, inventory systems | late delivery, interrupted transport, damage to goods, shortage of stock, missing products, accidents |
| Financial risk (flows of money) | payments, cash flows, debt, investments, accounting systems | poor returns on investment, excessive costs, unpaid bills, shortage of cash, missing accounts |
| Information risk (systems & flows of information) | data capture and transfer, integrity, information processing, market intelligence, system failure | missing data, errors in information, breaches of data security, systems failure, incorrect transactions |
| Organizational risk (links between members of the SC) | relationships between suppliers and customers, alliances, shared benefits | poor communications, lost customers, problems with supplies, disagreements over contracts, legal disputes |

Source adapted from (Waters, 2007)

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Interestingly, Peck (2005) takes another perspective and discusses multi-level risk analysis. She believes that sources of supply chain risk operate at four different levels in the chain. The first level refers to the prevailing process engineering-based SCM perspective. It is based on the idea that supply chain members act and work together to facilitate the flows of information and material run through the logistics pipelines within and between the SC members. The second level addresses the assets and infrastructure needed to carry these flows (e.g., factories, distribution centres). The third level considers supply chain as inter-organizational networks, in which individual organizations in commercial and public sectors own or manage the assets and infrastructure to let materials and information flow swiftly. The fourth level is the wider macroeconomic environment within which organizations do business, assets and infrastructure are positioned and value streams flow.

In line with most other methods of risk source classification, Trkman and McCormack (2009) broadly categorize sources as endogenous (within the SC) and exogenous (outside the SC), following the work of Ritchie and Brindley (2000). Endogenous risk sources comprise market and technology turbulence, while exogenous risk sources include discrete and continuous risks. Further details can be seen in *Table 4*.

In a more extensive study, Rangel et al. (2014) propose a SC risk classification system that includes 14 types of risk that can occur in the plan, source, make, delivery and return processes (see *Table 5*). This classification improves understanding and management of risks in a SC through facilitating risk identification and indicating the process in which the risk can occur.

GAP ANALYSIS AND FUTURE RESEARCH

This chapter makes an important contribution to the theoretical understanding of supply chain risk management through an extensive review of the literature in this area. Although much research has centred on the concept of risk and risk management in a supply chain context, the lack of consensus among researchers in some areas, such as risk management types, is apparent. Future research may focus on standardizing supply chain risk sources based on industry type and providing an industry-based risk classification system.

CONCLUSION

Increasing product/service complexity, propensity in outsourcing business activities and pressure from globalization process all have increased the risk and uncertainty in supply chain networks. This has encour-

Table 4. Endogenous/exogenous risk classification

| Trkman & McCormack (2009) | | | | Ritchie & Brindley (2000) | |
|---------------------------|----------------------------------|--|---------------------------------------|--|--|
| Endogenous | | Exogenous | | Endogenous | Exogenous |
| Market turbulence | Technology turbulence (whole SC) | Discrete events (e.g. terrorist attacks) | Continuous risk (e.g. inflation rate) | The quality of internal financial control systems, effective management structures | Technology, developments, changing customer tastes |

Source adapted from (Trkman & McCormack, 2009)

Supply Chain Risk Management*Table 5. Supply chain risk classification*

| Process | Risk | Definition |
|----------|---------------|---|
| Plan | Strategic | Characterized by any event affecting the business strategy, such as a lack of strategic planning (both organizational and SC-dependent) and the absence of a systemic perspective |
| | Inertia | Defined by the inability to remain in a competitive market, usually caused by the failure of the organization and/or chain to follow the market changes (e.g. technology, design, function, etc.) |
| | Informational | Results from failure in the information system due to deficient data feed systems or electronic systems or the inability to receive, transfer and access information |
| | Capacity | Caused by effective production over- or underutilization capacity, lack of flexibility to respond to changes in demand or even the inability of some links (SC members) to plan, schedule and control production and inventory management |
| | Demand | Occurs when there is poor demand forecasting (in terms of quantity and mix), seasonality, long lead times, short product life cycles, small customer bases or information distortion due to promotions and incentives. May result in the bullwhip effect |
| Source | Supply | Stems from inefficiencies in the supply chain process (e.g. an increase in the price of some inputs, suppliers' lack of responsiveness, unavailability of inputs in terms of quantity and/or quality) and problems in internal product flow |
| | Financial | Arises from cash flow problems (product pricing, delinquencies by debtors, non-payment) and changes in the financial market (taxes, exchange rates, licenses, etc.) |
| | Relational | Stems from the relationship among supply chain links (members), such as members' lack of visibility, opportunism, trust in information transfer, sub-par cooperation and interaction among members and outsourcing (e.g. a supplier supplying the chain and its competitors or a supplier redesigning parts and creating its own product) |
| Make | Operational | Results from situations preventing the focal company from performing its production activities, which may be related to problems with production systems, internal policies, procedures, processes and people |
| | Disruption | Results from discontinuity in the materials flow in the production process (following suspension in activities that add value to the customer), for example, arising from the reliance on a single source of supplies and labor strikes |
| Delivery | Customer | Focuses on situations that modify customer choice, reducing the number of applications, e.g. product obsolescence, product delivery, customer service (before, during and after the order request) and confidence loss in the product or brand |
| Return | Legal | Begins with the inability of the organization and/or the chain to comply with legal restrictions or further exposure to litigation |
| Others | Environmental | Stems from events outside the chain, e.g. natural disasters and uncertainties in governmental (legislation, regulatory), economic, technological and social policies |
| | Culture | Defined by the difference in business culture among the links (members) of the chain or differences in the culture, language and people in the countries in which they are located |

Source adapted from (Rangel et al., 2014, Page:19)

aged more studies addressing the topic of SCRM. This chapter aimed to provide a better understanding of risk management construct in supply chain using an extensive review of the literature. The present literature review is based on the latest publications in the areas of supply chain risk management in reputable international journals, books, doctoral dissertations, and credible reports. This chapter addressed the concepts of risk and risk management in general and in the supply chain, and more importantly, the difference between risk and uncertainty. Moreover, identification of different types and sources of supply chain risk as the first stage of every SCRM process was explained.

Supply Chain Risk Management

This extensive and structured review of the supply chain risk management literature is constructed to provide basic knowledge for all researchers interested in conducting research in any aspect of supply chain risk management. It also provides a basis for future studies that may further enhance our understanding of the importance of managing risks in supply chains.

REFERENCES

- Aloini, D., Dulmin, R., Mininno, V., & Ponticelli, S. (2012). Supply chain management: A review of implementation risks in the construction industry. *Business Process Management Journal*, *18*(5), 735–761. doi:10.1108/14637151211270135
- Baird, I., & Thomas, H. (1990). What is risk anyway? Using and measuring risk in strategic management. *Risk, strategy, and management*, *5*, 21–54.
- Bernstein, P. L. (1996). *Against the gods: The remarkable story of risk*. New York: Wiley.
- Bradbury, J. A. (1989). The policy implications of differing concepts of risk. *Science, Technology & Human Values*, *14*(4), 380–399. doi:10.1177/016224398901400404
- Brindley, C., & Ritchie, B. (2004). Introduction. In C. Brindley (Ed.), *Supply chain risk*. Hampshire: Ashgate Publishing Limited.
- Chicken, J. C. (1996). *Risk acceptability and decision-making*. *Risk handbook* (pp. 12–41). London: International Thomson Business Press.
- Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *International Journal of Logistics Management*, *15*(2), 1–14. doi:10.1108/09574090410700275
- Cousins, P. D. (2002). A conceptual model for managing long-term inter-organisational relationships. *European Journal of Purchasing & Supply Management*, *8*(2), 71–82. doi:10.1016/S0969-7012(01)00006-5
- Faisal, M. N., Banwet, D. K., & Shankar, R. (2007). Quantification of risk mitigation environment of supply chains using graph theory and matrix methods. *European Journal of Industrial Engineering*, *1*(1), 22–39. doi:10.1504/EJIE.2007.012652
- Ghadge, A., Dani, S., & Kalawsky, R. (2012). Supply chain risk management: Present and future scope. *International Journal of Logistics Management*, *23*(3), 313–339. doi:10.1108/09574091211289200
- Harland, C. M., Brenchley, R., & Walker, H. (2003). Risk in supply networks. *Journal of Purchasing and Supply Management*, *9*(2), 51–62. doi:10.1016/S1478-4092(03)00004-9
- Hult, G. T. M., Craighead, C. W., & Ketchen, D. J. Jr. (2010). Risk, uncertainty and supply chain decisions: Option perspective. *Decision Sciences*, *41*(3), 435–458. doi:10.1111/j.1540-5915.2010.00276.x
- Jüttner, U. (2005). Supply chain risk management: Understanding the business requirements from a practitioner perspective. *International Journal of Logistics Management*, *16*(1), 120–141. doi:10.1108/09574090510617385

Supply Chain Risk Management

- Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: Outlining an agenda for future research [Literature review / Semi-structured interview with SC professionals / Purposive or theoretical sampling plan]. *International Journal of Logistics: Research and Applications*, 6(4), 197–210. doi:10.1080/13675560310001627016
- Kaplan, S. (1997). The words of risk analysis. *Risk Analysis*, 17(4), 407–417. doi:10.1111/j.1539-6924.1997.tb00881.x
- Kaplan, S., & Garrick, B. J. (1981). On the quantitative definition of risk. *Risk Analysis*, 1(1), 11–27. doi:10.1111/j.1539-6924.1981.tb01350.x PMID:11798118
- Khan, O., & Burnes, B. (2007). Risk and supply chain management: Creating a research agenda. *International Journal of Logistics Management*, 18(2), 197–216. doi:10.1108/09574090710816931
- Knight, F. (1921). *Risk*. Boston, New York: Uncertainty and Profit.
- Lupton, D. (1999). *Risk*. London, New York: Taylor & Francis e-Library.
- MacCrimmon, K. R., & Wehrung, D. A. (1986). *Taking risks: The management of uncertainty*. New York: Free Press.
- March, J. G., & Shapira, Z. (1987). Managerial perspectives on risk and risk taking. *Management Science*, 33(11), 1404–1418. doi:10.1287/mnsc.33.11.1404
- Mason-Jones, R., & Towill, D. R. (1998, September). Shrinking the supply chain uncertainty circle. *Control*, 17-22.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management [Literature review]. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Mitchell, V.-W. (1995). Organizational risk perception and reduction: A literature review. [Literature review]. *British Journal of Management*, 6(2), 115–133. doi:10.1111/j.1467-8551.1995.tb00089.x
- Moore, P. G. (1983). *The business of risk*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511582448
- Neiger, D., Rotaru, K., & Churilov, L. (2009). Supply chain risk identification with value-focused process engineering. *Journal of Operations Management*, 27(2), 154–168. doi:10.1016/j.jom.2007.11.003
- Norrman, A., & Jansson, U. (2004). Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal of Physical Distribution & Logistics Management*, 34(5), 434–456. doi:10.1108/09600030410545463
- Norrman, A., & Lindroth, R. (2004). Categorization of supply chain risk and risk management. In C. Brindley (Ed.), *Supply chain risk*. Hampshire: Aghgate Publishing Limited.
- Paulsson, U. (2007). *On managing disruption risks in the supply chain – The DRISC model*. Lund, Sweden: Lund University.

Supply Chain Risk Management

- Peck, H. (2005). Drivers of supply chain vulnerability: An integrated framework. *International Journal of Physical Distribution & Logistics Management*, 35(4), 210–232. doi:10.1108/09600030510599904
- Peck, H. (2006). Reconciling supply chain vulnerability, risk and supply chain management. *International Journal of Logistics: Research and Applications*, 9(2), 127–142. doi:10.1080/13675560600673578
- Rangel, D. A., Oliveira, T. K., & Leite, M. S. A. (2014). Supply chain risk classification: Discussion and proposal. *International Journal of Production Research*, 1–20. doi:10.1080/00207543.2014.910620
- Ritchie, B., & Brindley, C. (2000). The information-risk conundrum. *Marketing Intelligence & Planning*, 19(1), 29–37. doi:10.1108/02634500110363781
- Ritchie, B., & Brindley, C. (2007). An emergent framework for supply chain risk management and performance measurement. *The Journal of the Operational Research Society*, 58(special issue), 1398–1411. doi:10.1057/palgrave.jors.2602412
- Royal Society. (1992). *Risk: Analysis, perception and management*. Royal Society Study Group.
- Sitkin, S. B., & Pablo, A. L. (1992). Reconceptualizing the determinants of risk behavior. *Academy of Management Review*, 17(1), 9–38.
- Smallman, C. (1996). Risk and organizational behaviour: A research model. *Disaster Prevention and Management*, 5(2), 12–26. doi:10.1108/09653569610112880
- Standards New Zealand. (2009). *New Zealand standards catalogue*. Wellington, New Zealand: Standards New Zealand.
- Svensson, G. (2002). A conceptual framework of vulnerability in firms' inbound and outbound logistics flows. *International Journal of Physical Distribution & Logistics Management*, 32(2), 110–134. doi:10.1108/09600030210421723
- Svensson, G. (2004). Key areas, causes and contingency planning of corporate vulnerability in supply chains: A qualitative approach. *International Journal of Physical Distribution & Logistics Management*, 34(9), 728–748. doi:10.1108/09600030410567496
- Tang, C. S. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics*, 103(2), 451–488. doi:10.1016/j.ijpe.2005.12.006
- Trkman, P., & McCormack, K. (2009). Supply chain risk in turbulent environments: A conceptual model for managing supply chain network risk. *International Journal of Production Economics*, 119(2), 247–258. doi:10.1016/j.ijpe.2009.03.002
- Tummala, R., & Schoenherr, T. (2011). Assessing and managing risks using the supply chain risk process (SCRMP). *Supply Chain Management. International Journal (Toronto, Ont.)*, 16(6), 474–483.
- Vanany, I., Zailani, S., & Pujawan, N. (2009). Supply chain risk management: Literature review and future research. *International Journal of Information Systems and Supply Chain Management*, 2(1), 16–33. doi:10.4018/jisscm.2009010102
- Vilko, J., Ritala, P., & Edelmann, J. (2014). On uncertainty in supply chain risk management. *The International Journal of Logistics Management*, 25(1), 3–19. doi:10.1108/IJLM-10-2012-0126

Supply Chain Risk Management

Wagner, S., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risks. *Journal of Business Logistics*, 29(1), 307–325. doi:10.1002/j.2158-1592.2008.tb00081.x

Waters, D. (2007). *Supply chain risk management: Vulnerability and resilience in logistics*. London: Kogan Page Limited.

Yates, J. F., & Stone, E. (1992). The risk construct. In J. F. Yates (Ed.), *Risk-taking behavior* (pp. 1–25). Chichester, England: Wiley.

Zhao, X., Huo, B., Sun, L., & Zhao, X. (2013). The impact of supply chain risk on supply chain integration and company performance: A global investigation. *Supply Chain Management: An International Journal*, 18(2), 115–131. doi:10.1108/13598541311318773

Zsidisin, G. A. (2003). A grounded definition of supply risk. *Journal of Purchasing and Supply Management*, 9(5-6), 217–224. doi:10.1016/j.pursup.2003.07.002

Zsidisin, G. A., & Ellram, L. M. (2003). An agency theory investigation of supply risk management. *Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, 39(3), 15-27.

Zsidisin, G. A., Ellram, L. M., Carter, J. R., & Cavianto, J. L. (2004). An analysis of supply risk assessment techniques. *International Journal of Physical Distribution & Logistics Management*, 34(5), 397–413. doi:10.1108/09600030410545445

Zsidisin, G. A., Panelli, A., & Upton, R. (2000). Purchasing organization involvement in risk assessments, contingency plans, and risk management: An exploratory study. *Supply Chain Management: An International Journal*, 4(4), 187–197. doi:10.1108/13598540010347307

Zsidisin, G. A., & Ritchie, B. (2008). Supply chain risk management: Developments, issues and challenges. In G. A. Zsidisin & B. Ritchie (Eds.), *Supply chain risk: A handbook of assessment, management, and performance* (Vol. 124, pp. 1-12). New York: Springer.

Chapter 30

The Influence of Supply Chain Sustainability Practices on Suppliers

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ABSTRACT

Literature shows that focal firms (downstream in supply chain, the customers) which initiate supply chain sustainability (SCSIs) can increase their financial performance; however, the impact of SCSIs on the suppliers (upstream in supply chain, supplying firms) is unclear. This chapter analyzes the costs and benefits from the perspective of suppliers in SCSIs by focal companies. Furthermore, impact of suppliers-specific characteristics (firm size, resources dependence setting and self-sustainability) on SCSIs are investigated. According to the findings, we propose a performance implication-based conceptual model of SCSIs from the perspective of suppliers. We conclude that costs of SCSIs happen immediately to suppliers in implementation, but the benefits are expected in long run. These suppliers-specific characteristics are the decisive factors if suppliers can survive over short-run costs and reach the long-run benefits. This chapter extends the understanding of SCSIs from focal companies to suppliers while providing managerial support on collaboration between supply chain actors.

INTRODUCTION

Today, the business community has recognized that sustainability contributes to individual firms' financial performance (Becchetti, Ciciretti, Hasan, & Kobeissi, 2012; Jacobs, Singhal, & Subramanian, 2010; Scholtens & Dam, 2007). Moreover, in search of strategic advantages, many firms are expanding the scope of their sustainability initiatives to encompass their full supply chains (Fiksel, 2010), as suppliers, focal companies, and customers become linked by information, material and capital flow in the sustainable supply chain. In this chapter, we consider the focal companies to be the more powerful

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companies in the supply chain. They design products and services, and they contact directly to customers (Seuring & Müller, 2008); therefore, they mostly launch supply chain sustainability initiatives (SCSI). Due to its importance in SCSIs, focal companies have been studied by a proliferation of sustainable supply chain management (SSCM) literature. In general, scholars illustrate positive impact of SCSIs on focal companies by cost reduction, compliance to future regulation and reputation improvement (Carter & Rogers, 2008). However, there remains a lack of work addressing the internal organizational process of suppliers, while it is widely accepted that participation of suppliers in SCSIs is essential (Caniëls, Gehrsitz, & Semeijn, 2013).

Although the SCSIs by focal firms can result in pressure on suppliers to make substantial investments in sustainability within their firms, focal companies rarely make concrete promises how they will reward such increased sustainability by suppliers. Consequently, it is unclear if suppliers achieve benefits by meeting the requirements that focal companies impose through the SCSIs. This confusion forms a theoretical gap in extant SSCM literature in terms of performance implications to suppliers in SCSIs. Meanwhile, the uncertainty leaves supply chain managers in a dilemma. While suppliers' managers hesitate to implement the SCSIs as the benefits or costs are unknown, managers from focal firms find it challenging to convince their suppliers to adopt the SCSI as the evidence of benefits is lacking. Thus, there is a clear need to research the costs and benefits to suppliers in SCSI by focal companies to provide theoretical development in this research area and support of managerial decisions on supply chain sustainability.

The overall goal of this chapter is to provide the reader with insights into the essence of SSCM from the perspective of suppliers, with the view of identifying both benefits and costs of suppliers in SCSIs by focal companies in the supply chains, and meanwhile analyzing moderating factors which influence challenges to suppliers. Following this introduction, an overview of background on SSCM is presented. Carter and Rogers (2008)'s definition implies that factors impact on focal companies but differently on their suppliers in the SCSI. The concept of supply chain dyadic perspective in literature also supports the difference and demonstrates costs led by SCSIs of focal companies to suppliers, which seems inevitable to suppliers by focal companies' SSCM mechanisms.

The core of the chapter then provides a detailed description of immediate costs and long-run benefits to suppliers in SCSIs. Consequently, the suppliers' dilemma is whether they can survive over immediate/short-run costs and thereafter obtain the long-run benefits. The supplier-specific characteristics, such as firm size, resource dependence setting, and the suppliers' self-sustainability, are moderating factors that may aid them in overcoming the significant short-run costs, by which suppliers managers are able to estimate their financial or operational benefits/loss in SCSIs by focal companies. These findings propose a conceptual model to cover the theoretical gap and present a springboard to managers. According to the foregoing, future research directions are suggested and conclusions are presented.

BACKGROUND

Within its general framework, SSCM includes supply chain management (SCM) and sustainability (Turker & Altuntas, 2014). SCM is integration of material, information, and capital flows as well as cooperation among companies along the supply chain through improved supply chain relationship to achieve a

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competitive advantages (Seuring & Müller, 2008). Owing to the important positions of focal companies and their suppliers in the supply chains, their relationships are more broadly studied in SCM than other supply chain partners (Hawkins, Wittmann, & Beyerlein, 2008; Joshi & Stump, 1999; Liu, Luo, & Liu, 2009; Mahapatra, Das, & Narasimhan, 2012; Saccani & Perona, 2007). The transaction costs theory (Williamson, 1979) and resources dependence theory (Pfeffer & Salancik, 1978) are two of most widely theories applied in the literature to analyze the cooperation between focal companies and suppliers.

On the other hand, sustainability is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their needs” (WCED, 1987). To help with operationalizing sustainability on firm-level, Carter and Rogers (2008) illustrate the triple bottom line concept which simultaneously considers and balances economic, environmental, and social goals from a microeconomic standpoint. Compared with early development of SCM and sustainability, the study of sustainable supply chain management is predominantly a 21st century phenomenon (Hoejmose & Adrien-Kirby, 2012). In the context of SSCM, different terms are used to stress the specific research focuses. Clean/Green supply chain studies environmental issues. Ethical supply chain investigates social issues. Socially and environmental responsible procurement (SERP) explores sustainable purchasing issues.

In this chapter, the interest of research is to study the impact of supply chain sustainability initiatives (SCSIs) from focal companies on their suppliers which covers broad concept of sustainability, but focuses especially on suppliers in supply chain management. Carter and Rogers (2008) define a supply chain sustainability initiative as the strategic, transparent integration and achievement of a focal company’s social, environmental, and economic goals in the systemic coordination of supply chain business processes for improving the long-run economic performance of the focal company and its supply chain. SCSIs require awareness of the full product supply chain, ranging from the conduct of upstream suppliers to the disposition of obsolete products (Fiksel, 2010).

Furthermore, it states that at the intersection of social, environmental, and economic performance, there are activities that focal companies can engage in which positively affect that natural environment and society, and result in long-run economic benefits and competitive advantage for the firms and the supply chains. Carter and Rogers (2008)’s definition emphasizes the importance of focal companies in SCSIs. This is perhaps the reason that extant literature in SSCM mainly is interested in the research from the perspective of focal companies.

The themes in existing literature cover drivers/barriers of SCSIs to focal companies in the external and internal environment; implementation of SCSIs in the supply chain by focal companies; and performance implications at the focal companies and buyer (focal companies)-supplier level (Hoejmose & Adrien-Kirby, 2012). Whereas focal companies are broadly studied, there is little analysis of suppliers in SCSIs with exception of contributions such as Caniëls et al. (2013); Hoejmose and Adrien-Kirby (2012); Ramanathan, Bentley, and Pang (2014); and Carter (2000). However, as stated by Caniëls et al. (2013), these exceptions aim to develop strategies that foster willingness in suppliers to take part in green supply chain initiatives. The direct and indirect performance implications of suppliers in SCSIs by focal companies are still not explored, which leaves suppliers’ managers a quandary when they are either pressured or motivated by focal companies in SCSIs. This chapter, therefore, investigates the benefits and costs from the perspective of suppliers in SCSIs, proposes the conceptual framework of SCSIs impact on suppliers, and provides managerial decision support.

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SUPPLY CHAIN SUSTAINABILITY TO SUPPLIERS

The interest of the present study on the standing point of suppliers in SCSIs is motivated by the dyadic perspective in supply chain (although there are more than two echelons in the supply chains, in this chapter the interest is on focal companies and their suppliers). Supply chain management literature illustrates different perception of supply chain attributes between suppliers and focal companies, such as information sharing, satisfaction on the relationship, and performance improvement (Oosterhuis, Molleman, & van der Vaart, 2013). This finding also contributes to the study of SSCM. The dyadic perspective in supply chain suggests different views of SCSIs between suppliers and focal companies. While focal companies expect effective performance improvement as suggested by Carter and Rogers (2008), suppliers perceive SCSIs as compliance to focal companies in the supply relationship. This disparity will influence the financial or operational performance of suppliers in SCSIs.

Focal companies are those that usually rule or govern the supply chain, provide direct contact to customers, and design the product or service offered (Seuring & Müller, 2008). When the environmental and social problems are present in their supply chains, they are likely to come under pressure from legal demand, regulations or non-government organizations (NGOs). Moreover, they are triggered by profits and competitive advantages through initiating sustainable supply chain, such as reputation gain and premium prices. On the other hand, suppliers are not motivated to integrate environmental or social concerns into their management practices. Compared with focal companies, suppliers are not tightly inspected by NGOs and government regulations in the supply chain. Normally, they do not hold responsibility for the environmental or social issues. Focal companies seldom promise how they will reward suppliers' involvement in the supply chain sustainability.

Therefore, as the implementation costs in supply chain sustainability fall mainly on suppliers, suppliers may suspect that they may not be compensated for involvement in the SCSIs to cover the costs. Consequently, suppliers are often reluctant to be involved into the supply chain sustainability (Hoejmose & Adrien-Kirby, 2012). Nevertheless, when the focal company is pressured, it usually passes this pressure on to suppliers (Seuring & Müller, 2008). Suppliers are forced by focal companies to join the supply chain sustainability initiatives in order to secure the supply relationship. Hence, the most common trigger for suppliers' involvement in sustainable supply chain is to meet focal companies' demand. This is why the supply chain sustainability is mostly initiated by focal companies, and suppliers passively follow in the process.

There are two ways that suppliers are requested by focal companies into the supply chain sustainability: use of codes of conduct or third party certification. Codes of conduct are by far the most common way of implementing supply chain sustainability amongst suppliers (Hoejmose & Adrien-Kirby, 2012). Codes of conduct address focal companies' expectation of suppliers' responsible behaviors in both social and environmental natures (Preuss, 2009). Suppliers are not systematically monitored by focal companies, but they comply with the codes of conduct based on trust, communication, and collaboration with focal companies.

The second way of suppliers' implementation in supply chain sustainability is by third-party certification. Third-party certification is arguably more rigorous than codes of conduct, as suppliers are required to comply with mandatory practices. They make it easier to compare social and environmental responsible performance of suppliers, and reduce the cost of monitoring (Hoejmose & Adrien-Kirby, 2012). These certificates are, for example, ISO 14001 (environmental standard) series and SA 8000

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certificates (social standard). While codes of conduct are built upon mutual trust, third-party certification brings compulsory practices to suppliers.

Suppliers may be able to create more collaborative relationship with focal companies in codes of conduct. The third-party certification requires suppliers' continuous costly and time-consuming investment. Furthermore, literature suggests that financial benefits of third-party certificates are not clear to suppliers (Heras-Saizarbitoria, Molina-Azorín, & Dick, 2011; Hoejmose & Adrien-Kirby, 2012; Paulraj & de Jong, 2011). However, there are more and more suppliers requested by focal companies to acquire third-party certificates, partly because of stakeholder's pressure on focal firms of objective and rigorous sustainable supply chain conduct, and partly because of focal firms' intention of reduction on monitoring cost. This gives suppliers more costs in the SCSIs implementation.

Under the circumstance that suppliers are pressured by focal companies to comply with supply chain sustainability, and there is uncertainty of reward from focal companies for compliance of suppliers, it is important to study the motives of supply chain sustainability from the perspective of suppliers. In the next paragraphs, costs and benefits to suppliers in SCSIs are presented. In either codes of conduct or third part-certification, it can be expected that suppliers must invest heavily to change their existing productions in order to implement the SCSIs according to request from focal companies. It will bring suppliers substantial implementation cost, opportunity cost and transaction cost.

The primary costs are the implementation cost and opportunity cost to suppliers, which are identified as the biggest barrier by literature in implementation (Carter & Rogers, 2008; Giunipero, Hooker, & Denslow, 2012; Seuring & Müller, 2008). To meet the SCSi practices of focal firms, suppliers have to make considerable cultural and capital investments which include designing sustainable products, transforming production lines, improving working conditions, changing the input resources, and recycling products. These can be significant investments which may be time-consuming to implement.

Additionally, the supply chain sustainability is mostly initiated by focal companies which are powerful than suppliers in the relationship. Thus, the timing, available resources, and future costs of suppliers in implementation are less considered. It is true that some suppliers have exhausted the easy, 'low-hanging fruit' and are now into harder, long-run investments in which economic and environmental/social criteria are not necessarily harmonious (Carter & Rogers, 2008). In other words, Suppliers may be forced to relinquish their existing competitiveness by making adjustments in their manufacturing process in order to comply with the supply chain sustainability initiatives of focal companies. It is not believed that immediate financial benefits will be delivered to suppliers after implementation. Therefore, the significant implementation and opportunity costs must be considered to suppliers before the implementation.

Furthermore, collaborative efforts in SCSIs may represent transaction-specific investments in focal companies by suppliers and thus may lead to higher transaction costs, or even sunk costs to suppliers (Gimenez & Sierra, 2013). When suppliers comply and collaborate with focal companies to implement the supply chain sustainability, the transaction specific investments, which are non-transferable investments whose utility is unique to a specific relationship with the focal companies, will rise to suppliers. These investments include site specificity, physical asset specificity, and human asset specificity that suppliers invest in at the request of the focal companies (Williamson, 1981).

According to transaction cost economics (TCE), these transaction specific investments increase the opportunism of focal companies in the relationship and in turn raise the transaction costs of suppliers in the relationship. Opportunism may refer to "hold-ups" of focal companies, which are violations of the original intent of the agreement in the relationship, leading to the investing supplier incurring losses

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(Wagner & Bode, 2014). Additionally, if suppliers or focal companies abandon the supply relationship, these investments will become sunk costs, because they are transaction-specific to certain focal companies in the implementation of SCSIs. These immediate costs are enormous and may deter suppliers in the supply chain sustainability. Suppliers can, however, achieve long-run benefits if they can sustain over these costs.

Suppliers' strategic and cultural investments can create new sustainable technology and knowledge transfers which can lead to a difficult-to-replicate competitive advantage for suppliers themselves (Carter & Dresner, 2001). By implementing the supply chain sustainability initiatives, suppliers learn the new sustainable technologies. These technologies adjust suppliers' production equipment, methods, procedures, product designs and product delivery mechanisms to conserve use of energy and resources. The nature of sustainable technologies on resources conservation and waste reduction brings suppliers' competitive advantages.

These competitive advantages include reductions in the cost of labor, material, energy costs, waste, and packaging; production efficiency improvements; and design for disassembly (Shrivastava, 1995). Besides, by the information sharing with focal companies in SCSIs, suppliers can reduce inventory management costs, lead time, and logistics costs (Chen, Paulraj, & Lado, 2004). These competitive advantages gains from the SCSIs can improve suppliers' future position in competition. In addition, coordinating sustainability compliance improves the suppliers' relationship with focal firms.

As mentioned earlier, the most important trigger to suppliers in SCSIs is to fulfill customer demand. By satisfying the focal companies' request, suppliers can create a long-run relationship with them through trust and relation norms (Liu et al., 2009). Supply chain sustainability is a time-consuming and costly process. It is challenging to apply it within the transactional mechanisms commonly used in supply management (e.g., contracts). The close collaboration, sharing of monitoring information, and reinforcement of remediation expectations in SCSIs require transparency between companies. Transparency subsequently increases the investments of both supplier and focal companies in the relationship, and mutual trust in long-run collaboration can be built up. Additionally, this relational mechanism (trust) in the supply management can provide suppliers a safeguard to the opportunism of focal companies, as focal companies are interlocked with their suppliers by their investment in the long-run relationship.

Moreover, the SCSi enables suppliers to create a good public image within their industry and manage risk (Shrivastava, 1995). Suppliers implementing the SCSIs can improve focal companies' perception of suppliers' reputation in a supply chain management context. To avoid sustainability risks and pressures, focal companies are willing to procure from sustainable suppliers. SCSIs increase suppliers' image in the industry, and offer them an intangible asset that helps them compete internationally.

Additionally, proactive engagement in sustainability practices lower the risk of suppliers to other stakeholders' reputation damage. Supply chain members' reputation and image can be tainted by the actions of another member who engages in activities that result in public sentiment or outcry where liability extends up and down the supply chain (Carter & Rogers, 2008). By SCSIs, suppliers are able to build up supply chain risk management to prevent and manage the environmental and social risks in the supply chain.

Finally, focal firms should be willing to pay more for sustainable products and at a certain point they may only want to buy sustainable products, so the premium prices can be set by these suppliers to obtain the higher profits (Siegel & Vitaliano, 2007). The sustainable goods create special value to "green" consumer segments in industries. The added value increases focal company's willingness to pay more for suppliers' sustainable products. In certain circumstance, owing to the regulations or market demands,

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only sustainable goods are allowed to provide to end customers. Suppliers' unique ability to produce sustainably can help them charge higher prices from focal companies.

Many of the costs of SCSIs to suppliers accrue in the short-run or immediate phase in implementation, while benefits can be expected in the long-run or after implementation. Consequently, the challenge to suppliers is to survive the short-run costs and reach the long-run benefits in the future. The factors influencing supplier's survival in supply chain sustainability are the supplier-specific characteristics. In the next section, these characteristics are analyzed.

SUPPLIER-SPECIFIC CHARACTERISTICS TO SCSIs

To cope with short-run costs, suppliers' sufficient resources and support of focal companies are important. Supplier-specific characteristics, such as firm size, resources dependence setting and self-sustainability are essential factors for suppliers to secure the resources and support. Firm size is traditionally assumed to be among the key determining factors of corporate competitiveness and ability as evidenced by a wealth of literature on the subject (Führer & Michel, 2004). Large suppliers can promise adequate resources to ensure the implementation of SCSIs. With sufficient funds and manpower to respond to stakeholders and to react to the sustainability-related pressures, large suppliers can devote time and attention to sustainability-related details and to researching and implementing contemporary practices.

Such suppliers also leverage experience and advance their maturity in sustainability practices (Reefke, Sundaram, & Ahmed, 2010). Moreover, large suppliers have been in business for a long time and thereby have substantial capacity and capability for knowledge acquisition. Cost advantages come from producing in large volumes (i.e., economies of scale) or from many related products (i.e., economies of scope). Accordingly, since large suppliers have resources, capabilities, and cost advantages, they are more possible to absorb the increasing costs in short-run caused by SCSIs than small suppliers.

As stated by resources dependence theory (Pfeffer & Salancik, 1978), the resources dependence of two firms in supply chain can moderate the costs and benefits in the implementation. If focal companies must secure certain scarce resources from suppliers, in the SCSIs process focal companies are willing to share more costs or benefits with suppliers on which they depend more on. Hence, these suppliers supported by focal companies can have more capabilities to deal with these immediate costs in SCSIs. There are two distinct theoretical dimensions of resource dependence: total dependence, or the sum of two organizations' dependence; and power imbalance, or the dependence differential between them (Casciaro & Piskorski, 2005).

Total dependence indicates the total value created in the relationship of two firms. As total dependence rises and more value is to be divided, both firms have a higher incentive to cooperate, because the benefits of coordination are more likely to weigh against the costs of coordination (Paulraj & Chen, 2007). When SCSIs are initiated by the focal firms under higher total dependence, suppliers can expect that it is mutual beneficial behavior for both firms. Focal companies will provide reliable support. Power imbalance indicates the difference in dependences in the relationship of two firms. The effect of power imbalance seems to be the opposite to that of total dependence: a large power imbalance indicates that one firm is much less dependent on the other firm than vice versa and interests in the relationship diverge if power imbalance grows.

As the power imbalance in favor of the focal firms' increases, the supplier faces undesirable exchange conditions and higher levels of uncertainty (Casciaro & Piskorski, 2005). Hence, under higher power

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imbalance in favor of the focal firm, it can be assumed that focal companies will have little willingness to share costs and benefits with suppliers in the implementation of SCSIs. Suppliers may have less support from focal companies. As a result, it is crucial for suppliers to analyze the resource dependence setting with focal companies before implementation in order to measure possible support of focal companies during the process.

Self-sustainability indicates the suppliers' sustainable culture and capital stance prior to SCSIs implementation. Supply chain sustainability is a big project affecting many functions throughout organizations, such as training employees, changing production lines, and buying new facilities. For those suppliers which have high self-sustainability before implementation, they have less cultural and capital difficulty to adapt to the changes, and they consume less time to commit the supply chain sustainability practices. Therefore, they will face lower costs in implementation. Moreover, suppliers with high self-sustainability have less risk of losing the business of focal companies during the long process of implementation.

Sustainable suppliers have the necessary technical and organizational experience and knowledge and are able to fulfil the supply chain sustainability requirements of focal companies. Focal companies expect higher success rates from already sustainable suppliers during SCSIs; thus, focal firms are willing to keep or increase transactions with these suppliers during the long implementation process. In turn, trading with focal companies promises suppliers to have sufficient capital covering the costs in the implementation and reach the long-run benefits. Many sustainability indices provide insight into firms' sustainability standings (e.g., the KLD index and Dow Jones Sustainability index). They can refer to measurements of suppliers' self-sustainability. Firm size, self-sustainability fluctuate suppliers' capability of cost reduction in SCSIs, and resources dependency ensures focal companies' support during the process. These are factors deciding the success rate of SCSIs on suppliers.

TOWARD A PERFORMANCE IMPLICATION-BASED FRAMEWORK FOR SUPPLIERS IN SCSIs BY FOCAL COMPANIES

This section builds on the findings of the previous analysis to propose a performance implication-based conceptual model. This model conceptualizes suppliers' performance implications in terms of direct and indirect benefits and costs under the circumstance that supply chain sustainability initiatives launched by focal companies in the supply chains. The general theoretical proposition is:

When suppliers are pressured by focal companies to implement the SCSIs, it is expected that considerable costs will be accrued by suppliers immediately on implementation, but benefits will occur in long-run. To survive over the short-run challenge and reach the long-run profits, suppliers must measure (1) firm resources in terms of firm size; (2) resources dependence setting; and (3) self-sustainability.

Figure 1 presents the conceptual mode and underpins the proposition. In general, compared with focal companies, as an upstream actor in the supply chain, suppliers are less pressured or motivated to implement supply chain sustainability initiatives, because they are less exposed to general public scrutiny or they are more reliant to focal companies in the supply chain activities. However, owing to the bargain power, focal companies always transfer the external pressure and motivations to suppliers through either codes of conduct or third party certification.

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Hence, when it comes to the SCSIs, dyadic analysis is necessary to create a more complete theoretical understanding. For practitioners, it suggests that suppliers' managers can create strategies and approaches in terms of firm-specific characteristics to balance and estimate the impact of SCSIs implementation. Moreover, it reveals focal companies' support/reward, especially on early stages of SCSIs, is essential to suppliers. It recommends the high and early involvement of focal companies in the suppliers' implementation of SCSIs.

However, a main limitation in this chapter is that it is assumed that focal companies have the bargaining power to dictate terms and, therefore, suppliers passively implement SCSIs. In future research, studies may investigate different supply chain systems including industrial settings in which firms share relatively equal bargain power. Moreover, further research can examine different aspects in supply chain sustainability (e.g., environmental or social standards) to compare the distinct influence on suppliers and provide managerial support. Furthermore, much of the research has been conceptual and more empirical research is required to validate the conceptual framework. This could be case study research (e.g., Wycherley, 1999), survey-based studies (e.g., Carter, 2000), event studies (e.g., Wang, Petkova, & Wood, 2014)

CONCLUSION

By proposing a conceptual model, this chapter illustrates costs and benefits to suppliers in the supply chain sustainability initiated by focal companies, and also presents the supplier-specific characteristics as the moderating factors to suppliers' performance. In general, costs to suppliers are substantial and occur immediately in SCSi implementation. Nevertheless, suppliers can expect high benefits in long-run. To reach these long-run benefits, suppliers must sustain over the immediate costs of SCSi implementation. Firm size, resources dependence setting, and self-sustainability are the most appropriate measurements to evaluate suppliers' capability of coping with these costs.

This chapter expands the understanding of supply chain sustainability from focal firms (initiators of SCSIs) to suppliers. While literature suggests the benefits to companies initiating supply chain sustainability, the suppliers' perspective is rarely considered independently. Owing to substantial investment in the SCSIs, and that suppliers are passively involved by focal companies in these initiatives, suppliers may hesitate to implement. These benefits presented in this chapter give suppliers' managers stimulus to join SCSIs. Furthermore, this chapter provides suppliers' managers with strategies to minimize immediate costs during implementation. These findings contribute by examining the closer SCSIs collaboration between supply chain partners.

REFERENCES

- Becchetti, L., Ciciretti, R., Hasan, I., & Kobeissi, N. (2012). Corporate social responsibility and shareholder's value. *Journal of Business Research*, 65(11), 1628–1635. doi:10.1016/j.jbusres.2011.10.022
- Caniëls, M. C. J., Gehrsitz, M. H., & Semeijn, J. (2013). Participation of suppliers in greening supply chains: An empirical analysis of German automotive suppliers. *Journal of Purchasing and Supply Management*, 19(3), 134–143. doi:10.1016/j.pursup.2013.02.005

The Influence of Supply Chain Sustainability Practices on Suppliers

- Carter, C. R. (2000). Ethical issues in international buyer–supplier relationships: A dyadic examination. *Journal of Operations Management*, 18(2), 191–208. doi:10.1016/S0272-6963(99)00016-9
- Carter, C. R., & Dresner, M. (2001). Purchasing's Role in Environmental Management: Cross-Functional Development of Grounded Theory. *Journal of Supply Chain Management*, 37(2), 12–27. doi:10.1111/j.1745-493X.2001.tb00102.x
- Carter, C. R., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38(5), 360–387. doi:10.1108/09600030810882816
- Casciaro, T., & Piskorski, M. J. (2005). Power Imbalance, Mutual Dependence, and Constraint Absorption: A Closer Look at Resource Dependence Theory. *Administrative Science Quarterly*, 50(2), 167–199. doi:10.2307/30037190
- Chen, I. J., Paulraj, A., & Lado, A. A. (2004). Strategic purchasing, supply management, and firm performance. *Journal of Operations Management*, 22(5), 505–523. doi:10.1016/j.jom.2004.06.002
- Fiksel, J. (2010). Evaluating Supply Chain Sustainability. *Chemical Engineering Progress*, 106(5), 28–36.
- Führer, C., & Michel, J. (2004). An Empirical Study of Firm Size and Competitiveness in German Life Insurance. *Zeitschrift für die gesamte Versicherungswissenschaft*, 93(2), 251–267. doi:10.1007/BF03191410
- Gimenez, C., & Sierra, V. (2013). Sustainable Supply Chains: Governance Mechanisms to Greening Suppliers. *Journal of Business Ethics*, 116(1), 189–203. doi:10.1007/s10551-012-1458-4
- Giunipero, L. C., Hooker, R. E., & Denslow, D. (2012). Purchasing and supply management sustainability: Drivers and barriers. *Journal of Purchasing and Supply Management*, 18(4), 258–269. doi:10.1016/j.pursup.2012.06.003
- Hawkins, T. G., Wittmann, C. M., & Beyerlein, M. M. (2008). Antecedents and consequences of opportunism in buyer–supplier relations: Research synthesis and new frontiers. *Industrial Marketing Management*, 37(8), 895–909. doi:10.1016/j.indmarman.2007.05.005
- Heras-Saizarbitoria, I., Molina-Azorín, J. F., & Dick, G. P. M. (2011). ISO 14001 certification and financial performance: Selection-effect versus treatment-effect. *Journal of Cleaner Production*, 19(1), 1–12. doi:10.1016/j.jclepro.2010.09.002
- Hoejmose, S. U., & Adrien-Kirby, A. J. (2012). Socially and environmentally responsible procurement: A literature review and future research agenda of a managerial issue in the 21st century. *Journal of Purchasing and Supply Management*, 18(4), 232–242. doi:10.1016/j.pursup.2012.06.002
- Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5), 430–441. doi:10.1016/j.jom.2010.01.001
- Joshi, A. W., & Stump, R. L. (1999). Determinants of Commitment and Opportunism: Integrating and Extending Insights from Transaction Cost Analysis and Relational Exchange Theory. *Revue Canadienne des Sciences de l'Administration [Canadian Journal of Administrative Sciences]*, 16(4), 334–352. doi:10.1111/j.1936-4490.1999.tb00693.x

The Influence of Supply Chain Sustainability Practices on Suppliers

- Liu, Y., Luo, Y., & Liu, T. (2009). Governing buyer–supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management*, 27(4), 294–309. doi:10.1016/j.jom.2008.09.004
- Mahapatra, S. K., Das, A., & Narasimhan, R. (2012). A contingent theory of supplier management initiatives: Effects of competitive intensity and product life cycle. *Journal of Operations Management*, 30(5), 406–422. doi:10.1016/j.jom.2012.03.004
- Oosterhuis, M., Molleman, E., & van der Vaart, T. (2013). Differences in buyers' and suppliers' perceptions of supply chain attributes. *International Journal of Production Economics*, 142(1), 158–171. doi:10.1016/j.ijpe.2012.11.001
- Paulraj, A., & Chen, I. J. (2007). Environmental Uncertainty and Strategic Supply Management: A Resource Dependence Perspective and Performance Implications. *Journal of Supply Chain Management*, 43(3), 29–42. doi:10.1111/j.1745-493X.2007.00033.x
- Paulraj, A., & de Jong, P. (2011). The effect of ISO 14001 certification announcements on stock performance. *International Journal of Operations & Production Management*, 31(7), 765–788. doi:10.1108/01443571111144841
- Pfeffer, J., & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper and Row.
- Preuss, L. (2009). Ethical Sourcing Codes of Large UK-Based Corporations: Prevalence, Content, Limitations. *Journal of Business Ethics*, 88(4), 735–747. doi:10.1007/s10551-008-9978-7
- Ramanathan, U., Bentley, Y., & Pang, G. (2014). The role of collaboration in the UK green supply chains: An exploratory study of the perspectives of suppliers, logistics and retailers. *Journal of Cleaner Production*, 70(0), 231–241. doi:10.1016/j.jclepro.2014.02.026
- Reefke, H., Sundaram, D., & Ahmed, M. D. (2010). Maturity Progression Model for Sustainable Supply Chains. In W. Dangelmaier, A. Blecken, R. Delius, & S. Klöpfer (Eds.), *Advanced Manufacturing and Sustainable Logistics* (Vol. 46, pp. 308-319): Springer Berlin Heidelberg. Retrieved from doi:10.1007/978-3-642-12494-5_28
- Saccani, N., & Perona, M. (2007). Shaping buyer–supplier relationships in manufacturing contexts: Design and test of a contingency model. *Journal of Purchasing and Supply Management*, 13(1), 26–41. doi:10.1016/j.pursup.2007.03.003
- Scholtens, B., & Dam, L. (2007). Banking on the Equator. Are Banks that Adopted the Equator Principles Different from Non-Adopters? *World Development*, 35(8), 1307–1328. doi:10.1016/j.worlddev.2006.10.013
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699–1710. doi:10.1016/j.jclepro.2008.04.020
- Shrivastava, P. (1995). The Role of Corporations in Achieving Ecological Sustainability. *Academy of Management Review*, 20(4), 936–960. doi:10.2307/258961

The Influence of Supply Chain Sustainability Practices on Suppliers

Siegel, D. S., & Vitaliano, D. F. (2007). An Empirical Analysis of the Strategic Use of Corporate Social Responsibility. *Journal of Economics & Management Strategy*, 16(3), 773–792. doi:10.1111/j.1530-9134.2007.00157.x

Turker, D., & Altuntas, C. (2014). Sustainable supply chain management in the fast fashion industry: An analysis of corporate reports. *European Management Journal*, 32(5), 837–849. doi:10.1016/j.emj.2014.02.001

Wagner, S. M., & Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management*, 32(3), 65–78. doi:10.1016/j.jom.2013.11.001

Wang, X., Petkova, B. N., & Wood, C. L. (2014). Do suppliers benefit from supply chain sustainability programs? The case of Wal-Mart. Presented at the meeting of the ANZAM Operations, *Supply Chain and Services Management conference*, Auckland.

WCED (World Commission on Environment and Development). (1987). *Our common future*. Oxford: Oxford University Press.

Williamson, O. E. (1979). Transaction-Cost Economics: The Governance of Contractual Relations. *The Journal of Law & Economics*, 22(2), 233–261. doi:10.1086/466942

Williamson, O. E. (1981). The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), 548–577. doi:10.1086/227496

Wycherley, I. (1999). Greening supply chains: The case of The Body Shop International. *Business Strategy and the Environment*, 8(2), 120–127. doi:10.1002/(SICI)1099-0836(199903/04)8:2<120::AID-BSE188>3.0.CO;2-X

ADDITIONAL READING

Carter, C. R. (2005). Purchasing social responsibility and firm performance. *International Journal of Physical Distribution & Logistics Management*, 35(3), 177–194. doi:10.1108/09600030510594567

Corbett, C. J., & Kirsch, D. A. (2001). International diffusion of ISO 14000 certification. *Production and Operations Management*, 10(3), 327–342. doi:10.1111/j.1937-5956.2001.tb00378.x

Dam, L., & Petkova, B. N. (2014). The impact of environmental supply chain sustainability programs on shareholder wealth. *International Journal of Operations & Production Management*, 34(5), 586–609. doi:10.1108/IJOPM-10-2012-0482

Frooman, J. (1997). Socially irresponsible and illegal behavior and shareholder wealth. *Business & Society*, 36(3), 221–249. doi:10.1177/000765039703600302

Green, K. W., Jr., Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green supply chain management practices: impact on performance. *Supply Chain Management*, 17(3), 290–305.

The Influence of Supply Chain Sustainability Practices on Suppliers

Lo, C. K. Y., Pagell, M., Fan, D., Wiengarten, F., & Yeung, A. C. L. (2014). OHSAS 18001 certification and operating performance: The role of complexity and coupling. *Journal of Operations Management*, 32(5), 268–280. doi:10.1016/j.jom.2014.04.004

Tate, W. L., Ellram, L. M., & Dooley, K. J. (2012). Environmental purchasing and supplier management (EPSM): Theory and practice. *Journal of Purchasing and Supply Management*, 18(3), 173–188. doi:10.1016/j.pursup.2012.07.001

KEY TERMS AND DEFINITIONS

Focal Company: Companies governing over the supply chains, providing direct contact to end customers, and having bargain power over other actors in the supply chain.

Opportunism: Aggressive selfishness and disregards the impact of the firm's actions on others. It refers to breach of contract, information deception and data distortion and so on.

Opportunity Cost: The maximum alternative earning that might have been obtained if resources had been applied to alternative use.

Resources Dependence Theory: Organisations are dependent on external stakeholders. The external stakeholder has the power to affect organisational behaviours. As firms are embedded in broader relationship in supply chain, they may experience different degrees of external pressures to engage in certain initiatives. Thus, greater dependence on a specific stakeholder usually suggests a greater influence of that stakeholders' demands.

Supply Chain Sustainability: Systematic coordination of supply chain actors on social, environmental, and economic integration for improving the long-run economic performance of the supply chains.

Transaction Cost: The cost associated with exchange of goods and services. It include costs of source selection, contract management, performance measurement, and dispute resolution.

Transaction-Specific Investment: A firm's non-transferable investment whose utility is unique to a specific relationship with another firm.

Chapter 31

Methodology to Support Supply Chain Integration A Business Process Perspective

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ABSTRACT

This chapter explains and describes a detailed framework based on integrating a number of different methodological strands from the literature. A literature review was conducted in three different domains - business process re-design, supply chain re-design and e-business process design-. The literature review revealed potential for integrating elements of a number of different methods and techniques found in different methodological strands into a framework for conducting Business Process Re-design (BPR) to support Supply Chain Integration (SCI). The proposed BPR methodology can be applied in any company or sector; methods and techniques incorporated are not specific to any sector.

BACKGROUND

The supply chain has grown in importance as a source of competitive advantage among companies across different sectors. Companies have been facing a new competitive environment due to changes brought by the globalization of markets, characterized by an increase in the number of competitors, shorter product life cycles and changing customer demand. Therefore, many companies are aiming to achieve competitiveness by improving their supply chains. Accordingly, integration of the supply chain has gained importance as a key issue in supply chain management (SCM). When integration is achieved, the supply chain operates as a single entity driven directly by customer demand. The more integration across the supply chain, the easier to balance supply and demand. Additionally, integration allows synchronization among supply chain partners and well-coordinated flows of materials. SCI is also attractive because it allows reduction of the bullwhip effect and brings a number of operational benefits such as reduction of supply chain costs, lead time and risks.

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Challenges in the Construction of SCI

However, the supply chain literature shows the existence of a number of challenges associated to the integration of supply chains (Awad & Nassar, 2010; Baghchi & Skjoett-Larsen, 2005). According to Awad and Nassar (2010), different perspectives have been used to enumerate the challenges associated to the construction of SCI. In this chapter, a business process perspective will be used. A process is a set of one or more linked activities that collectively accomplish a business objective by transforming a set of inputs into a specific set of outputs. From the business process perspective, sharing of information, coordination of material flows and integration of business processes appear to be most critical challenges.

Traditionally, business processes were understood as a series of sequential tasks and activities restricted to the functional areas in a business. However, as result of the evolution of management paradigms and internet and communications technologies (ICT) applications, a new dimension was added to the business process definition. This new dimension consists of business processes crossing functional and organizational boundaries, as is the case with supply chain processes. Additionally, as the number of process links between supply chain partners increase, the coordination of material flows becomes more difficult affecting inventories all across the supply chain and ultimately the customer service level offered. In order to achieve supply chain integration, is necessary for the supply chain partners to coordinate the material flows with each other.

Information sharing can be viewed as a prerequisite to material flow coordination. However, as result of the supply chain complexity, information flows have to cross through several processes and entities provoking information distortion, delays and unreliability. Thus, one of the challenges in SCI is to share critical information in real time among selected partners. The challenge of information sharing is not reduced to a technical issue of transferring data. It is necessary to consider an adequate distribution of the information among supply chain partners, in other words, to transfer the correct information to the right supply chain partner.

For a successful SCI initiative, business processes need to be integrated so that they can work synchronously and aligned. However, integration of business processes is affected by the presence of elements of dynamic complexity such as: (1) non-linearity, (2) feedback loops, and (3) time delays. As explained by Sterman (2000), non-linearity is an element of dynamic complexity which consists of unproportional effects attributed to multiple factors, as opposite to a simple cause-effect relation between variables. In the internet era, business processes became more nonlinear as a consequence of alliances and increased collaboration between companies. Feedback loops are understood as the existence of future consequences from present actions (Sterman, 2000). Time delays are explained as a non-direct cause-effect relation between variables, bringing as consequence variations and oscillations in the behaviour of systems (Sterman, 2000). Presence of these elements of dynamic complexity affects synchronization and alignment of business processes for a successful construction of SCI.

In search for solutions which can facilitate the construction of SCI, companies have turned their attention to internet based technologies (Wiengarten, Humpreys, McKittrick, & Fynes, 2013; Chen & Holsapple, 2012; Cagliano, Caniato, & Spina, 2003; Auramo, Aminoff, & Punakavi, 2002). New internet based e-collaboration tools allow the integration of multiple organizations, making it feasible to construct SCI systems. According to a study conducted by Auramo et al, (2002), organizations across different sectors have recognized the potential of ICT to share timely and reliable information, to enable business process integration and coordination of activities. ICT can support the collaboration through the supply chain and closer integration among partners.

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Furthermore, ICT potentially increases the capability of joint decision making and the automation of repetitive business processes. However, tools alone are not sufficient as it is necessary to undertake organizational and technological changes together with a co-alignment in structure, management processes, strategy, technology and individuals/roles for successful e-business adoption (Chen & Ching, 2002). At the core of organizational changes from an operational point of view are business processes; when internet based technologies are implemented, in particular in the case of the supply chain, business processes should be re-designed to support the new technology, because it is necessary not only to integrate internal processes but also with those of external partners.

However, redesigning business processes to support the adoption of e-business technologies is difficult. Although a number of methodologies exist for BPR, SCR, and e-business process design, there is a lack of an integrated methodological framework to support SCI (Palma-Mendoza et al., 2014). These methodologies were selected for their process re-design oriented approach (Table 1 and Table 2). The review found that none of the methodologies provides a comprehensive solution to the research question, although it seems that a number of the methodologies reviewed could potentially be combined for that aim. Whilst considering different methodologies for a particular intervention, a number of methodologies tend to be more useful in relation to some phases than others, so it becomes attractive to combine different methodologies for a better result. When linking different methodologies it is necessary to decompose them into detachable elements.

Table 1. BPR methodologies decomposed in generic stages

| | Methodologies | | | |
|---|--|--|---|--|
| Generic Stages | Process Analysis and Design Methodology (Wastell, White & Kawalek, 1994) | Conceptual framework for decision support system (Ashayeri, Keij & Broker, 1998) | Business process redesign method (Adair, & Murray, 1994) | Business process Redesign (Davenport & Short 1990) |
| Strategic Vision and Business Understanding | Not present | Not present | <ul style="list-style-type: none"> • Understanding customer and market • Develop vision • Determine vision imperatives • Develop strategy | Develop business vision |
| Process Definition and Business Objectives | Process definition | <ul style="list-style-type: none"> • Formulation of objectives • Criteria selection | <ul style="list-style-type: none"> • Choose the right process • Customer/client surveys | <ul style="list-style-type: none"> • Develop process objectives • Identify Process to be re-designed |
| Understanding Business Process AS IS | Baseline process capture | <ul style="list-style-type: none"> • Identification of business process and activities • Evaluation of business process and activities • SD model | Baseline process | Understand and measure existing process |
| Design of Process TO BE | Process evaluation | <ul style="list-style-type: none"> • Scenario formulation • Impact analysis | Analyze | Identify IT levers |
| Implementation of changes | Target process design | Choice of strategy to implement | Implement breakthrough improvements or innovative designs | Design and build a prototype of the process |
| Evaluation of changes | Not present | Not present | <ul style="list-style-type: none"> • Monitor • Measure • Adjust | Not present |

Methodology to Support Supply Chain Integration A Business Process Perspective*Table 2. Supply chain re-design and e-business process design methodologies decomposed in generic stages*

| | Methodologies | | | |
|---|---|--|--|--|
| Generic Stages | Cardiff supply chain modelling and reengineering methodology (Towill, 1996) | Supply chain excellence approach (Bolstorff & Rosenbaum, 2012) | Supply chain re-design framework (Changchien & Shen, 2002) | E-business process Improvement (Kirchmer, 2004) |
| Strategic Vision and Business Understanding | Real world supply chain | <ul style="list-style-type: none"> • Business context • Strategic background | <ul style="list-style-type: none"> • Evaluation of organizational structure • Identification of needs | Not present |
| Process Definition and Business Objectives | Business objectives | <ul style="list-style-type: none"> • Supply chain definition and priorities • Metric definition • Industry comparison | <ul style="list-style-type: none"> • Definition of objectives • Identification of core processes to be re-designed | Not present |
| Understanding Business Process AS IS | <ul style="list-style-type: none"> • Systems input-output analysis • Conceptual model • Block diagram formation • Control theory, computer simulation and statistical techniques • Verification and validation • Dynamic analysis | <ul style="list-style-type: none"> • Understanding process AS IS • Identification of problems and solutions | Analysis of current process | Not present |
| Design of Process TO BE | <ul style="list-style-type: none"> • Tune existing parameters • Structural re-design • What if Scenarios | Design of to be process | <ul style="list-style-type: none"> • Design for innovation, use of IT as enabler of alternatives for improvement • Evaluating new processes • Selection of best alternative | Vision |
| Implementation of changes | Not present | Not present | <ul style="list-style-type: none"> • Implementation | <ul style="list-style-type: none"> • Specification • Realization |
| Evaluation of changes | Not present | Not present | Not present | Continuous Improvement |

According to Mingers and Brocklesby (1997), it is possible to decompose methodologies at the stage level (what) or at the technique level (how). Accordingly, the relevant methodologies (Table 1 and Table 2) were first decomposed at their stage level. Next, through an inductive approach of pattern recognition similar to the one used by Kettinger, Teng, and Guha (1997), the commonalities and differences between the decomposed methodologies were analysed in terms of their stages and activities. This analysis identified a set of distinct stages included in each methodology. Then a set of common stages were identified to be present in all the methodologies reviewed. Finally a brief description for each common stage was elaborated, giving as result the identification of generic stages for the construction of a BPR methodology structure.

Lessons learned from the review conducted on the methodologies shown in Tables 1 and 2, is that no particular methodology exists to tackle the research question, although it seems that a number of the methodologies reviewed could potentially be combined for that goal. After being decomposed at the

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stage level, it can be observed that the methodologies reviewed share common stages, these similarities can be used for the purpose to combine different methodologies for a particular intervention in a single BPR structure (Mingers & Brocklesby, 1997).

BUSINESS PROCESS REDESIGN METHODOLOGY TO SUPPORT SUPPLY CHAIN INTEGRATION

The methodologies reviewed were decomposed a second time in terms of their techniques and methods employed in order to select the most suitable for each stage. Additional methods and techniques were adopted from the wider supply chain management and e-business literature. The proposed BPR methodology as shown in Figure 1 is a multi-methodology, the essence of which is to link together parts of different methodologies to tackle a particular problem situation (Mingers & Brocklesby, 1997).

Stage 1. Top Management Commitment and Vision

According to the literature review, this stage should include meetings with management executives (in cross functional groups), presentations and discussions to reach an agreement on project scope, reach and outcomes. The particular focus should be on a specific portfolio of products/services.

Stage 2. Business Understanding

The objective of this stage is to develop an overall understanding of the business in which the BPR project will be conducted. This understanding can be divided into two areas – first understanding the business context followed by understanding the business logic.

Understanding the business context involves gaining knowledge about the sector in which the company competes, the market characteristics and company history. Annual report analysis and strengths, weaknesses, opportunities, and threats (SWOT) analysis are the most useful methods to follow.

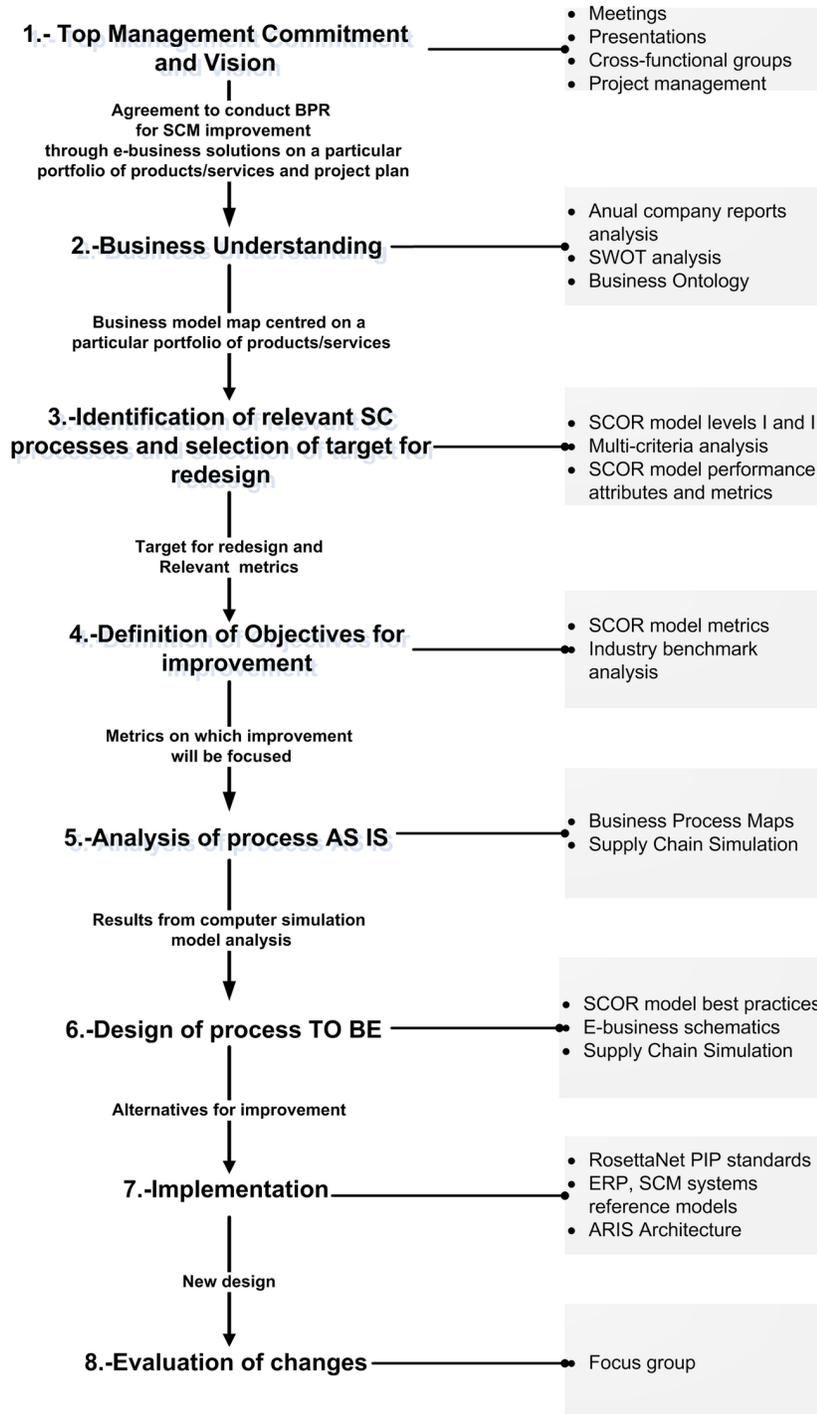
Next, it is necessary to understand the business logic, meaning how the company operates to satisfy its customers with emphasis on identifying the current roles of supply chain management and e-business technologies, if present. However, none of the process design methodologies reviewed was found to address this. Therefore, the business model ontology proposed by Osterwalder and Pigneur (2004) is adopted from the e-business literature. The business ontology allows the construction of a business logic map around a particular value proposition to represent the most important elements of a business model. Its block structure allows the description of the current role performed by SCM and ICT.

Stage 3. Identification of Relevant Supply Chain Processes and Selection of Target for Redesign

An initial identification of relevant supply chain processes comes from the business model ontology used in Stage 2. However, this initial identification can be enhanced by the use of the supply chain operations reference (SCOR) model. The SCOR model was developed by the Supply Chain Council (SCC) in 1996 to

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Figure 1. Business process re-design methodology to support supply chain integration



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understand, describe, and evaluate supply chains. The SCOR model follows a hierarchical structure with different levels of decomposition. The basic hierarchical composition of the SCOR model is as follows:

- **SCOR model Level I Process Types:** Level 1 defines scope and content using five process types: Plan, Source, Make, Delivery and Return.
- **SCOR model Level II Process Categories:** This level defines configuration level, where a supply chain can be defined using core process categories.
- **SCOR model Level III Process Activities:** This level decompose processes in process elements, describing inputs and outputs, process performance metrics and recommended best practices

The SCOR model aids the understanding of a particular supply chain by means of mapping it in business process terms. Accordingly, SCOR model process types and process categories can be used to identify and map the supply chain processes present. The mapping process starts in by identifying the process types present in a supply chain under study, provided that scope of the study was defined beforehand as described in stages 1 and 2 (Fig.1) of the BPR methodology. Once the adequate process types have been selected, it is necessary to select which process categories describes the supply chain processes present. Definitions and description of each process configuration are available in SCOR model version 11(SCC, 2012).

Some processes in a supply chain are more critical than others. Thus, in order to differentiate the degree of importance among several supply chain processes, it is proposed to use multi-criteria decision analysis such as AHP as a decision support tool for process selection. AHP assumes that decision problems can be structured by translating goals into measurable criteria which in turn can be related to alternative decisions. As result, AHP provides a priority number at each level of the hierarchy, then priorities of the alternatives are weighted against those of the criteria so that the eventual importance of the alternatives related to the goal are quantified (Saaty & Vargas, 2012). The AHP structure proposed for the selection of a key supply chain process for redesign consists of a two level criteria composed by SCOR model performance attributes and level 1 metrics (Figure 2).

At the top of Figure 2 is the overall objective, in this case the selection of a target for re-design. The next two levels are the criteria, here consisting of SCOR model performance attributes and level 1 metrics. Below are the decision alternatives, here represented by relevant supply chain processes previously identified through SCOR model mapping.

In the SCOR model, performance attributes serve to define generic supply chain characteristics and to describe supply chain strategy. SCOR model metrics are organized around the performance attributes and possess different hierarchical levels, similarly to SCOR processes. Figure 3 shows how level 1 metrics relate to performance attributes. SCOR model level 1 metrics are considered to be key performance indicators (KPI) intended to measure and express the overall performance of a particular performance attribute. Detailed description of performance attributes and level 1 metrics is found in SCOR model version 11 (SCC, 2012).

At the bottom of the AHP structure (Figure 2) are the relevant supply chain processes which will be compared using the two level criteria (SCOR model performance attributes and level 1 metrics). In respect to how relevant supply chain processes will relate to the two level criteria, the SCOR model assigns for each process category (SCOR model level II) different level 1 metrics (SCC, 2012). Once the structure is constructed, the AHP analysis will provide a priority numerical order for the supply chain

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Figure 2. AHP structure for selection of a target supply chain process for redesign

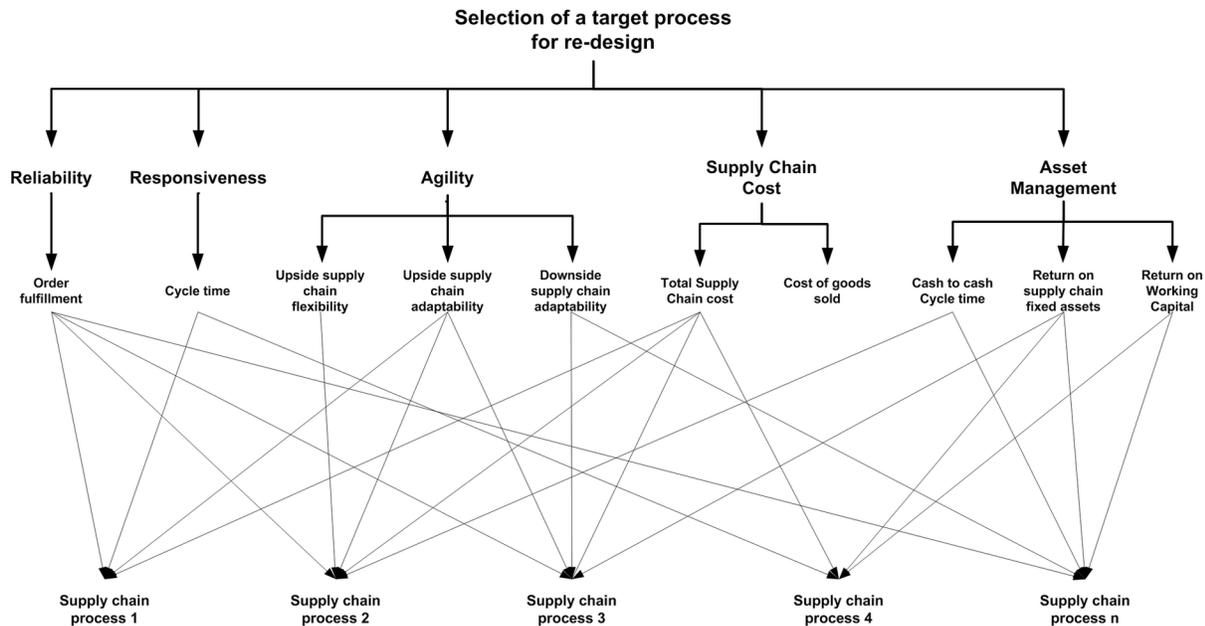
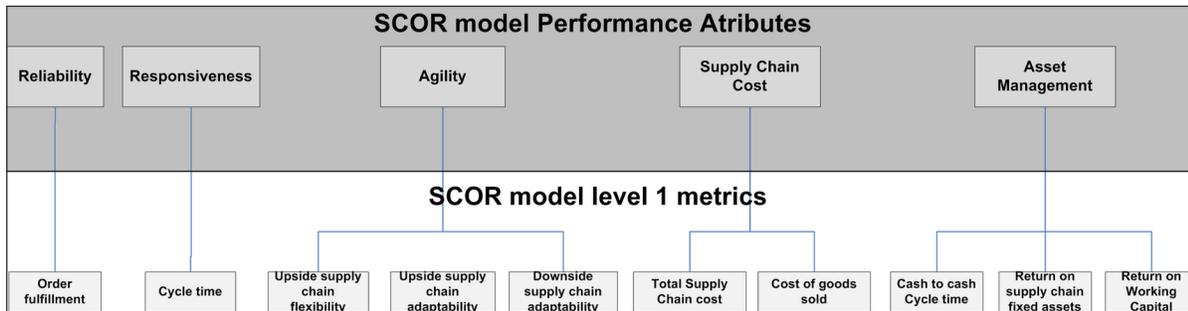


Figure 3. SCOR model performance attributes and 1st level metrics



processes under consideration. From this priority numerical order, it should be easy to decide on which supply chain process to focus the re-design effort.

Stage 4. Definition of Objectives for Improvement

Next, it is necessary to define objectives for improvement. Few methodologies in the reviewed literature address this in detail. A number of suggestions and approaches in the wider supply chain literature are combined here to provide a method for definition of objectives for improvement. First, relevant metrics are identified, followed by a benchmark analysis to define the levels of improvement desired. From the AHP analysis, it is possible to calculate a priority rank for the metric criteria used, thus making it possible to identify the most important SCOR metrics associated with the process targeted for re-design.

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For the definition of objectives for improvement, it is recommended to conduct a benchmark analysis to identify gaps between current performance and industry benchmarks (for the most important SCOR metrics identified). Next, based on the gaps, a constructive discussion should lead towards deciding the levels of improvement desired.

Stage 5. Understanding the Process As Is

Once a process has been selected and objectives for improvement defined, it is necessary to understand the targeted process. The understanding of a supply chain process should be quite exhaustive to comprehend the diverse elements, interactions and flows. A number of methods and techniques are recommended in the literature such as business process maps, system dynamics and discrete event simulation. In addition to these methods and techniques, here is also recommended to consider hybrid simulation. Business process maps are useful in analysing flows, clarifying the relationships and sequence of operations. However, they have limitations in showing structure, dynamic elements and causal relationships (An & Jeng, 2005).

One of the obstacles for evaluating business processes is their complexity, consisting of a series of linked activities which crosses departmental and organizational boundaries as is the case with supply chain processes. Moreover, when combined with elements of dynamic complexity (Sterman, 2000), the task of evaluation becomes even more difficult. The existence of these elements points towards the need to use a systemic and dynamic approach to tackle such complexity. System dynamics (SD) is such an approach as it can be used to generate insight into dynamic behaviour and causal relationships (Akkermans & Dellaert, 2005). In SD modelling, a supply chain is represented as a series of stocks and flows where state changes occur continuously over time; although SD is well suited to model complex systems, it has limitations in providing a detailed representation of a supply chain with discrete changes.

Another simulation approach widely used for supply chain analysis is discrete event simulation (DES). DES simulation models are usually built upon process maps or flow chart diagrams. DES models systems perform as a network of queues and activities where changes occur at discrete points of time, entities of a system are represented individually; models are generally stochastic in nature. DES tends to be convenient for detailed process analyses, resource utilization, queuing, and relatively shorter-term analyses (Jahangirian, Eldabi, Nasser, Stergioulas, & Young, 2010). However, DES cannot capture qualitative relations such as those between supply chain partners, and it requires a long and arduous data gathering.

Understanding the dynamics of the supply chain in a safe computer environment is the main value of computer simulation models. Simulation models in both DES and SD are built to understand how systems behave over time. However, given the fact that pure DES and SD simulation have a number of drawbacks preventing a thorough and exhaustive supply chain analysis, hybrid SD/DES simulation have been suggested (Lee, Cho, Kim & Kim, 2002; Pereira, 2009; Rabelo et al, 2005; Reiner, 2005; Venkateswaran & Son, 2005). A hybrid SD/DES simulation approach analyses both discrete and continuous aspects of a supply chain simultaneously (Pereira, 2009).

According to An and Jeng (2005), understanding the sequencing and synchronization of activities through a DES approach is not enough; SD can provide an insight on the hidden factors affecting performance. SD can be applied to understand the supply chain structure and interaction between partners (Vlachos, Georgiadis & Iakovou, 2007), whilst DES can be used to represent uncertainties, individual events and disturbances (Kleijnen, 2005). Thus, hybrid DES/SD simulation could provide more insight and accurate analysis of a supply chain.

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Stage 6. Design of Process as To Be

After achieving a good understanding, of the process, what follows is the generation and evaluation of alternatives for SCI based on the use of ICT. From the analysis of the process AS IS, it should be possible to identify where problems or poor performances, as measured by the relevant metrics defined in stage 4, are located. To generate alternatives for improvement, it is recommended to conduct a comparison of the existing system with recommended best practices in SCOR model (level II and III). For the proposed methodology the emphasis will be in best practices on the use of ICT for SCI. E-business schematics provide an additional aid in exploring options for change (Weill & Vitale, 2001).

E-business model schematics are used to capture important elements, such as type of actors (e.g. supplier, customer), electronic links, and for depicting the major flows (money, items and information) in the main transactions. Thus, the SCOR model provides ideas on improvement options; however, for a more detailed examination of these, e-business model schematics can be used to decompose a particular recommendation into its basic elements; this depiction provides a basis for discussion among decision makers/ stakeholders, from which a set of alternatives for improvement is generated. Once different alternatives have been generated, it is necessary to evaluate them. The computer model created in Stage 5 to understand the process AS IS can be used/ modified to evaluate the alternatives generated, as measured by the metrics defined in Stage 4. From these results, it will be possible to select the alternative that offers the best performance.

Stage 7. Implementation of Changes

The next step is the specification of the new business process design for its implementation. To tackle the implementation stage here it is recommended to use SCOR model level III, RosettaNet Partner Interface Processes (PIP), e-business solutions reference models, and for detailed process specification the Architecture of Integrated Information Systems (ARIS). RosettaNet is an industry organization that develops universal standards for the global supply chain; RosettaNet standards provide a common language for transactions and the foundation for integrating critical processes among partners (RosettaNet, 2012).

The standards prescribe how to implement collaborative business processes between supply-chain trading partners using networked applications. These specifications include the business process definitions and technical elements for interoperability and communication.

E-business process specification can be complemented by ERP/SCM reference models (e.g., mySAP ERP). Finally, the new process specification is built using the ARIS architecture. ARIS offers a framework to completely describe information systems within business processes.

Stage 8. Evaluation of Changes

The final phase is to evaluate the performance of the real process after implementation so a comparison can be made between performance before and after redesign in order to assess the impact. This could be conducted by assembling a focus group composed of executives from the areas affected by the business re-design, to collect and discuss the actual change in performance.

Methodology to Support Supply Chain Integration A Business Process Perspective*Table 3. Differences between the proposed BPR methodology and other methodologies*

| Stages | Difference with other methodologies |
|---|---|
| 9. Top Management Commitment and Vision | Similar to other methodologies |
| 10. Business Understanding | Integration of the business model ontology into a BPR methodology to map the logic of a business with emphasis on understanding the current roles of SC activities and e-business in the creation of value. |
| 11. Identification of relevant SC processes and selection of target for re-design | Use of a particular AHP structure which uses as criteria for evaluation SCOR model performance attributes and level 1 metrics for the selection of a target for re-design. |
| 12. Definition of Objectives for Improvement | Use of SCOR model to define relevant metrics for objective definition |
| 13. Analysis of process AS IS | Use of a combined DES and SD computer simulation modelling approach for the analysis of supply chain processes. |
| 14. Design of process AS TO BE | Use of SCOR model to identify best practices in the use of e-business. Use of e-business schematics to represent alternatives for improvement. |
| 15. Implementation | Integration and use of RosettaNet PIP standards, reference models and ARIS architecture in a BPR methodology for process specification. |
| 16. Evaluation of changes | Similar to other methodologies |

SOLUTIONS AND RECOMMENDATIONS

Despite the potential benefits of internet based technologies for the construction of SCI, the literature suggests a number of challenges preventing its successful adoption, in particular the need to re-design business processes. A number of methodologies were found that address business process re-design, supply chain re-design and e-business process design. However, none of these methodologies addressed in particular how to redesign business processes to support SCI. By adopting a number of methods and techniques relevant to supply chain re-design and e-business process design, this methodology is distinct from other BPR methodologies, providing specific solutions for adoption at each stage in supporting supply chain integration based on ICT technologies. Table 3 shows the main differences between this BPR methodology and the ones reviewed.

FUTURE RESEARCH DIRECTIONS

As new developments in the field of business process redesign emerge, it is desirable to incorporate them to the proposed BPR methodology. Moreover, the BPR methodology will require further validation to proof the appropriateness of the methods and structure of the methodology.

CONCLUSION

There is a particular concern to improve supply chain management practice due to the always changing competitive environment. The supply chain literature shows a growing interest on integrating the supply chain as a way to improve competitiveness. However, SCI construction is difficult due to a number

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of challenges such as coordination of material flows, information sharing and integration of business processes. Many researchers argue that ICT can potentially aid the construction of supply chain integration; however, evidence found in the ICT and supply chain literature shows a limited adoption of ICT for SCI. This limited adoption can be explained as a combination of high expectations with the presence of technical and organizational challenges. In terms of expectations, many firms have wrongly assumed they will obtain huge benefits from this new technology without making changes to the existing organizational structure.

Accordingly, from a literature review diverse challenges were identified, both technical and organizational. Among the key organizational challenges found is the necessity to redesign business processes to support the successful implementation of ICT technologies. However, this necessity has not been covered in the literature. Through a literature review conducted in different domains, a new BPR methodology has been developed and described here to tackle the redesign of business processes to support the construction of supply chain integration. For each one of the BPR methodology stages, relevant methods and techniques were reviewed from the literature, selected and combined. Although it will require further validation, the appropriateness of the methods and structure of this proposed BPR methodology suggests it can clearly guide a business process re-design to support the construction of SCI.

REFERENCES

- Adair, C. B., & Murray, B. A. (1994). *Break-through process re-design, new pathways to customer value*. New York: Rath & Strong.
- Akkermans, H., & Dellaert, N. (2005). The rediscovery of industrial dynamics: The contribution of system dynamics to supply chain management in a dynamic and fragmented world. *System Dynamics Review*, 21(3), 173–186. doi:10.1002/sdr.317
- An, L., & Jeng, J.-J. (2005). On developing system dynamics model for business process simulation. *Proceeding of the 37th Winter Simulation Conference*, Orlando, Florida (pp. 2068-2077)
- Ashayeri, J., Keij, R., & Broker, A. (1998). Global business process re-engineering: A system dynamics-based approach. *International Journal of Operations & Production Management*, 18(9/10), 817–831. doi:10.1108/01443579810225478
- Auramo, J., Aminoff, A., & Punakivi, M. (2002). Research agenda for e-business logistics based on professional opinions. *International Journal of Physical Distribution & Logistics*, 32(7), 513–531. doi:10.1108/09600030210442568
- Awad, H. A. H., & Nassar, M. O. (2010). Supply chain integration: Definition and challenges. *Proceedings of the international MultiConference of engineers and computer scientists IMECS 2010*, Hong Kong.
- Bolstorff, P., & Rosenbaum, R. (2012). *Supply Chain Excellence* (3rd ed.). New York: AMACOM.
- Cagliano, R., Caniato, F., & Spina, G. (2003). E-business strategy, how companies are shaping their supply chain through the internet. *International Journal of Operations & Production Management*, 23(10), 1142–1162. doi:10.1108/01443570310496607

Methodology to Support Supply Chain Integration A Business Process Perspective

- Changchien, S. W., & Shen, H.-Y. (2002). Supply chain reengineering using a core process analysis matrix and object-oriented simulation. *Information & Management*, 39(5), 345–358. doi:10.1016/S0378-7206(01)00102-1
- Chen, J., & Ching, R. (2002). A proposed framework for transitioning to an e-business model. *Quarterly Journal of Electronic Commerce*, 3(4), 375–389.
- Chen, L., & Holsapple, C. (2012). E-Business adoption research: analysis and structure. *Proceedings of the 18th Americas Conference on Information Systems (AMICS)*, Seattle, Washington.
- Davenport, T. H., & Short, J. E. (1990). The new industrial engineering information technology and business process re-design. *Sloan Management Review*, 31, 11–27.
- Jahangirian, M., Eldabi, T., Naseer, A., Stergioulas, L. K., & Young, T. (2010). Simulation in manufacturing and business: A review. *European Journal of Operational Research*, 203(1), 1–13. doi:10.1016/j.ejor.2009.06.004
- Kettinger, J. W., Teng, J. T. C., & Guha, S. (1997). Business process change: A study of methodologies techniques and tools. *Management Information Systems Quarterly*, 21(1), 55–80. doi:10.2307/249742
- Kirchmer, M. (2004). E-business process networks - successful value chains through standards. *Journal of Enterprise information Management*, 17, 20-30.
- Kleijnen, J. P. C. (2005). Supply chain simulation, tools and techniques: A survey. *International Journal of Simulation and Process Modeling*, 1(1/2), 82–89. doi:10.1504/IJSPM.2005.007116
- Lee, Y. H., Cho, M. K., Kim, S. J., & Kim, Y. B. (2002). Supply chain simulation with discrete-continuous combined modelling. *Computers & Industrial Engineering*, 43(1-2), 375–392. doi:10.1016/S0360-8352(02)00080-3
- Mingers, J., & Brocklesby, J. (1997). Multimethodology: Towards a framework for mixing methodologies. *International Journal of Management Sciences*, 25(5), 489–509.
- Osterwalder, A., & Pigneur, Y. (2004). An ontology for e-Business models. In W. Currie (Ed.), *Value creation from e-business models* (pp. 65–97). Oxford, UK: Elsevier. doi:10.1016/B978-075066140-9/50006-0
- Palma-Mendoza, J. A. (2014). Analytical hierarchy process and SCOR model to support supply chain re-design. *International Journal of Information Management*, 34(5), 634–638. doi:10.1016/j.ijinfomgt.2014.06.002
- Palma-Mendoza, J. A., Neailey, K., & Roy, R. (2014). Business process re-design methodology to support supply chain integration. *International Journal of Information Management*, 34(2), 167–176. doi:10.1016/j.ijinfomgt.2013.12.008
- Rabelo, L., Helal, M., Jones, J., & Min, H.-S. (2005). Enterprise simulation: A hybrid system approach. *International Journal of Computer Integrated Manufacturing*, 18(6), 498–508. doi:10.1080/09511920400030138

Methodology to Support Supply Chain Integration A Business Process Perspective

- Reiner, G. (2005). Customer-Oriented improvement and evaluation of supply chain processes supported by simulation models. *International Journal of Production Economics*, 96(3), 381–395. doi:10.1016/j.ijpe.2004.07.004
- Rosettanet. (2012). *Overview: Clusters, segments, and PIPS*. Retrieved from <http://www.rosettanet.org>
- Saaty, T. L., & Vargas, L. G. (2012). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process* (2nd ed.). New York: Springer. doi:10.1007/978-1-4614-3597-6
- SCC. (2012). *Supply Chain Operations Reference Model Version 11*. Pittsburgh: Supply Chain Council Inc.
- Sterman, J. D. (2000). *Business Dynamics, systems thinking and modeling for a complex world*. New York: McGraw-Hill.
- Towill, D. R. (1996). Industrial dynamics modelling of supply chains. *Logistics Information Management*, 9(4), 43–56. doi:10.1108/09576059610116707
- Venkateswaran, J., & Son, Y. J. (2005). Hybrid system dynamic –Discrete event simulation - Based architecture for hierarchical production planning. *International Journal of Production Research*, 43(20), 4397–4429. doi:10.1080/00207540500142472
- Verissimo Pereira, J. (2009). SD-DES model: A new approach for implementing an e-Supply Chain. *Journal of Modelling in Management*, 4(2), 134–148. doi:10.1108/17465660910973952
- Vlachos, D., Georgiadis, P., & Iakovou, E. (2007). A system dynamics model for dynamic capacity planning of remanufacturing in closed-loop supply chains. *Computers & Operations Research*, 34(2), 367–394. doi:10.1016/j.cor.2005.03.005
- Wastell, D. G., White, P., & Kawalek, P. (1994). A methodology for business process re-design: Experiences and issues. *The Journal of Strategic Information Systems*, 3(1), 23–40. doi:10.1016/0963-8687(94)90004-3
- Weill, P., & Vitale, M. R. (2001). *Place to Space, migrating to ebusiness models*. Boston, MA: Harvard Business School Publishing Corporation.
- Wiengarten, F., Humphreys, P., McKittrick, A., & Fynes, B. (2013). Investigating the impact of e-business applications on supply chain collaboration in the German automotive industry. *International Journal of Operations & Production Management*, 33(1), 25–48. doi:10.1108/01443571311288039

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KEY TERMS AND DEFINITIONS

Business Process Re-Design: An approach to remove non-value activities from processes and improve cycle-time, response capability and lower process costs.

Business Processes: Business processes perform the supply chain activities necessary to ensure the achievements of the supply chain goals.

e-Business: e-Business can be understood as a business process improvement oriented technology based on the internet.

Hybrid SD/DES simulation: A simulation approach which simultaneously employs SD and DES to study discrete and continuous aspects of a system.

Supply Chain Integration: An approach to supply chain which is characterized by trust, information sharing, collaboration, cooperation, shared technology and integrated processes along the supply chain.

Supply Chain Simulation: Approach to understand the dynamics of the supply chain.

Supply Chain: A systemic concept that considers all the activities from procurement of raw materials to the delivery of finished goods as a linked chain of business processes.

Chapter 32

Evolution of the Role of Measurement Systems in Industrial Decision Support

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ABSTRACT

Measurement data can be used for decision support in multiple ways – from one-time, manual data collection/presentation (reporting) through flexible business intelligence solutions to online, automated measurement systems. In centralized organizations, the measurement data is often collected through reporting, but the trends in modern organizations with empowered teams, globalized development, and needs to monitor continuously longer supply chains requires shift in the design and use of measurement systems. In this chapter, we present a study of evolving measurement systems at three companies with global businesses – Ericsson, Volvo Cars, and Axis Communications. The results of the study include the identification of the timeline of the evolution, distinct generations of measurement systems and information needs in the different phases of the evolution. The experiences show how to evolve centralized decision support systems to support global and distributed decision support.

1. INTRODUCTION

Modern software development companies often experience the trend of moving from centralized project planning, monitoring, and execution towards distributed organizations with empowered software development teams and globalized software development processes (Ebert & De Neve, 2001; Herbsleb & Mockus, 2003). In this context software is often regarded as a part of a larger product which is one or more links in a global supply chain. An example of such a supply chain is the development of modern passenger cars where there are multiple layers/links of sub-contractors finally delivering sub-components

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(many of these being computer units with software) to Original Equipment Manufacturers (OEMs) such as Volvo or Volkswagen.

Decision support in such companies requires reliable facts to formulate the decisions and to support the monitoring of decision implementation. To support decisions, companies have a number of methods and tools at their disposal. The methods and tools vary from generic business intelligence systems to dedicated measurement systems which trigger the decision formulation processes and monitor the execution/implementation of the decisions (Staron, 2012). The efficiency of the decision support has an important impact on the performance of the organizations – both in the time frame of the decision support (e.g., triggering the decisions when there is still possibility to act) and in the quality of the decisions (e.g., triggering the right decisions).

Although this trend of moving towards globalized software development is recognized when it comes to evolving software processes and organizations (Šmite et al., 2010), little has been studied on the evolution of measurement systems and the associated decision support towards globalized software enterprises. The mission of this chapter is to address this gap by identifying and documenting industrial experiences from evolution of measurement systems from centralized reporting to distributed decision support systems. In this chapter, we have a unique opportunity to study three software development organizations which use measurement systems in decision making in three different ways.

First, we explore Volvo Cars, a Swedish vehicle manufacturer in a sector with increased importance of software. Second, we study measurement systems at one unit of Ericsson which develops products for telecommunication networks and where software has a major role. Finally, we have a chance to explore the information needs of Axis Communications, which is a company developing network cameras and video management software where embedded software development is an important part. Each of these organizations have distinct properties and market situation, but all of them are aligned in terms of identifying the emerging trends of new information needs focused on software development teams and identifying needs for increasing efficiency of measurement processes.

The chapter is structured as follows. Section 2 presents the background including the related work. Section 3 presents the related work most relevant to the study presented in this chapter. Section 4 discusses the research method employed in the study and Section 5 includes the results of studies at the companies in terms of the evolution timeline. Section 6 presents the conclusions from the study. The chapter concludes with the summary and a list of further literature for the interested reader.

2. BACKGROUND

In this section, we introduce the concept of measurement systems which we investigate in the context of three companies – Ericsson, Volvo Cars, and Axis Communications. Towards the end of the section, we describe the current trends in measurement systems.

2.1. Measurement Systems, Business Intelligence and Metric Tools

The measurement systems presented in the chapter are based on the international standard ISO 15939 (Software and Systems Engineering – Measurement Processes, (ISO/IEC 2007)) and its use in practice to design, develop and deploy measurement systems for monitoring products, processes and organizations (Staron et al., 2010).

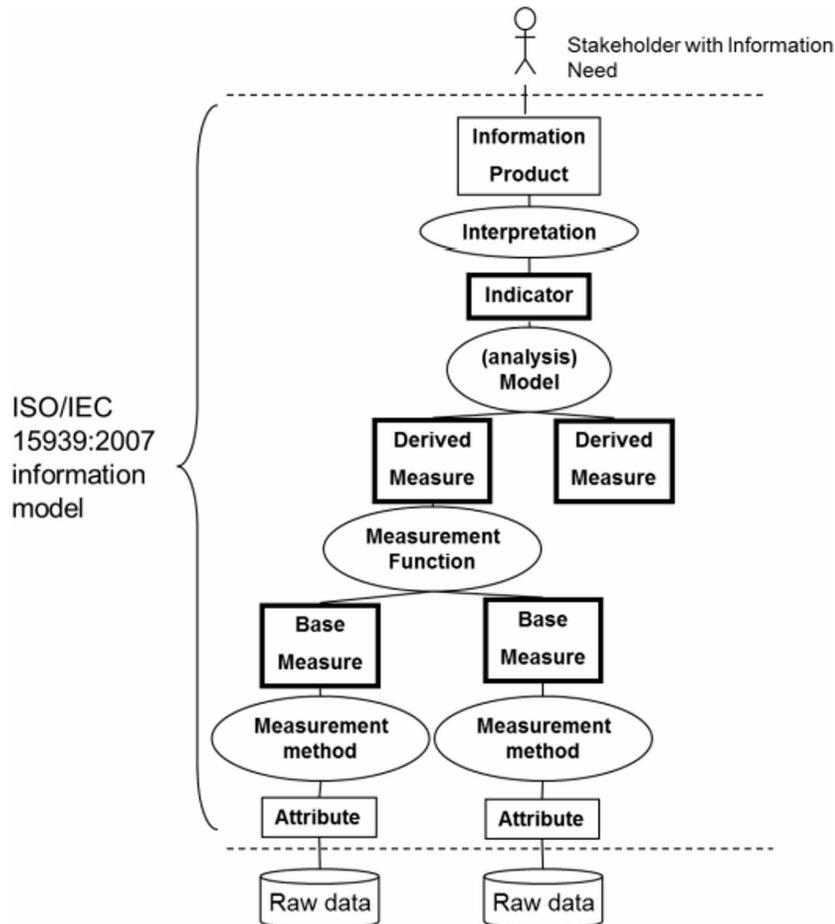
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A measurement system is defined in the ISO 15939 standard as *set of measurement instruments assembled together in order to measure quantities of a specific kind*. The measurement systems designed based on ISO/IEC 15939 are characterized by the focus on the *information need* and the way in which measurement systems support decision formulation and decision implementation for a specific stakeholder – as depicted in Figure 1.

The measurement information model reflects an important paradigm shift in the field of software metrics – from *what can be measured?* to *what do we need to measure?* This shift happened in parallel to the evolution of the field of Corporate Performance Management (Harvard Business School, 1998; Paladino, 2007) and the gain of popularity of Agile software development (Cockburn 2002, 2006). An example of a measurement system from Ericsson is presented in Figure 2.

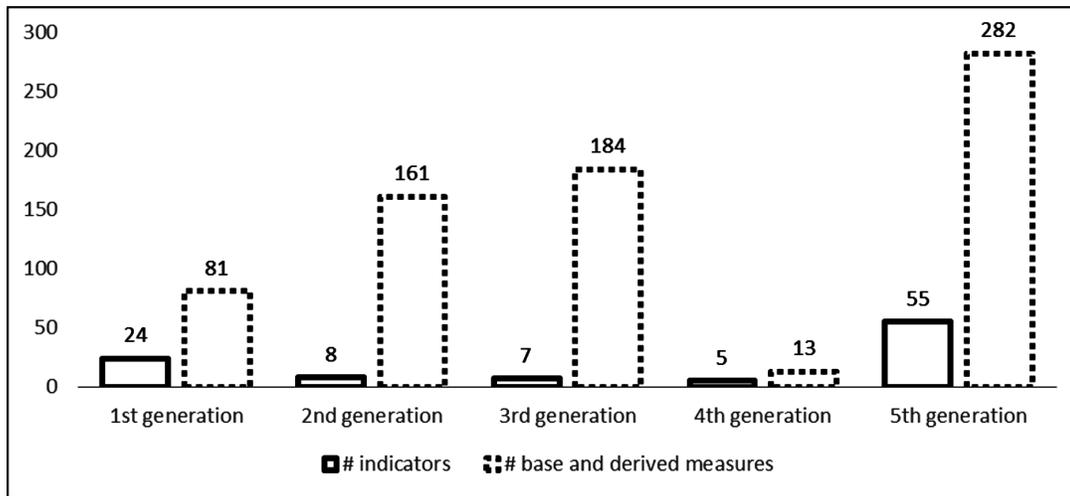
The example measurement system is an MS Excel file with measures (the grey area – worksheets) and a number of scripts for calculating the measures and indicators (the indicator is the green-colored cell with the number), scripts for accessing and storing measures and raw data and the scripts for controlling the information quality (Staron & Meding, 2009). Each measurement system contains a set of measures

Figure 1. Measurement information model of ISO/IEC 15939, based on (IEEE 2007, ISO/IEC 2007, Staron, Meding et al. 2010)



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Figure 2. Evolution measurement systems from Ericsson



which are dedicated to fulfilling an information need of a stakeholder. An example information need is the test progress and, thus, such a measurement system contains both the indicator (providing the status if the progress is sufficient or not according to stakeholder-defined criteria) and measures showing the trends. The measures are calculated from raw data, which is often obtained from measurement instruments embedded in software development tools (e.g., test-log file analyzers). This stakeholder-centric measurement system is to the contrary of the traditional view of software measurement.

The traditional focus of software measurement postulated the need to measure properties of entities and emphasized the need to use quantitative data in software engineering in such process frameworks as, for example, Team Software Process (Humphrey, 2000). The measurement of multiple properties of a specific type of entities (e.g., program) is usually the task of metric tools. The traditional focus is on monitoring progress and supporting managers in formulating decisions and in monitoring the implementation of their decisions. Business intelligence tools are usually used for this context because they combine the flexibility of using data from multiple sources and producing reproducible reports for management (Luhn, 1958) and their strategic decision processes (Ashton & Intelligence, 1997).

Together with the popularity of agile methods for developing software, the emphasis of teams as self-organized and self-directed entities increased. The focus of measurements changed so that the teams were the primary stakeholders for the measurement information and the management became responsible for reducing hinders in software processes. The terms of information radiators and dashboards were coined for the purpose of spreading information to empowered software development teams (Voinea & Telea, 2007; Buse & Zimmermann, 2012; Feldt et al., 2013). Although there are differences in these concepts, in this chapter we consider them as similar for the sake of argument.

Together with the shift from management-oriented to team-oriented information needs, the focus shifts from the lower part of the measurement information model to the upper part. In the next section, we describe these current trends which make the evolution of software measurement and emphasize the focus on measurement systems rather than measurement instruments only.

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2.2. Current Trends in Measurement Information Needs for Global Software Development Companies

Modern software development companies use the different types of measurement systems in different ways. On one hand, there are companies which use measurements to monitor single entities and focus on the unification of measurement tools, definitions and decisions. On the other hand, we have companies which embrace the fact that diversity is an integral part of software development and software supply chains (when we deal with software development across the globe) and therefore provide flexibility in designing measurement systems in order to prioritize the focus on the goal of the measurement rather than the form of the measurement system.

By observing these latter companies and studying the literature we could identify a number of trends:

1. **Increased Importance of Software as An Element of a Supply Chain:** Software development becomes increasingly important for more domains and thus the information needs related to software development become more universally applicable (even in the fields traditionally considered non-software)
 - a. For example, in the automotive domain the amount of in-house developed software is growing. At Volvo Cars, system/software are developed by using traditional external automotive suppliers (e.g., Robert Bosch GmbH, Continental AG, Delphi, Valeo as well as Volvo Cars internal system/software suppliers) (Durisic et al., 2013; Durisic, Staron et al., 2014).
 - b. For the telecom sector, the importance of software has long been recognized which now leads to increased importance of monitoring of software evolution (Antinyan et al., 2014).
2. **Empowered Teams Embracing Diversity:** Teams become both information consumers and information radiators; the teams adjust the measurements to the specifics of their software product:
 - a. Agile and Lean teams have more responsibility and, thus, increasingly more freedom to decide upon ways of working and estimating the release time rather than working towards pre-defined readiness deadline (Staron et al., 2012).
 - b. Agile teams formed bottom up. Building teams of experts with local responsibility and accountability and also create a clear interface between line (creates and owns technical knowledge and solutions) and program (owns and balances the final product) (Olsson et al., 2013).
 - c. Empowered teams to support the transformation to knowledge based product development vision are now formed at Volvo Cars bottom up (Eklund & Bosch, 2012).
3. **Status Reporting is Getting Replaced by the Need to Have Deeper Insight** into the development status, allowing to embrace the fact that the development is distributed:
 - a. Tracking features instead of individual components. The expected progress in software development projects are tracked based on features (e.g., using feature-ready gates) to make sure that a new product launch (e.g., start of production) is not delayed due to late implementation, testing, or quality issues (remaining errors).
 - b. Internal software development teams and external suppliers are treated in the same manner
 - c. Deeper insights are needed into products, features, teams, components, files, functions (i.e., into a wider spectrum of entities)

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4. **High Level KPIs are Complemented More Often with (Private) Low Level Trends and PIs:**
 - a. The tools for high-level KPIs (Key Performance Indicators) such as customer satisfaction have the goal of collecting data from already existing systems (e.g., planning tools, issue tools), forming KPIs and present them as “current project temperature” in a large number of areas during the lifecycle of projects. Such systems often grow over time and visibility is reduced due to excessive parameters to track and newly added ones tend to be based on manual input. Therefore, these systems are often complemented with KPIs local for development teams who want to have quantitative information for them – often referred to as “private measurement systems”.
5. **Technology Shifts:** From providing information as gadgets to providing information that triggers decisions (e.g., e-mails and SMS)
 - a. As the number of measurement systems grows, the organizations are looking for ways of making the delivery of information more efficient (e.g., by sending notification e-mails) when actions are needed instead of using MS Sidebar Gadgets to constantly display the information on the computer desktop (Staron et al., 2014).
6. **Availability of Large Data Sets:**
 - a. Together with the shift from top-level KPIs to using metrics at all levels, we observe there are a large number of emerging large data sets available at all levels of the organization. Each team generates data and the methods for mining software repositories become more efficient generating large quantities of data about software products.
 - b. Availability of large data sets provides new possibilities for visualizing and analyzing data. Techniques like visual analytics are emerging as even more important (Thomas & Cook 2006).

These trends are the motivation for identifying and documenting the experiences from evolving measurement systems towards global and distributed software development.

3. RELATED WORK

Burkhard et al., 2005) found that although the indicators are presented visually, stakeholders are surrounded by overwhelming information and miss the big picture. This “bigger picture” in the context of monitoring of software product development means that the stakeholders need to monitor entities that they formally do not manage. For example, project managers monitor projects but also need to understand how the “product has it” (e.g., the quality of the developed product). For stakeholders responsible for parts of product development, this means they need to understand the situation “upstream” (i.e., whether there are any potential problems that might affect their work after a period of time).

Dashboards for monitoring supply chains are related to monitoring bottlenecks in large software development organizations which have been studied by Staron and Meding (2011) and Pedersen and Wohlin (2011). Monitoring bottlenecks is a useful method for monitoring the capacity of the organization. In the previous work, we developed and introduced a method based on automated indicators for monitoring the capacity and bottlenecks in the work flow in the large software development project (i.e., the process/project view of software development in that organization). Buse and Zimmermann (2012) reported on a survey conducted at Microsoft where information needs were collected from 110 Microsoft designers,

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project managers, and architects. The results from the survey are in line with the results presented in this chapter. The information needs are diverse in the organization indicating different location in the evolution timeline of different units at the company.

Visualization is considered important in agile development and Cockburn (2006) proposes the concept of an ‘information radiator’ which displays information in a place where passersby can see it. However, Sharp et al. (2009) studied the use that agile teams made of such visualization and found that it was mostly used for progress tracking with little to no application-specific information. Instead, Sharp et al. (2009) focus on the physical artifacts of story cards and how they are (physically) pinned to a wall to create a shared view and common understanding of the system under development. Sharp et al. (2009) conclude that the social perspective is critical when developing methods and techniques to support agile teams.

This view is supported by the study of Whitworth and Biddle (2007). Agile practitioners in that study considered ‘information radiators’ to be a source of inspiration, excitement, and team cohesion. However, also in this case the visualization discussed was basically a burn-up chart (i.e., progress tracking). It seems possible that the group-based reflective discussions that our use of heat maps created could be of general use in strengthening the social processes both in agile development, but also in more plan-driven development approaches. The quality patterns it can help reveal could complement the progress tracking described in existing research.

Lawler and Kitchenham (2003) provided an approach for aggregating measures across organizations and presenting aggregated measures for managers. Although the approach in itself is similar to ISO/IEC 15939 (ISO/IEC 2007) the studied organizations does not use aggregated measures as they do not provide the possibility to quickly guide improvements in the organizations – and in the extreme cases led to measures and indicators that were hard to interpret and backtrack which events caused the indicators to change status (e.g. Staron, et al., 2010). Lawler and Kitchenham’s (2003) approach is similar to the approach used in modern business intelligence tools which aim to provide stakeholders with all available information on request.

Although this approach is promising and used in mature disciplines, like mechanical engineering, with established metric systems and theoretically well-grounded measures, the approach has high risks in software development organizations. The risks are related to the potential misinterpretation of data across different projects and products (e.g., even the simplest measures like lines of code can be measured in multiple ways). Organizations starting to use business intelligence tools often face the problem of using these tools in an efficient way after overcoming the initial threshold of establishing the infrastructure for the tools.

Elbashir et al. (2008) studied the problems of measuring the value that business intelligence tools bring into organizations in a longer run and concluded that these tools are spreading from strategic decision support to support decisions at the operational levels in the company. The value of measures from these tools, according to Elbashir et al. (2008) calls for more research. This chapter contributes to the body of research explaining partially the phenomena discovered by Elbashir et al. (2008).

Balanced Score Cards and corporate performance management tools are often considered at top management level as methods and tools for controlling the performance of organization (Wade & Recardo, 2001; Bourne et al., 2004; Milis & Mercken 2004; Visser & Sluiter, 2007). The traces of the Balanced Score Card approach are observed at the top management level even in the study presented in this chapter. However, these measures are often collected manually which indicates the companies using only the Score Card usually are located in the quantitative reporting phase.

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4. RESEARCH DESIGN

We conduct our research using a case study as a method. The units of analyses are the three studied companies and their measurement programs. The case study is comprised of three steps as follows:

1. Identifying the focus area and the relevant stakeholders within software development. Our focus is to include a broad sample of interviewees ranging from managers, measurement program leaders, project leaders, and measurement champions.
2. Interviews with the identified stakeholders. The goal is to map the main information needs and conduct an overview of the status of the organizations' use of measures in decision making.
3. Workshop to elicit common information needs – Volvo Cars. The goal of the workshop is to elicit the common needs within one organization with the largest diversity of software development of safety systems, electrical systems, and powertrains.

We complement the interviews and workshops with document analyses at each company:

- At Volvo Cars we analyze the main program status reporting tool, its structure, KPIs for one organization (due to size limitation), evolution, reporting mechanisms, and stakeholders
- At Ericsson we analyze the measurement program, its structure, technical infrastructure, measurement systems, included indicators (for one large software development program)
- At Axis we analyze the existing project reports to investigate the need for measures and their current status

The results from the investigations, interviews and workshops are presented in Section 4.

One of the important methods to validate our findings is triangulation. We triangulate either the method of data collection – interviews and document analysis in cases of Volvo Cars and Ericsson; and researcher triangulation in the case of Axis. The process of synthesizing the findings presented in this chapter includes:

1. **Identification of the Trends Which Drive the Evolution of Measurement Systems:** This was done through literature studies and through interviews at the first step of the case study.
2. **Development of the Evolution Timeline:** This was done through the interviews at Ericsson in step 2. Since Ericsson was the company with the longest history of research in measurement systems we considered their experiences as reference for the other companies.
3. **Identification of Research Activities Needed to Support the Evolution Timeline:** This was done through interviews with companies in step 2 and partially in step 3.
4. **Validation of the Findings through a Workshop at Volvo Cars:** The workshop focused on discussing the information needs based on the reference model from Ericsson.

The results are presented in section 4.

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4.1. Studied Companies

In this chapter, we chose to study three companies from different domains and with different focus on the use of measurement data in decision support.

Volvo Cars is a manufacturer of cars and has a long-term tradition of developing integrated mechanical, electrical/electronic, and software systems. Volvo Cars is a Swedish OEM based in Gothenburg. Volvo Cars was developing software and hardware in a distributed software development environment. Software was developed in-house for a number of Electronic Control Units (ECUs). The development was done by the software development teams which usually also had responsibility for integrating the software with the hardware developed by suppliers. The majority of the embedded software development in the car, however, was developed by external suppliers who design, implement, and test the functionality based on specifications from Volvo Cars (McGee et al., 2010; Eklund et al., 2012).

At Volvo Cars, the measures and their use in decision support are process and deliverable oriented as the company has a solid history of developing complex distributed systems where software is only one of many disciplines (e.g., mechanical engineering, passive safety engineering, electronics (hardware) engineering). We study a selection of software teams at three organizations within Volvo Cars to obtain specific context of platform development: (Electrics/Electronics & E-Propulsion (EEEP)), application design (Active Safety and Chassis (ASC)) and systems integration (Powertrain Engineering (P/T)). The organizations develops different systems and components in a car but interact with each other and report the progress in a common tool – Program Status Report (PSR) with over 700 KPIs at the top level.

Ericsson AB (Ericsson) develops large software products for the mobile telecommunication network. The size of the organization during the study is several hundred engineers and the size of the projects is up to a few hundred¹. Projects are increasingly often executed according to the principles of Agile software development and Lean production system, referred to as Streamline development (SD) within Ericsson (). In this environment, various teams are responsible for larger parts of the process compared to traditional processes: design teams (cross-functional teams responsible for complete analysis, design, implementation, and testing of particular features of the product), network verification and integration testing, etc.

The organization uses a number of measurement systems for controlling the software development project (per project) described above, a number of measurement systems to control the quality of products in field (per product) and a measurement system for monitoring the status of the organization at the top level. All measurement systems are developed using the in-house methods described in (Staron et al., 2008; Staron, et al., 2010), with the particular emphasis on models for design and deployment of measurement systems presented in (Meding & Staron, 2009; Staron & Meding, 2009). The needs of the organization evolved from metrics calculations and presentations (during the period of eight years of research collaboration), to using predictions, simulations, early warning systems and handling of vast quantities of data to steer organizations at different levels, and providing information from project and line. These needs are addressed by the action research projects conducted in the organization since 2006.

At Ericsson, we study the measurement program established in one of the product development organizations responsible for more than five products. The measurement program includes both the metric team and a set of automated measurement systems (Staron, et al., 2010). Studying the measurement program allows us to describe the experiences from the establishing the measurement program. In contrast to Volvo Cars, this organization managed to fully automate the majority of measurement systems, but limited the scope to software development only.

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Axis Communications (Axis) is a company developing a range of software products – software embedded in network cameras, video encoders, and desktop video management software. Software development processes at the company are based on the agile principles with frequent deliveries to the main branch and empowered software development teams. The product which is studied in this company was the network camera product with a number of releases on the market. The team was multidisciplinary and comprised designers, architects and testers.

The study at Axis is based on the interviews done on site by one of the authors, complemented with experiences and discussions. During previous studies, we were able to identify a number of needs at the company which were integrated as part of this work. The three organizations have a distinct role in this study based on their experiences and context of their developed products:

1. Volvo Cars and their use of a single reporting tool – Program Status Reporting – to report and monitor progress (including mechanical, electrical, software, etc.) of car development projects. The integration of reporting of different disciplines allows us to explore the diversity of indicators in large and diversified organization.
2. Ericsson and their use of measurement systems with a distinct notion of a stakeholder which define how metrics are used in the company. Ericsson's transition from manual measurement to automated infrastructure allows us to define a timeline for organizations adopting measurement systems for decision support.
3. Axis focus on introducing automated measurements allows us to explore the information needs are the most important for an organization which is focused on “mass” market and where the software is a very important part.

Despite obvious differences, the companies also show a number of common needs and observed common trends in the use of measurement systems for decision support.

5. MEASUREMENT SYSTEMS' EVOLUTION TIMELINE

The needs of the collaborating organizations vary and thus vary the way in which the measurement systems are introduced in the organization. The evolution timeline presented in this chapter is aimed at guiding the companies and not as a maturity model. This means that some of the phases can be omitted if they lead to the final goal. However, based on the experiences these phases make the evolution smoother and align with learning processes of the organizations – moving directly from quantitative reporting to simulations would be considered as a “revolution” and could be rejected by the organization as being too “drastic” change.

We divide the timeline into four phases as show in Table 1 based on the results from the interviews at Ericsson which is the company with the longest tradition in measurement research and their evolution model can be regarded as a reference model. These phases are represented graphically in Figures 3 – 5 where we complement the characteristics with required research and development activities.

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Table 1. Phases of the timeline for introducing measurement systems, types of stakeholders and types of measures

| Phase | Characteristics | Types and examples of measures | Types and examples of stakeholders |
|---|---|---|---|
| Quantitative reporting | The organization identifies the need for quantitative, fact-based decisions and uses quantitative information in reporting. Disperse metric tools are used to collect information. | Manually collected measures (e.g., # of customer defects) are manually collected; graphs are created manually and used in manually prepared reports (e.g., in the form of powerpoint presentations). | Usually project, quality and line managers who receive the reports. The notion of stakeholder is implicit. |
| Infrastructure and common language set-up | The organization identifies which standards are to be used (e.g., ISO/IEC 15939), provides interpretation of the standard's concepts to the organization and provides first measurement systems. 1 st and 2 nd generation of measurement systems (Table 1) are used in this phase. | Manually and semi-automatically collected measures (e.g., # of defects) are developed in the new infrastructure. Newly developed measures are usually project-related (e.g., cost, milestone completion). | Usually project and quality managers who are used to making decisions based on measures – their needs are to “formalize” the main measures into indicators |
| Proactive measurement | The organization uses indicators to predict the status and act before potential problems become real ones. Indicators are “pushed” to the stakeholders. 3 rd and 4 th generation of measurement systems are used in this phase. | Fully automated indicators with decision support criteria (e.g., product downtime); often placed together in a “flow” which shows how they are dependent on each other. | Project, quality and line managers need overviews and information from both development teams and also from the maintenance/market organizations. |
| What-if analyses | The organization uses measures and indicators to simulate the future status and thus make decisions using simulated future scenarios. 5 th generation of measurement systems are used in this phase. | Indicators and measures built to support simulations (e.g., product release date based on number of defects). | Managers and teams have different needs: managers want to have overview (public indicators) and teams need to have monitoring on detailed level (private indicators). |

5.1. Infrastructure and Common Language Set-Up

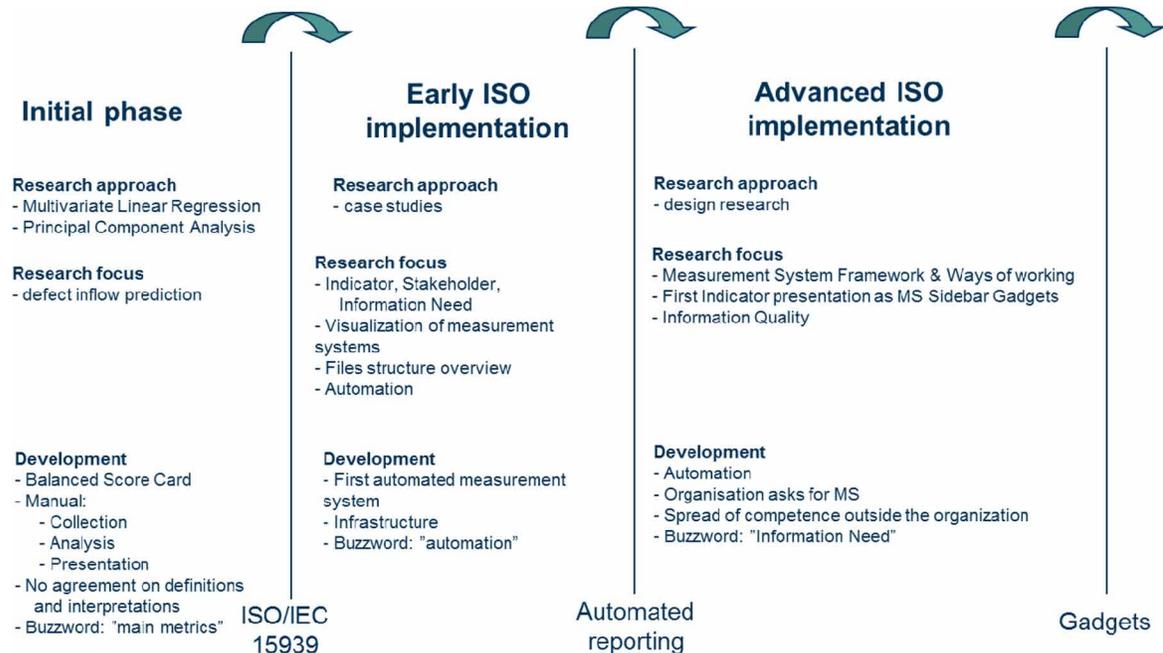
In the case of the studied companies, the timeline for the phase of infrastructure and common language set-up was focused on the establishment of the culture of the company – in particular, on the definition and implementation of *stakeholder* as opposed to metric champions. As opposed to the metric champions, stakeholders have the mandate from the organization to establish new measures/indicators and the ability to act upon their status (e.g., managers able to order overtime to reduce the number of open defects). The timeline is shown in Figure 3.

An example of measurement systems of this type can be found in such organizations as Electrical Propulsion Development at Volvo Cars where the main focus of the interviews and thus the identified measures was to support decisions around *how much control should we have to create a high-quality product?* The major information needs include:

- Number of faults in the development linked to the test-series of vehicles
- Quality of continuous integration of in-house developed software

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Figure 3. Timeline for introducing measurement systems in the infrastructure set-up phase



- Completeness of design/specifications at various project integration gates
- Quantitative progress monitoring of function implementation (FIP)
- Objective insights in the readiness of the development

Another example comes from Axis Communications where the information needs in the company are focused on the two main aspects: quality and speed of development. While the quality is a pre-requisite for the development the company monitors it and focuses on increasing speed without decreasing the quality. The main stakeholders were product manager and product specialists. Examples of the information needs were:

- Measurement of number of open tickets and their status thus allowing the quality managers to make judgements and decision based on the incline of the curve and its amplitude.
- Measurement of functionality, stability, and performance deviations from the requirements set on these aspects are reported as tickets
- Ticket burndown charts
- Test error rates

The measures showed the focus of the organization on the quality and speed with the clear influence of Agile measures (burndown charts). The company was focused on tickets as one of the ways of structuring and organizing the development and therefore quality can be seen as a part of the ticketload needed to release the product; in other words, the number of open tickets. This information was complemented with the information about the customer satisfaction which was collected through distributor network's and partnerships. The main requirements on the measurement systems are on the infrastructure for au-

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tomated measurement and to include new indicators. The measures are used to trigger decisions (e.g., refactorings of components in the area of architecture). In the area of quality management, the decisions can be triggered by the quality assurance reports.

Finally, the organization indicated that there was an increased need to analyze, visualize and use the information and data which was collected (e.g., test progress) in a more efficient way to trigger decisions and discussions. Some pro-active measures (triggering decisions) were also identified and the need was to develop those kind of measures further.

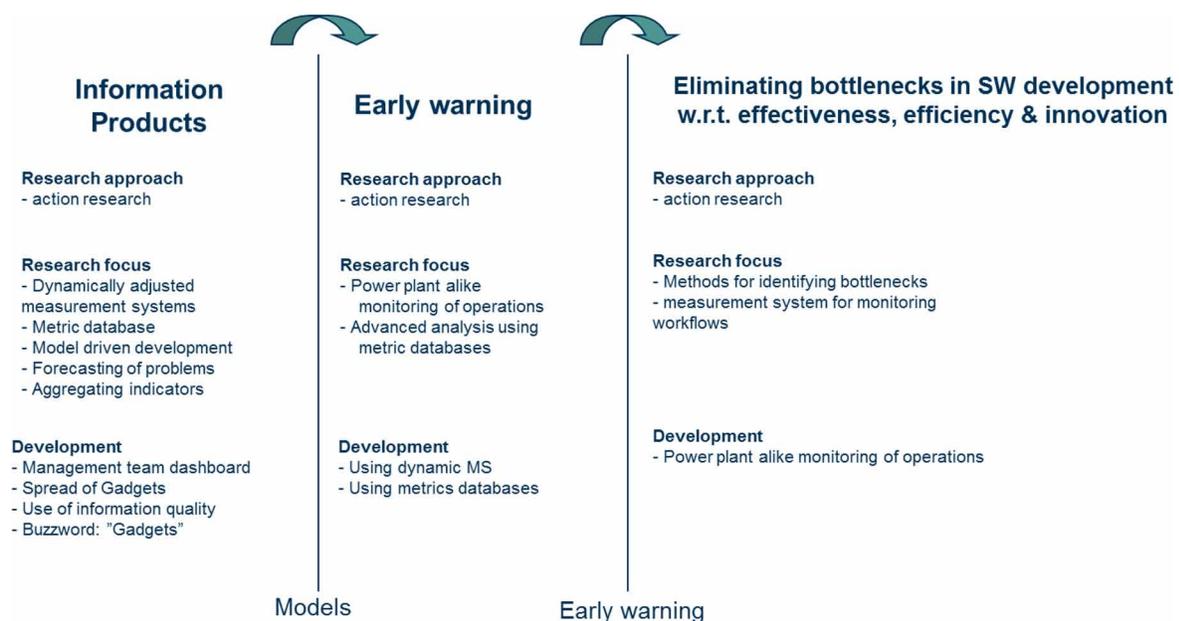
5.2. Proactive Measurement

In the proactive measurement phase, the focus of the organization is on providing measures which can help the organization to indicate potential problems and thus preventing them. The measurement systems are focus of such aspects as *early warning* which is a sequence of dependent indicators – if the first one is “red” then there is a high probability that the next one in the sequence also turns “red” after a predefined period of time. This kind of monitoring was applied at Ericsson to study bottlenecks in software development processes. Figure 4 shows the milestones in the timeline for the proactive measurement phase.

An example of measurement systems of this type can be found at in the Active Safety at Volvo Cars organization we focus on the information needs related to the development of functions of cars at a higher level (e.g., breaking). In the organization, we explore information needs around the question *how good are we in developing the right product?* The elicited information needs are:

- Fault degradation times and fault-slip-through
- Fault density in the design

Figure 4. Timeline during the proactive measurement phase



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- Requirements density – how many diverse requirements areas are linked to one function (e.g., how many active safety functions are related to one design component)
- Extensibility of the design – how extensible the design is for future implementation of new functions

The information needs for the function development (studied at ASC) focus on the quality of the design and its future extensibility. For example, the high-density of faults can indicate that adding new functions to the high-fault-density components can cause new faults and thus higher costs for testing.

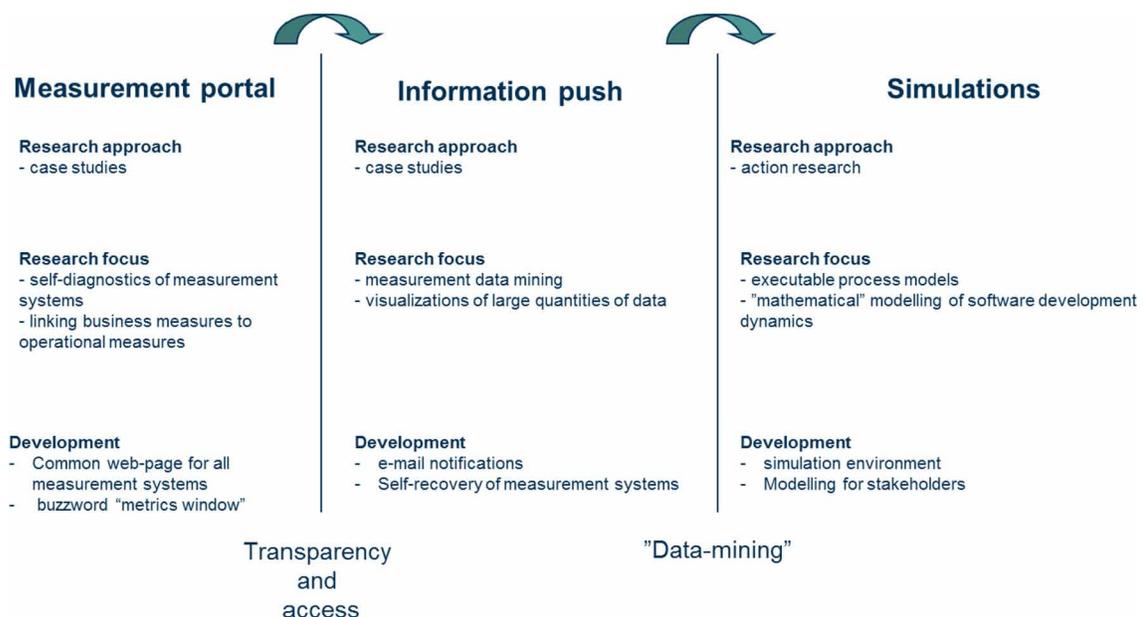
5.3. What-if Analyses

In the what-if analyses phase, the focus is on providing the organization with the possibility to simulate scenarios based on the measurement experience. In the studied organization at Ericsson, the transition from the proactive measurement phase is depicted in Figure 5.

The common characteristics of measures and indicators at this phase can be found at Ericsson and include:

- Objective over subjective
- Automated over manual
- Product-driven over milestone-driven
- Input to decisions over making decisions
- Link between business and organizational metrics
- Quantitative input to reporting – measurements should be automatically used in reports and no manual interpretation should be required

Figure 5. Timeline for the what-if analyses phase



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The characteristics seem to be similar to the needed characteristics of the other companies. At Ericsson, the first step was the establishment of the *measurement portal* to provide access to all measurement systems from one place. Measurement systems were categorized by development project/program, product, stakeholder and stakeholder type. The portal is an active web-page where all measurement systems are linked. The transparency and access also makes it challenging to get an overview so the stakeholders often choose to get *information push* when the status of their entities changes (i.e., when the decisions are to be triggered). This triggering releases the burden of the stakeholders to be on-alert and monitor their indicators, thus leaving more time for actively working with *simulations* and analyses of what can happen if a certain scenario occurs.

At Volvo Cars, when investigating the company's strategies we found that the company monitors a number of areas on the top level which fall into this phase of the timeline:

- Customer satisfaction (e.g., vehicle satisfaction)
- Market share and profitability (e.g., % of market in a given region)
- Environment (e.g., CO₂ emissions)
- Organizational performance (e.g., brand opinion ranking)

5.4. Generations of Measurement Systems

Based on the analyses of measurement systems at Ericsson and Volvo Cars plus literature, we could identify five generations of measurement systems. The generations of measurement systems are briefly characterized in Table 2.

Each of the generations is also used in different organizational levels. The first generation is focused on one level only while the fifth generation is focused on one level with the objective input from all underlying levels, thus providing managers and teams with objective input for decision making.

Table 2. Generations of measurement systems

| Generation | New Focus Areas | Example Measures |
|-------------------|--|---|
| 1 st | quality | Defect backlog: an indicator showing the trend in the number of defects detected on the main development branch of the entire program. |
| 2 nd | - project management - product management | Product downtime in field: a set of indicators showing the reliability and availability of the product in the field. |
| 3 rd | process management | Process bottlenecks: a set of indicators monitoring the flow of development and pinpointing bottlenecks in the flow. Process monitoring: a set of indicators for monitoring the deliverables and their "completeness" and quality. |
| 4 th | maintenance | Code stability: an indicator showing how stable software code base is. |
| 5 th | customers | Release readiness: an indicator for the head of development program showing in how many weeks the development program will be ready to deliver the next full release. |

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6. CONCLUSION

Modern software development organizations often experience the need to evolve (or are already evolving) to increasingly global software development enterprises. In such an evolution, the processes of decision formulation and decision monitoring also need to evolve – the trends show that the decisions are increasingly more distributed. Together with the evolution of the companies, their measurement systems used in decision support also need to evolve.

In this chapter, we have discussed the use of the notion of measurement system and the evolution of measurement systems. By studying how three organizations use measurement systems, we outlined five generations of measurement systems and the timeline of evolving of five generations of measurement systems. By describing the evolution, identifying the generations of measurement systems and providing recommendations for other companies this chapter helps other organizations to be faster in the evolution and to avoid the most common mistakes such as too much focus on “what can be measured” instead of focusing on “what should be measured.”

Our recommendations for other companies are to find their current position in the timeline of introducing measurement systems, assess their needed position on the timeline and move accordingly. The evolution path (i.e., which phases are followed by the companies), can vary, but we strongly recommend against leaps from the first to the last stages of the evolution. Such leaps might require too steep learning curve which might result in numerous mistakes in using measurement systems.

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REFERENCES

- Antinyan, V., Staron, M., Meding, W., Osterstrom, P., Wikstrom, E., Wrangler, J., . . . Hansson, J. (2014). *Identifying risky areas of software code in Agile/Lean software development: An industrial experience report*. Proceedings of IEEE Conference on Software Maintenance, Reengineering and Reverse Engineering (CSMR-WCRE). IEEE.
- Ashton, C., & Intelligence, B. (1997). *Strategic Performance Measurement: Transforming Corporate Performance by Measuring and Managing the Drivers of Business Success*. London: Business Intelligence.
- Bostock, M., Ogievetsky, V., & Heer, J. (2011). D³ Data-Driven Documents. *Visualization and Computer Graphics. IEEE Transactions*, 17(12), 2301–2309.
- Bourne, M., Franco-Santos, M. & Cranfield School of Management. Centre for Business Performance. (2004). *Corporate performance management*. Cary, NC: SAS Institute.
- Building Customer Profiles (2001). Using data mining methods to build customer profiles.

Evolution of the Role of Measurement Systems in Industrial Decision Support

- Burkhard, R., Spescha, G., & Meier, M. (2005). *A-ha!: How to Visualize Strategies with Complementary Visualizations. Conference on Visualising and Presenting Indicator Systems.*
- Buse, R. P. L., & Zimmermann, T. (2012). Information Needs for Software Development Analytics. *Proceedings of the 34th International Conference on Software Engineering (ICSE 2012 SEIP Track)*, Zurich. Microsoft Research Report. doi:10.1109/ICSE.2012.6227122
- Cockburn, A. (2002). *Agile Software Development*. Boston: Addison-Wesley.
- Cockburn, A. (2006). *Agile software development: the cooperative game*. New York: Addison-Wesley Professional.
- Duriscic, D., Nilsson, M., Staron, M., & Hansson, J. (2013). Measuring the impact of changes to the complexity and coupling properties of automotive software systems. *Journal of Systems and Software*, 86(5), 1275–1293. doi:10.1016/j.jss.2012.12.021
- Duriscic, D., Staron, M., Tichy, M., & Hansson, J. (2014). *Evolution of Long-Term Industrial Meta-Models--An Automotive Case Study of AUTOSAR*. Proceedings of IEEE 40th Conference on Software Engineering and Advanced Applications (SEAA).
- Ebert, C., & De Neve, P. (2001). Surviving global software development. *Software, IEEE*, 18(2), 62–69. doi:10.1109/52.914748
- Eklund, U., & Bosch, J. (2012). Applying agile development in mass-produced embedded systems. *Agile Processes in Software Engineering and Extreme Programming* (pp. 31-46). New York: Springer.
- Eklund, U., Jonsson, N., Eriksson, A., & Bosch, J. (2012). *A reference architecture template for software-intensive embedded systems. Proceedings of the WICSA/ECSA 2012 Companion*. ACM. doi:10.1145/2361999.2362022
- Elbashir, M. Z., Collier, P. A., & Davern, M. J. (2008). Measuring the effects of business intelligence systems: The relationship between business process and organizational performance. *International Journal of Accounting Information Systems*, 9(3), 135–153. doi:10.1016/j.accinf.2008.03.001
- Feldt, R., Staron, M., & Hult, E. Hult, & Liljegren, T. (2013). Supporting Software Decision Meetings: Heatmaps for Visualising Test and Code Measurements. *Proceedings of the 39th Euromicro conference on Software Engineering and Advanced Applications*, Santander, Spain (pp. 62-69). IEEE. doi:10.1109/SEAA.2013.61
- Fenton, N. E., & Pfleeger, S. E. (1996). *Software metrics: a rigorous and practical approach*. London: International Thomson Computer Press.
- Harvard Business School. (1998). *Harvard business review on measuring corporate performance*. Boston: Harvard Business School Press.
- Hashiura, H., Matsuura, S., & Komiya, S. (2010). *A tool for diagnosing the quality of java program and a method for its effective utilization in education*. Proceedings of the 9th WSEAS international conference on Applications of computer engineering, World Scientific and Engineering Academy and Society (WSEAS).

Evolution of the Role of Measurement Systems in Industrial Decision Support

Herbsleb, J. D., & Mockus, A. (2003). An empirical study of speed and communication in globally distributed software development. *Software Engineering. IEEE Transactions*, 29(6), 481–494.

Humphrey, W. S. (2000). *Introduction to the team software process(sm)*. Reading, MA: Addison-Wesley.

IEEE. (2007). *IEEE Std 15939–2007 IEEE Systems and Software Engineering—Measurement Process*. IEEE-SA.

ISO/IEC. (2007). *ISO/IEC 15939 Software engineering – Software measurement process*. Geneva: International Standard Organization / International Electrotechnical Commission.

Johnson, P. M. (2007). Requirement and Design Trade-offs in Hackystat: An In-Process Software Engineering Measurement and Analysis System. *Proceedings of the First International Symposium on Empirical Software Engineering and Measurement* (pp. 81-90). IEEE Computer Society. doi:10.1109/ESEM.2007.36

Johnson, P. M., Kou, H., Agustin, J. M., Zhang, Q., Kagawa, A., & Yamashita, T. (2004). Practical automated process and product metric collection and analysis in a classroom setting: Lessons learned from Hackystat-UH. *Empirical Software Engineering - Proceedings of the 2004 International Symposium ISESE'04*. IEEE.

Lawler, J., & Kitchenham, B. (2003). Measurement modeling technology. *IEEE Software*, 20(3), 68–75. doi:10.1109/MS.2003.1196324

Luhn, H. P. (1958). A business intelligence system. *IBM Journal of Research and Development*, 2(4), 314–319. doi:10.1147/rd.24.0314

McGarry, J. (2002). *Practical software measurement: objective information for decision makers*. Boston: Addison-Wesley.

McGee, R. A., Eklund, U., & Lundin, M. (2010). *Stakeholder identification and quality attribute prioritization for a global Vehicle Control System. Proceedings of the Fourth European Conference on Software Architecture: Companion*. ACM. doi:10.1145/1842752.1842765

Meding, W., & Staron, M. (2009). The Role of Design and Implementation Models in Establishing Mature Measurement Programs. In J. Peltonen (Ed.), *Nordic Workshop on Model Driven Engineering*, Tampere, Finland, Tampere University of Technology: 284-299.

Milis, K., & Mercken, R. (2004). The use of the balanced scorecard for the evaluation of Information and Communication Technology projects. *International Journal of Project Management*, 22(2), 87–97. doi:10.1016/S0263-7863(03)00060-7

Olsson, H., Sandberg, A., Bosch, J., & Alahyari, H. (2013). *Customers Are All the Same--But Different: A case study on customer-specific teams for solving the conflict between scale and responsiveness in large-scale software development*.

Olsson, H. H., & Bosch, J. (2013). Post-deployment Data Collection in Software-Intensive Embedded Products. *Software Business. From Physical Products to Software Services and Solutions* (pp. 79-89). New York: Springer.

Evolution of the Role of Measurement Systems in Industrial Decision Support

- Paladino, B. (2007). *Five key principles of corporate performance management*. Hoboken, NJ: John Wiley & Sons.
- Petersen, K., & Wohlin, C. (2011). Measuring the flow in lean software development. *Software, Practice & Experience*, 41(9), 975–996. doi:10.1002/spe.975
- Sharp, H., Baddoo, N., Beecham, S., Hall, T., & Robinson, H. (2009). Models of motivation in software engineering. *Information and Software Technology*, 51(1), 219–233. doi:10.1016/j.infsof.2008.05.009
- Šmite, D., Wohlin, C., Gorschek, T., & Feldt, R. (2010). Empirical evidence in global software engineering: A systematic review. *Empirical Software Engineering*, 15(1), 91–118. doi:10.1007/s10664-009-9123-y
- Staron, M. (2012). Critical role of measures in decision processes: Managerial and technical measures in the context of large software development organizations. *Information and Software Technology*, 54(8), 887–899.
- Staron, M., & Meding, W. (2009). *Ensuring Reliability of Information Provided by Measurement Systems. Software Process and Product Measurement*. Berlin, Heidelberg: Springer.
- Staron, M., & Meding, W. (2009). Using Models to Develop Measurement Systems: A Method and Its Industrial Use. *Software Process and Product Measurement*, 5891, 212–226. doi:10.1007/978-3-642-05415-0_16
- Staron, M., & Meding, W. (2011). *Monitoring Bottlenecks in Agile and Lean Software Development Projects – A Method and Its Industrial Use. Product-Focused Software Process Improvement*. Berlin, Heidelberg: Springer.
- Staron, M., Meding, W., Hansson, J., Höglund, C., Niesel, K., & Bergmann, V. (2014). *Dashboards for continuous monitoring of quality for software product under development. System Qualities and Software Architecture (SQSA)*. Amsterdam: Elsevier Scientific Publishing.
- Staron, M., Meding, W., Karlsson, G., & Nilsson, C. (2010). Developing measurement systems: an industrial case study. *Journal of Software Maintenance and Evolution: Research and Practice*, 23(2), 89–107.
- Staron, M., Meding, W., Karlsson, G., & Nilsson, C. (2011). Developing measurement systems: An industrial case study. *Journal of Software Maintenance and Evolution: Research and Practice*, 23(2), 89–107. doi:10.1002/smr.470
- Staron, M., Meding, W., & Nilsson, C. (2008). A Framework for Developing Measurement Systems and Its Industrial Evaluation. *Information and Software Technology*, 51(4), 721–737. doi:10.1016/j.infsof.2008.10.001
- Staron, M., Meding, W., & Palm, K. (2012). Release Readiness Indicator for Mature Agile and Lean Software Development Projects. *Agile Processes in Software Engineering and Extreme Programming* (pp. 93–1070).
- Staron, M., Meding, W., & Söderqvist, B. (2010). A method for forecasting defect backlog in large streamline software development projects and its industrial evaluation. *Information and Software Technology*, 52(10), 1069–1079. doi:10.1016/j.infsof.2010.05.005

Evolution of the Role of Measurement Systems in Industrial Decision Support

Thomas, J. J., & Cook, K. A. (2006). A visual analytics agenda. *Computer Graphics and Applications, IEEE*, 26(1), 10–13. doi:10.1109/MCG.2006.5 PMID:16463473

Tomaszewski, P., Berander, P., & Damm, L.-O. (2007). From Traditional to Streamline Development - Opportunities and Challenges. *Software Process Improvement and Practice*, (1): 1–20.

Visser, J. K., & Sluiter, E. (2007). *Performance measures for a telecommunications company. Proceedings of AFRICON 2007*. doi:10.1109/AFRCON.2007.4401479

Voinea, L., & Telea, A. (2007). Visual data mining and analysis of software repositories. *Computers & Graphics*, 31(3), 410–428. doi:10.1016/j.cag.2007.01.031

Wade, D., & Recardo, R. J. (2001). *Corporate performance management: how to build a better organization through measurement-driven strategic alignment*. Boston: Butterworth-Heinemann.

Whitworth, E., & Biddle, R. (2007). The social nature of agile teams. *Proceedings of Agile conference* (pp. 26-36). IEEE.

ADDITIONAL READING

Using business intelligence and corporate performance measurement can be of interest for readers interested in decision making at the strategic level – e.g. (Harvard Business School 1998, Wade and Recardo 2001, Paladino 2007)

Readers interested in other examples of information needs for software metrics are referred to a survey study conducted at Microsoft where the authors interview over 100 engineers, managers, testers to map their current and future information needs (Buse and Zimmermann 2012).

Readers interested in the concepts of measurement systems should explore the following publications:
• ISO/IEC 15939 (and its IEEE correspondent) defining the concepts related to measurement systems (IEEE 2007, ISO/IEC 2007). • Practical Software Measurement (McGarry 2002)

SonarSource tool suite for monitoring internal quality of software products during development (Hashiura, Matsuura et al. 2010) and • Dashboards for visualizing product development where the authors describe experiences from introducing dashboards for a single team (Feldt, Staron et al. 2013)

The classical book on software metrics by Fenton and Pfleeger (Fenton and Pfleeger 1996)

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The process of designing measurement systems in industry (Staron, Meding et al. 2011) One of the trends observed in the software industry is the growing focus on customers even in measurement of internal quality attributes. Readers interested in how to work with customer data can find the following works of value: • Post-deployment data collection (Olsson and Bosch 2013) • Developing customer profiles (Building Customer Profiles 2001), and • Mining and visualizing customer data (Hui and Jha 2000)

Readers interested in mechanisms of effective visualization and manipulation of measurement data can explore the field of visual analytics – e.g. (Voinea and Telea 2007, Bostock, Ogievetsky et al. 2011). Close to the field of visual analytics is the field of project telemetry, which focuses on on-line visualization of selected software metrics; interested readers should explore: • Tools like Hackystat are examples in this field (Johnson, Kou et al. 2004, Johnson 2007)

ENDNOTES

¹ The exact size of the unit cannot be provided due to confidentiality reasons.

Compilation of References

- Aastrup, J., Kotzab, H., Grant, D. B., Teller, C., & Bjerre, M. (2008). A model for structuring efficient consumer response. *International Journal of Retail & Distribution Management*, 36(8), 590–606. doi:10.1108/09590550810883450
- ABDI. (2011). A Agência Brasileira de Desenvolvimento Industrial As Design Houses (DHs) Brasileiras: Relatório Analítico. Brasília. Retrieved from http://www.abdi.com.br/Estudo/Relatorio_Design_Houses_FINAL_280312.pdf
- Abraham, J. (2014). Clusters in tourism, agriculture and food processing within the Visegrad Group. *Zemědělská Ekonomika [Agricultural Economics]*, 60(5), 208–218.
- Achman, R. (2011). *Stakeholders' Perspectives on Sustainability in Project Management Case studies of 4 different projects in the Netherlands*. Delft University of Technology.
- ACRP. (2012). *Authority, Coastal Restoration & Protection. Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Baton Rouge: The State of Louisiana.
- Adair, C. B., & Murray, B. A. (1994). *Break-through process re-design, new pathways to customer value*. New York: Rath & Strong.
- Adobor, H., & McMullen, R. (2007). Supplier Diversity and Supply Chain Management: A Strategic Approach. *Business Horizons*, 50(3), 219–229. doi:10.1016/j.bushor.2006.10.003
- Agee, J. (2009). Developing qualitative research questions: A reflective process. *International Journal of Qualitative Studies in Education*, 22(4), 431–447. doi:10.1080/09518390902736512
- Ahimbisibwe, A. (2014). The influence of contractual governance mechanisms, buyer-supplier opportunistic behavior on supplier performance. *Journal of African Business*, 15(2), 85–99. doi:10.1080/15228916.2014.920610
- Ahn, H. J., & Lee, H. (2004). An agent-based dynamic information network for supply chain management. *BT Technology Journal*, 22(2), 18–27. doi:10.1023/B:BTTJ.0000033467.83300.c0
- Aissaoui, N., Haouari, M., & Hassini, E. (2007). Supplier selection and order lot sizing modeling: A review. *Computers & Operations Research*, 34(12), 3516–3540. doi:10.1016/j.cor.2006.01.016
- Akkermans, H., & Dellaert, N. (2005). The rediscovery of industrial dynamics: The contribution of system dynamics to supply chain management in a dynamic and fragmented world. *System Dynamics Review*, 21(3), 173–186. doi:10.1002/sdr.317
- Aktepe, A., & Ersoz, S. (2011). A fuzzy analytic hierarchy process model for supplier selection and a case study. *International Journal Research Development*, 3(1), 33–37.
- Alan, I. S., Nilson, K., & Rutashobya, L. K. (2006). Gender, network and entrepreneurial outcomes in Tanzania. *Journal of African Business*, 10(1), 67–83.

Compilation of References

- Alavi, M., & Leidner, D. E. (1999). Knowledge management systems: Issues, challenges, and benefits. *Communications of the AIS, 1*.
- Ale, M. A., Toledo, C. M., Chiotti, O., & Galli, M. R. (2014). A conceptual model and technological support for organisational knowledge management. *Science of Computer Programming, 95*, 73–92. doi:10.1016/j.scico.2013.12.012
- Al-Hakim, L. (Ed.). (2007). *Information quality management: theory and applications*. Hershey, PA: IGI Global. doi:10.4018/978-1-59904-024-0
- Al-Mutawah, K., Lee, V., & Cheung, Y. (2009). A new multi-agent system framework for tacit knowledge management in manufacturing supply chains. *Journal of Intelligent Manufacturing, 20*(5), 593–610. doi:10.1007/s10845-008-0142-0
- Aloini, D., Dulmin, R., Mininno, V., & Ponticelli, S. (2012). Supply chain management: A review of implementation risks in the construction industry. *Business Process Management Journal, 18*(5), 735–761. doi:10.1108/14637151211270135
- Alonso, A. D. (2011). Educational institutions offering hospitality degrees and farmers: Is there a link? A case study from Alabama. *Journal of Agricultural & Food Information, 12*(1), 75–90. doi:10.1080/10496505.2011.539497
- Alt, R. M. (1949). Competition among types of retailers in selling the same commodity. *Journal of Marketing, 14*(3), 441–447. doi:10.2307/1248197
- Alvarado, U. Y., & Kotzab, H. (2001). Supply chain management: The integration of logistics in marketing. *Industrial Marketing Management, 30*(2), 183–198. doi:10.1016/S0019-8501(00)00142-5
- Alvesson, M., & Skoldberg, K. (2000). *Reflexive methodology: New vistas for qualitative research*. London: SAGE Publications.
- Ammer, D. S. (1968). *Manufacturing management and control*. New York: Appleton-Century-Crofts.
- Amoako, I. O., & Lyon, F. (2014, March 01). 'We don't deal with courts': Cooperation and alternative institutions shaping exporting relationships of small and medium sized enterprises in Ghana. *International Small Business Journal, 32*(2), 117–139. doi:10.1177/0266242613484778
- Anand, V., Glick, W. H., & Manz, C. C. (2002). Thriving on the knowledge of outsiders: Tapping organizational social capital. *The Academy of Management Executive, 16*(1), 87–101. doi:10.5465/AME.2002.6640198
- Ananth, P. (2007,). Business Continuity Planning. *ISSA Journal, December, 22-24*.
- Andersen, B. (1999). *Business improvement toolbox*. Milwaukee, WI: ASQ Quality Press.
- Andersen, T. J., & Foss, N. J. (2005). Strategic opportunity and economic performance in multinational enterprises: The role and effects of information and communication technology. *Journal of International Management, 11*(2), 293–310. doi:10.1016/j.intman.2005.03.008
- Anderson, D. L., Britt, F. F., & Favre, D. J. (2007). The 7 principles of supply chain management. *Supply Chain Management Review*.
- Anderson, E. (1988). Transaction costs as determinants of opportunism in integrated and independent sales forces. *Journal of Economic Behavior & Organization, 9*(3), 247–267. doi:10.1016/0167-2681(88)90036-4
- Anderson, E., & Oliver, R. L. (1987). Perspectives on behavior-based versus outcome-based sales control systems. *Journal of Marketing, 51*(4), 76–88. doi:10.2307/1251249
- Anderson, J. R. (2013). *The architecture of cognition*. New York: Psychology Press.

Compilation of References

- Andraski, J. C. (1994). Foundations for successful continuous replenishment programs. *The International Journal of Logistics Management*, 5(1), 1–8. doi:10.1108/09574099410805036
- Andresen, S., & Boasson, E. L. (Eds.). (2012). *International Environmental Agreements: An Introduction (Environmental Politics)*. New York: Routledge Publishing.
- Angeles, R., & Nath, R. (2000). An empirical study of EDI trading partner selection criteria in customer-supplier relationships. *Information & Management*, 37(5), 241–255. doi:10.1016/S0378-7206(99)00054-3
- Angeles, R., & Nath, R. (2001). Partner congruence in electronic data interchange (EDI) relationships. *Journal of Business Logistics*, 22(2), 109–127. doi:10.1002/j.2158-1592.2001.tb00006.x
- Angulo, A., Nachtmann, H., & Waller, M. A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of business logistics*, 25(1), 101-120.
- Angulo, A., Nachtmann, H., & Waller, M. A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of Business Logistics*, 25(1), 101–120. doi:10.1002/j.2158-1592.2004.tb00171.x
- An, L., & Jeng, J.-J. (2005). On developing system dynamics model for business process simulation. *Proceeding of the 37th Winter Simulation Conference*, Orlando, Florida (pp. 2068-2077)
- Anonymous. (2013, March). TAP begin pre-qualification of pipe suppliers. *Pipeline & Gas Journal*, 240(3), 14.
- Antinyan, V., Staron, M., Meding, W., Osterstrom, P., Wikstrom, E., Wrangler, J., . . . Hansson, J. (2014). *Identifying risky areas of software code in Agile/Lean software development: An industrial experience report*. Proceedings of IEEE Conference on Software Maintenance, Reengineering and Reverse Engineering (CSMR-WCRE). IEEE.
- APICS. (1998). *APICS Dictionary*. Falls Church, VA: APICS.
- Applegate, L., & Gogan, J. (1995). Electronic commerce: trends and opportunities. Harvard Business School Background Note (196-006), July.
- Arlbjörn, J. S., de Haas, H., & Munksgaard, K. B. (2013). Exploring supply chain innovation. *Logistics Research*, 3(1), 3–18. doi:10.1007/s12159-010-0044-3
- Arnold, U. (1999). Organisation of global sourcing: Ways towards an optimal degree of centralization. *European Journal of Purchasing and Supply Management*, 5(3-4), 167–174. doi:10.1016/S0969-7012(99)00023-4
- Arnseth, L. (2012, October). Developing Global Diverse Supply Chains. *Inside Supply Management*, 26-30.
- Arshinder, K., Kanda, A., & Deshmukh, S. G. (2011). A review on supply chain coordination: Coordination mechanisms, managing uncertainty and research directions. In T.M. Choi, & T.C. Edwin Cheng (Eds.), *Supply Chain Coordination under Uncertainty* (pp. 39-82).
- Ashayeri, J., Keij, R., & Broker, A. (1998). Global business process re-engineering: A system dynamics-based approach. *International Journal of Operations & Production Management*, 18(9/10), 817–831. doi:10.1108/01443579810225478
- Ashby, A., Leat, M., & Hudson-Smith, M. (2012). Making Connections: A Review of Supply Chain Management and Sustainability Literature, Supply Chain Management –. *International Journal (Toronto, Ont.)*, 17(5), 497–516.
- Ashton, C., & Intelligence, B. (1997). *Strategic Performance Measurement: Transforming Corporate Performance by Measuring and Managing the Drivers of Business Success*. London: Business Intelligence.

Compilation of References

- ATKearney. (2014). *Global retail development index*. Retrieved from <http://www.atkearney.com/documents/10192/4600212/Full+Steam+Ahead+for+Global+Retailers--+2014+Global+Retail+Development+In....pdf/6f55a59b-e855-4236-96cb-464c2ca01e91>
- Atkinson, G. (2008). Sustainability, the capital approach and the built environment. *Building Research and Information*, 36(3), 241–247. doi:10.1080/09613210801900734
- AtKisson, A., Hatcher, R. L., Green, S., & Lovins, H. (2004, Fall). Introducing pyramid: A versatile process and planning tool for accelerating sustainable development. Draft paper for publication in *The Natural Advantage of Nations*. Australia: EA Books.
- Attride-Stirling, J. (2001). Thematic network: An analytical tool for the qualitative research. *Qualitative Research*, 1(3), 385–405. doi:10.1177/146879410100100307
- Auramo, J., Inkiläinen, A., & Kauremaa, J. (2005a). The roles of information technology in supply chain management. Presented at the 17th Annual NOFOMA Conference.
- Auramo, J., Aminoff, A., & Punakivi, M. (2002). Research agenda for e-business logistics based on professional opinions. *International Journal of Physical Distribution & Logistics*, 32(7), 513–531. doi:10.1108/09600030210442568
- Auramo, J., Kauremaa, J., & Tanskanen, K. (2005b). Benefits of IT in supply chain management – an explorative study of progressive companies. *International Journal of Physical Distribution & Logistics Management*, 35(2), 82–100. doi:10.1108/09600030510590282
- Awad, H. A. H., & Nassar, M. O. (2010). Supply chain integration: Definition and challenges. *Proceedings of the international MultiConference of engineers and computer scientists IMECS 2010*, Hong Kong.
- Ayala-Zavala, J. F., González-Aguilar, G. A., Ansorena, M. R., Alvarez-Párrilla, E., & de la Rosa, L. (2014). Nanotechnology Tools to Achieve Food Safety. *Practical Food Safety: Contemporary Issues and Future Directions*, 341-353.
- Ayers, J. B. (2001). *Handbook of Supply Chain Management*. London: St. Lucie Press.
- Aziz, N., & Sparrow, J. (2011). Patterns of gaining and sharing of knowledge about customers: A study of an express parcel delivery company. *Knowledge Management Research and Practice*, 9(1), 29–47. doi:10.1057/kmrcp.2011.3
- Baars, H., Gille, D., & Strüker, J. (2009). Evaluation of RFID applications for logistics: A framework for identifying, forecasting and assessing benefits. *European Journal of Information Systems*, 18(6), 578–591. doi:10.1057/ejis.2009.32
- Bacallan, J. J. (2000). Greening the Supply Chain. *Business and Environment*, 6(5), 11–12.
- Bagchi, P. K., Chun Ha, B., Skjoett-Larsen, T., & Boege Soerensen, L. (2005). Supply chain integration: A European survey. *The International Journal of Logistics Management*, 16(2), 275–294. doi:10.1108/09574090510634557
- Bailey, J. E., & Pearson, S. W. (1983). Development of a Tool for Measuring and Analyzing Computer User Satisfaction. *Management Science*, 29(5), 530–545. doi:10.1287/mnsc.29.5.530
- Baily, P., Farmer, D., Jessop, D., & Jones, D. (1998). *Purchasing Principles & Management* (8th ed.). Prentice Hall.
- Baines, T., Brown, S., Benedettini, O., & Ball, P. (2012). Examining Green Production and Its Role within the Competitive Strategy of Manufacturer. *Journal of Industrial Engineering and Management*, 5(1), 53–87. doi:10.3926/jiem.405
- Baird, I., & Thomas, H. (1990). What is risk anyway? Using and measuring risk in strategic management. *Risk, strategy, and management*, 5, 21–54.

Compilation of References

- Bair, J. (2005). Global Capitalism and Commodity Chains: Looking Back, Going Forward. *Competition and Change*, 9(2), 153–180. doi:10.1179/102452905X45382
- Bajdor, P., & Grabara, J. K. (2011). Implementing Green Elements into the Supply Chain – The Literature Review and Examples. *Annales Universitatis Apulensis Series. Oeconomica*, 13(2), 584–589.
- Baker, K. R., Magazine, M. J., & Nuttle, H. L. W. (1986). The Effect Of Commonality On Safety Stock In A Simple Inventory Model. *Management Science*, 32(8), 982–988. doi:10.1287/mnsc.32.8.982
- Bakker, M., Riezebos, J., & Teunter, R. H. (2012). Review of inventory systems with deterioration since 2001. *European Journal of Operational Research*, 221(2), 275–284. doi:10.1016/j.ejor.2012.03.004
- Bakos, J. Y., & Treacy, M. E. (1986). Information technology and corporate strategy: A research perspective. *Management Information Systems Quarterly*, 10(2), 107–119. doi:10.2307/249029
- Bakos, Y. J., & Brynjolfsson, E. (1993). From Vendors to Partners: Information Technology and Incomplete Contracts in Buyer-Supplier Relationships. *Journal of Organizational Computing and Electronic Commerce*, 3(3), 301–328. doi:10.1080/10919399309540206
- Bala, K. (2014). Supply Chain Management: Some issues and challenges - A review. *International Journal of Current Engineering and Technology*, 4(2), 947–953.
- Ballou, R. H. (2007). The evolution and future of logistics and supply chain management. *European Business Review*, 19(4), 332–348. doi:10.1108/09555340710760152
- Bandyopadhyay, S., & Pathak, P. (2007). Knowledge sharing and cooperation in outsourcing projects: A game theoretical analysis. *Decision Support Systems*, 43(2), 349–358. doi:10.1016/j.dss.2006.10.006
- Banister, J. (2010). gCommerce: The Gamification of eCommerce. *Interpret - New Media and Technology Market Research Company*. Retrieved from <http://www.interpretllc.com/new-media-measure-interpretations.php?rid=49>
- Baran, E., Correia, A. P., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education*, 32(3), 421–439. doi:10.1080/01587919.2011.610293
- Barateiro, J., & Galhardas, H. (2005). A Survey of Data Quality Tools. *Datenbank-Spektrum*, 14(15-21), 48.
- Barnes, L., & Lea-Greenwood, G. (2010). Fast fashion in the retail store environment. *International Journal of Retail & Distribution Management*, 38(10), 760–772. doi:10.1108/09590551011076533
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. doi:10.1177/014920639101700108
- Barney, J. B. (1999, Spring). How a firm's capabilities affect boundary decisions. *Sloan Management Review*.
- Barney, J. B. (2012). Purchasing, supply chain management and sustained competitive advantage: The relevance of resource-based theory. *Journal of Supply Chain Management*, 48(2), 3–6. doi:10.1111/j.1745-493X.2012.03265.x
- Barratt, M. (2004). Understanding the meaning of collaboration in the supply chain. *Supply Chain Management: An International Journal*, 9(1), 30–42. doi:10.1108/13598540410517566
- Barratt, M., & Oke, A. (2007). Antecedents of supply chain visibility in retail supply chains: A resource-based theory perspective. *Journal of Operations Management*, 25(6), 1217–1233. doi:10.1016/j.jom.2007.01.003

Compilation of References

- Barrett, H. R., Ilbery, B. W., Brown, A. W., & Binns, T. (1999). Globalization and the changing networks of food supply: The importation of fresh horticultural produce from Kenya into the UK. *Transactions of the Institute of British Geographers*, 24(2), 159–174. doi:10.1111/j.0020-2754.1999.00159.x
- Barry, J., Cavinato, J. L., Green, A., & Young, R. R. (1996). A development model for effective MRO procurement. *International Journal of Purchasing and Materials Management*, 32(2), 35–44. doi:10.1111/j.1745-493X.1996.tb00284.x
- Bartlett, C. A., & Ghoshal, S. (1989). *Managing Across Borders: The Transnational Solution*. Boston, MA: Harvard Business School Press.
- Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45(2), 143–154. doi:10.1080/0013188032000133548
- Basnet, C., Corner, J., Wisner, J., & Tan, K.-C. (2003). Benchmarking supply chain management practice in NZ. *Supply Chain Management: An International Journal*, 8(1), 57–64. doi:10.1108/13598540310463369
- Basu, D. R., & Miroshnik, V. (1999). Strategic human resource management of Japanese Multinationals: A case study of Japanese multinational companies in the UK. *Journal of Management Development*, 18(9), 714–732. doi:10.1108/02621719910300775
- Bateson, G. (1972). *Steps to an ecology of mind: Collected essays in anthropology, psychiatry, evolution, and epistemology*. Chicago: University of Chicago Press.
- Batini, C., & Scannapieco, M. (2006). *Data quality: concepts, methodologies and techniques*. Berlin: Springer.
- Bayazit, O. (2006). Use of analytic network process in vendor selection decisions. *Benchmarking: An International Journal*, 13(5), 566–579. doi:10.1108/14635770610690410
- BBC. (2013). *Tesco offloads loss-making Fresh & Easy chain*. Retrieved on November 23, 2014, from: <http://www.bbc.co.uk/news/business-24040346>
- Beamon, B. M. (1998). Supply chain design and analysis: Models and methods. *International Journal of Production Economics*, 55(3), 281–294. doi:10.1016/S0925-5273(98)00079-6
- Becchetti, L., Ciciretti, R., Hasan, I., & Kobeissi, N. (2012). Corporate social responsibility and shareholder's value. *Journal of Business Research*, 65(11), 1628–1635. doi:10.1016/j.jbusres.2011.10.022
- Bechtel, C., & Jayaram, J. (1997). Supply chain management: A strategic perspective. *International Journal of Logistics Management*, 8(1), 15–34. doi:10.1108/09574099710805565
- Beckmann, E. A. (2010). Learners on the move: Mobile modalities in development studies. *Distance Education*, 31(2), 159–173. doi:10.1080/01587919.2010.498081
- Beckman, R. J. (1999). The current state of knowledge management. In J. Liebowitz (Ed.), *Knowledge Management Handbook* (pp. 1.1–1.22). Boca Raton, FL: CRC Press.
- Beekman, A. V., & Robinson, R. B. (2004). Supplier partnerships and the small, high-growth firm: Selecting for success. *Journal of Small Business Management*, 42(1), 59–77. doi:10.1111/j.1540-627X.2004.00097.x
- Bennet, J., & Jayes, S. (1995). *Trusting the Team: The Best Practice Guide to Partnering in Construction*. Centre for Strategic Studies in Construction Forum, Reading.
- Bennett, J., & Jayes, S. (1998). *The Seven Pillars of Partnering*. ICE Publishing.
- Bensaou, M. (1999). Portfolios of buyer-supplier relationships. *Sloan Management Review*, 40(4), 35–44.

Compilation of References

- Bensaou, M., & Venkatraman, N. (1995). Configurations of inter-organizational relationships: A comparison between U.S. and Japanese automakers. *Management Science*, *41*(9), 1471–1492. doi:10.1287/mnsc.41.9.1471
- Berger, G. (2007). *Sustainability Impact Assessment: Approaches and applications in Europe*. ESDN Quarterly Report.
- Berk, J., & DeMarzo, P. (2014). *Corporate Finance* (3rd ed.). Boston: Pearson.
- Berman, B., & Evans, J. R. (2004). *Retail management-A strategic approach* (9th ed.). New York: Pearson Prentice Hall.
- Bernstein, J. (2014). *Nuclear Iran*. Cambridge, MA: Harvard University Press. doi:10.4159/harvard.9780674735552
- Bernstein, P. L. (1996). *Against the gods: The remarkable story of risk*. New York: Wiley.
- Berry, D., Towill, D. R., & Wadsley, N. (1994). Supply chain management in the electronics products industry. *International Journal of Physical Distribution & Logistics Management*, *24*(10), 20–32. doi:10.1108/09600039410074773
- Bessant, J., & Tsekouras, G. T. (2000). *Developing learning networks*. London: A.I. and Society.
- Bhaskar, V., & Lallement, P. (2008). Activity routing in a distributed supply chain: Performance evaluation with two inputs. *Journal of Network and Computer Applications*, *31*(4), 402–428. doi:10.1016/j.jnca.2008.02.001
- Bhat, R., & Gomez-Lopez, V. M. (2014). *Practical Food Safety: Contemporary Issues and Future Directions*. Wiley. doi:10.1002/9781118474563
- Bhattacharya, A., Geraghty, J., & Young, P. (2010). Supplier selection paradigm: An integrated hierarchical QFD methodology under multiple-criteria environment. *Applied Soft Computing*, *10*(4), 1013–1027. doi:10.1016/j.asoc.2010.05.025
- Bhattacharya, R., Devinney, T. M., & Pillutla, M. M. (1998). A formal model of trust based on outcomes. *Academy of Management Review*, *23*, 456–476.
- Bhatt, G. (2000). Organizing knowledge in the knowledge development cycle. *Journal of Knowledge Management*, *4*(1), 15–26. doi:10.1108/13673270010315371
- Bhatt, G. D., & Grover, V. (2005). Types of information technology capabilities and their role in competitive advantage: An empirical study. *Journal of Management Information Systems*, *22*(2), 253–277.
- Bhote, K. R. (1989). *Strategic supply management: A blueprint for revitalizing the manufacturer-supplier partnership*. New York: AMACOM.
- Biboum, A. D., & Sigure, S. P. (2014). Conflict in supplier-retailer relationships in the Brewery Industry in Cameroon. *Journal of African Business*, *15*(2), 75–84. doi:10.1080/15228916.2014.925361
- Birtwistle, G., Fiorito, S. S., & Moore, C. M. (2006). Supplier perceptions of quick response systems. *Journal of Enterprise Information Management*, *19*(3), 334–345. doi:10.1108/17410390610658504
- Birtwistle, G., Siddiqui, N., & Fiorito, S. S. (2003). Quick response: Perceptions of UK fashion retailers. *International Journal of Retail & Distribution Management*, *31*(2), 118–128. doi:10.1108/09590550310462010
- Bishop, C. (2006). *Pattern Recognition and Machine Learning*. Singapore: Springer.
- Blackman, I. D., Holland, C. P., & Westcott, T. (2013). Motorola's global financial supply chain strategy. *Supply Chain Management: An International Journal*, *18*(2), 132–147. doi:10.1108/13598541311318782
- Blankenship, A. B., Crossley, A., Heidingsfield, M. S., Herzog, H., & Kornhauser, A. (1950). Questionnaire Preparation and Interviewer Technique. *Journal of Marketing*, *14*(3), 399–433. doi:10.2307/1248194

Compilation of References

- Blatt, R. (2009). Tough love: How communal schemas and contracting practices build relational capital in entrepreneurial teams. *Academy of Management Review*, 34(3), 533–551. doi:10.5465/AMR.2009.40633298
- Bloomberg. (2014). *Samsung Vietnam Phone Leap Has Farmhand Living a Dream*. Retrieved from <http://www.bloomberg.com/news/2014-09-10/samsung-vietnam-phone-leap-has-farmhand-living-a-dream.html>
- Blumer, H. (1969). *Symbolic interactionism: Perspective and method*. New Jersey: Prentice-Hall, Inc.
- Boampong, O. (2009). Market imperfections and the effectiveness of subcontracting and institutions in export market transactions in Ghana [Unpublished PhD Thesis]. University of Birmingham.
- Boddy, D. (2005). *Management: An Introduction* (3rd ed.). Harlow: Prentice Hall.
- Boddy, D., Macbeth, D., & Wagner, B. (2000). Implementing collaboration between organizations: An empirical study of supply chain partnering. *Journal of Management Studies*, 37(7), 1003–1017. doi:10.1111/1467-6486.00214
- Bode, C., Wagner, S. M., Petersen, K. J., & Ellram, L. M. (2011). Understanding responses to supply chain distributions: Insights from information processing and resource dependence perspectives. *Academy of Management Journal*, 54(4), 833–856. doi:10.5465/AMJ.2011.64870145
- Boeck, H., & Fosso Wamba, S. (2008). RFID and buyer-seller relationships in the retail supply chain. *International Journal of Retail & Distribution Management*, 36(6), 433–460. doi:10.1108/09590550810873929
- Bogdan, R., & Taylor, S. J. (1975). *Introduction to qualitative research methods: A phenomenological approach to the social sciences*. New York: John Wiley & Sons.
- Böhme, T. (2009). *Supply chain integration: A case-based investigation of status, barriers, and paths to enhancement* [Doctoral thesis]. University of Waikato, Hamilton, New Zealand. Retrieved from <http://researchcommons.waikato.ac.nz/handle/10289/3289>
- Bolstorff, P., & Rosenbaum, R. (2012). *Supply Chain Excellence* (3rd ed.). New York: AMACOM.
- Bonardi, J. P., Hillman, A. J., & Keim, G. D. (2005). The attractiveness of political markets: Implications for firm strategy. *Academy of Management Review*, 30(2), 397–413. doi:10.5465/AMR.2005.16387895
- Bonoma, T. V., & Johnston, W. J. (1978). The social psychology of industrial buying and selling. *Industrial Marketing Management*, 7(4), 213–224. doi:10.1016/0019-8501(78)90038-X
- Borenstein, M., Hedges, L. V., Higgins, J. P., & Rothstein, H. R. (2009). *Introduction to Meta Analysis*. Sussex, England: Wiley-Blackwell. doi:10.1002/9780470743386
- Borges, M. A. V., & Vieira, L. M. (2014). Brazil Moving up in the Semiconductor Global Chain. *Journal of Operations and Supply Chain Management*, 7(1), 69–84. doi:10.12660/joscmv7n1p68-84
- Bortolaso, I. V., Balestrin, A., Teixeira, R., & Faccin, K. (2013). Trajectory of the Brazilian Semiconductor Industry and Supply Chain: Economic, Governmental, and Technological Perspectives. *Journal of Operations and Supply Chain Management*, 6(2), 20–39.
- Bostock, M., Ogievetsky, V., & Heer, J. (2011). D³ Data-Driven Documents. *Visualization and Computer Graphics. IEEE Transactions*, 17(12), 2301–2309.
- Boulding, K. (1956). General systems theory-the skeleton of science. *Management Science*, 2(3), 197–208. doi:10.1287/mnsc.2.3.197
- Bourlakis, M. A., & Weightman, P. W. (Eds.). (2004). *Food supply chain management*. Blackwell Publication.

Compilation of References

- Bourne, M., Franco-Santos, M. & Cranfield School of Management. Centre for Business Performance. (2004). *Corporate performance management*. Cary, NC: SAS Institute.
- Bowerson, D. J., & Closs, D. J. (1996). *Logistical management: the integrated supply chain process*. New York: Mac-Graw Hill.
- Bowersox, D. J., Closs, D. J., & Stank, T. P. (2000). Ten mega-trends that will revolutionize supply chain logistics. *Journal of Business Logistics*, 21(2), 1–15.
- Boyd, D., & Crawford, K. (2012). Critical questions for big data. *Information Communication and Society*, 15(5), 662–679. doi:10.1080/1369118X.2012.678878
- Boysen, N., Emde, S., Hoeck, M., & Kauderer, M. (2015). Part logistics in the automotive industry: Decision problems, literature review and research agenda. *European Journal of Operational Research*, 242(1), 107–120. doi:10.1016/j.ejor.2014.09.065
- Bozarth, C. C., & Handfield, R. B. (2006). *Introduction to operations and supply chain management*. New York: Pearson Prentice Hall.
- Bradbury, J. A. (1989). The policy implications of differing concepts of risk. *Science, Technology & Human Values*, 14(4), 380–399. doi:10.1177/016224398901400404
- Brandenburger, A., & Stuart, H. (2007). Biform games. *Management Science*, 53(4), 537–549. doi:10.1287/mnsc.1060.0591
- Brandenburg, M., & Seuring, S. (2011). Impacts of supply chain management on company value: Benchmarking companies from the fast moving consumer goods industry. *Logistics Research*, 3(4), 233–248. doi:10.1007/s12159-011-0056-7
- Brandon-Jones, E., Squire, B., Autry, C. W., & Petersen, K. J. (2014). A contingent resource-based perspective of supply chain resilience and robustness. *Journal of Supply Chain Management*, 50(3), 55–73.
- Bratić, D. (2011). Achieving a competitive advantage by SCM. *IBIMA Business Review*, 2011, 1–13. doi:10.5171/2011.957583
- Braun, V., & Clarke, V. (2006). Using thematic analysis in Psychology. *Qualitative Research in Psychology*, 3(2), 77–101. doi:10.1191/1478088706qp063oa
- Brewer, A. M. (2001). *Handbook of Logistics and Supply-chain Management*. Amsterdam: Elsevier Science Ltd.
- Brewer, P. C., & Speh, T. W. (2000). Using the balanced scorecard to measure supply chain performance. *Journal of Business Logistics*, 21(1), 75–95.
- Brindley, C., & Ritchie, B. (2004). Introduction. In C. Brindley (Ed.), *Supply chain risk*. Hampshire: Ashgate Publishing Limited.
- Brom, F. W. (2000). Food, consumer concerns, and trust: Food ethics for a globalizing market. *Journal of Agricultural & Environmental Ethics*, 12(2), 127–139. doi:10.1023/A:1009586529518
- Brown, B., Chui, M., & Manyika, J. (2011). Are you ready for the era of 'big data'? *The McKinsey Quarterly*, October.
- Brown, J. S., & Adler, R. P. (2008). Minds on Fire: Open Education, the Long Tail, and Learning 2.0. *EDUCAUSE Review*, (January/February): 17–32.
- Brown, R. G. (1967). *Decision Rules For Inventory Management*. New York: Holt, Rinehardt, Winston.
- Brown, S., & Bessant, J. (2003). The manufacturing strategy-capabilities links in mass customisation and agile manufacturing—An exploratory study. *International Journal of Operations & Production Management*, 23(7), 707–730. doi:10.1108/01443570310481522

Compilation of References

- Bruce, M., Daly, L., & Towers, N. (2004). Lean or agile: A solution for supply chain management in the textiles and clothing industry? *International Journal of Operations & Production Management*, 24(1–2), 151–170. doi:10.1108/01443570410514867
- Brynzér, H., & Johansson, M. I. (1996). Storage location assignment: Using the product structure to reduce order picking times. *International Journal of Production Economics*, 46(47), 595–603. doi:10.1016/0925-5273(94)00091-3
- Budget, G. (2010). *Budget statement and economic policy for 2010*. Ghana: Retrieved from <http://www.ghana.gov.gh/documents/2010budget.pdf>
- Budget, G. (2012). *Budget statement and economic policy for 2012*. Ghana Government Retrieved from <http://www.modernghana.com/news/361684/1/2012-budget-full-statement.html>
- Building Customer Profiles (2001). Using data mining methods to build customer profiles.
- Bukowski, L. A., & Feliks, J. (2012). Multi-Dimensional Concept of Supply Chain Resilience. Proceedings of CLC 2012: Carpathian Logistics Congress (pp. 33-40). Ostrava: TANGER.
- Burgess, R. (2013, October 8). *Critters, weeds invading Louisiana, destroying habitat*. Retrieved from <http://theadvocate.com/home/7156714-125/critters-weeds-invading-la-destroying>
- Burgess, K., Singh, P. J., & Koroglu, R. (2006). Supply chain management: A structured literature review and implications for future research. *International Journal of Operations & Production Management*, 26(7), 703–729. doi:10.1108/01443570610672202
- Burgess, R. (1998). Avoiding supply chain management failure: Lessons from business process re-engineering. *International Journal of Logistics Management*, 9(1), 15–23. doi:10.1108/09574099810805717
- Burkhard, R., Spescha, G., & Meier, M. (2005). *A-ha!: How to Visualize Strategies with Complementary Visualizations. Conference on Visualising and Presenting Indicator Systems*.
- Burt, D. N., & Doyle, M. F. (1993). *The American Keiretsu: A strategic weapon for global competitiveness*. New York: McGraw-Hill.
- Burt, D. N., & Soukup, W. R. (1985). Purchasing's new role in new product development. *Harvard Business Review*, 63(5), 90–97.
- Burton, T. T. (1998). JIT/Repetitive sourcing strategies: Tying the knot with your suppliers. *Production and Inventory Management Journal*, 4, 38–41.
- Buse, R. P. L., & Zimmermann, T. (2012). Information Needs for Software Development Analytics. *Proceedings of the 34th International Conference on Software Engineering (ICSE 2012 SEIP Track)*, Zurich. Microsoft Research Report. doi:10.1109/ICSE.2012.6227122
- Business Standard. (2012). Retrieved from http://www.business-standard.com/article/companies/india-s-organic-foods-market-growing-at-over-20-112082300157_1.html
- Buvik, A. (2011, May 2-6). Industrial Purchasing: It all started with marketing (PhD course). Molde University College, Molde, Norway.
- Buvik, A. (2002). Hybrid governance and governance performance in industrial purchasing relationships. *Scandinavian Journal of Management*, 18(4), 567–587. doi:10.1016/S0956-5221(01)00030-6
- Buvik, A., & John, G. (2000). When does vertical coordination improve industrial purchasing relationships? *Journal of Marketing*, 64(4), 52–64. doi:10.1509/jmkg.64.4.52.18075

Compilation of References

- Buvik, A., & Reve, T. (2001). Asymmetrical deployment of specific assets and contractual safeguarding in industrial purchasing relationships. *Journal of Business Research*, 51(2), 101–113. doi:10.1016/S0148-2963(99)00056-9
- Cachon, G., & Terwiesch, C. (2013). *Matching Supply With Demand*. New York: McGraw-Hill Irwin.
- Cachon, G. P., & Fisher, M. (2000). Supply Chain Inventory Management and the Value of Shared Information. *Management Science*, 46(8), 1032–1048. doi:10.1287/mnsc.46.8.1032.12029
- Cagliano, R., Caniato, F., & Spina, G. (2003). E-business strategy, how companies are shaping their supply chain through the internet. *International Journal of Operations & Production Management*, 23(10), 1142–1162. doi:10.1108/01443570310496607
- Canavari, M., Centonze, R., Hingley, M., & Spadoni, R. (2010). Traceability as part of competitive strategy in the fruit supply chain. *British Food Journal*, 112(2), 171–186. doi:10.1108/00070701011018851
- Caniëls, M. C. J., Gehrsitz, M. H., & Semeijn, J. (2013). Participation of suppliers in greening supply chains: An empirical analysis of German automotive suppliers. *Journal of Purchasing and Supply Management*, 19(3), 134–143. doi:10.1016/j.pursup.2013.02.005
- Cao, M., & Zhang, Q. (2011). Supply chain collaboration: Impact on collaborative advantage and firm performance. *Journal of Operations Management*, 29(3), 163–180. doi:10.1016/j.jom.2010.12.008
- Cao, Y., Luo, X., Kwong, C., & Tang, J. (2014). Supplier pre-selection for platform-based products: A multi-objective approach. *International Journal of Production Research*, 52(1), 1–19. doi:10.1080/00207543.2013.807376
- Carter, C. R. (2000). Ethical issues in international buyer–supplier relationships: A dyadic examination. *Journal of Operations Management*, 18(2), 191–208. doi:10.1016/S0272-6963(99)00016-9
- Carter, C. R., & Dresner, M. (2001). Purchasing's Role in Environmental Management: Cross-Functional Development of Grounded Theory. *Journal of Supply Chain Management*, 37(2), 12–27. doi:10.1111/j.1745-493X.2001.tb00102.x
- Carter, J. R., & Narasimhan, R. (1996). Is purchasing really strategic? *International Journal of Purchasing and Materials Management*, 32(4), 20–28. doi:10.1111/j.1745-493X.1996.tb00216.x
- Carter, R. C., & Rogers, D. S. (2008). A framework of sustainable supply chain management: Moving toward new theory. *International Journal of Physical Distribution & Logistics Management*, 38(5), 360–387. doi:10.1108/09600030810882816
- Carter, R., & Hodgson, G. M. (2006). The impact of empirical tests of transaction costs economics on the debate on the nature of the firm. *Strategic Journal Management*, 27(5), 461–476. doi:10.1002/smj.531
- Carvalho, H., Azevedo, S., & Cruz-Machado, V. (2012). Agile and resilient approaches to supply chain management: Influence on performance and competitiveness. *Logistics Research*, 4(1–2), 49–62. doi:10.1007/s12159-012-0064-2
- Casciaro, T., & Piskorski, M. J. (2005). Power Imbalance, Mutual Dependence, and Constraint Absorption: A Closer Look at Resource Dependence Theory. *Administrative Science Quarterly*, 50(2), 167–199. doi:10.2307/30037190
- Cassivi, L. (2006). Collaboration planning in a supply chain. *Supply Chain Management: An International Journal*, 11(3), 249–258. doi:10.1108/13598540610662158
- Cavinato, J. L. (1991). Evolving procurement organizations: Logistics implications. *Journal of Business Logistics*, 13(1), 27–45.
- Cavusgil, S. T., Knight, G., & Riesenberger, J. R. (2012). *International Business: The New Realities* (2nd ed.). New Jersey: Pearson.

Compilation of References

- Cavusgil, T., & Zou, S. (1994). Marketing strategy-performance relationship: An investigation of the empirical link in export market ventures. *Journal of Marketing*, 58(1), 1–21. doi:10.2307/1252247
- Central Pollution Control Board. (2011). Implementation of E-Waste Rules 2011: Guidelines. Retrieved from http://cpcb.nic.in/upload/Latest/Latest_71_ImplementationOfE-WasteRules.pdf
- Cervera, C. M., & Flores, J. L. M. (2012). A Conceptual Framework for a Green Supply Chain Strategy. *Proceedings of the Global Conference on Business and Finance Proceedings*, 7(2), 269–273.
- Cetişli, B., & Barkama, A. (2009). Speeding up the scaled conjugate gradient algorithm and its application in neuro-fuzzy classifier training. *Soft Computing*, 14(4), 365–378. doi:10.1007/s00500-009-0410-8
- Chae, B. K., Yang, C., Olson, D., & Sheu, C. (2014). The impact of advanced analytics and data accuracy on operational performance: A contingent resource based theory (RBT) perspective. *Decision Support Systems*, 59, 119–126. doi:10.1016/j.dss.2013.10.012
- Chae, B., Yen, H. J. R., & Sheu, C. (2005). Information Technology and Supply Chain Collaboration: Moderating Effects of Existing Relationships between Partners. *IEEE Transactions on Engineering Management*, 52(4), 440–448. doi:10.1109/TEM.2005.856570
- Chan, F. T. S. (2003). Interactive selection model for supplier selection process: An analytical hierarchy process approach. *International Journal of Production Research*, 41(15), 3549–3579. doi:10.1080/0020754031000138358
- Chan, F. T. S., & Chan, H. K. (2005). The future trend on system-wide modelling in supply chain studies. *International Journal of Advanced Manufacturing Technology*, 25(7-8), 820–832. doi:10.1007/s00170-003-1851-3
- Chan, F. T. S., & Kumar, N. (2007). Global supplier development considering risk factors using fuzzy extended AHP-based approach. *Omega*, 35(4), 417–431. doi:10.1016/j.omega.2005.08.004
- Changchien, S. W., & Shen, H.-Y. (2002). Supply chain reengineering using a core process analysis matrix and object-oriented simulation. *Information & Management*, 39(5), 345–358. doi:10.1016/S0378-7206(01)00102-1
- Chang, H. H., Hung, C. J., Wong, K. H., & Lee, C. H. (2013). Using the balanced scorecard on supply chain integration performance: A case study of service businesses. *Service Business*, 7(4), 539–561. doi:10.1007/s11628-012-0175-5
- Chao, C. M., Yu, C. T., Cheng, B. W., & Chuang, P.-C. (2013). Trust and Commitment in Relationships among Medical Equipment Suppliers: Transaction Cost and Social Exchange Theories. *Social Behavior and Personality*, 41(7), 1057–1069. doi:10.2224/sbp.2013.41.7.1057
- Charles, A., Lauras, M., & Van Wassenhove, L. (2010). A model to define and assess the agility of supply chains: Building on humanitarian experience. *International Journal of Physical Distribution & Logistics Management*, 40(8/9), 722–741. doi:10.1108/09600031011079355
- Chatzinikolaou, P., & Manos, B. (2012). *Review of existing methodologies and tools for measuring sustainability in rural areas*. Retrieved from http://www.feem-project.net/belpasso_2012/files/studpapers/Paper_Chatzinikolaou.pdf
- Chen, Y., Watson, E., & Azevedo, R. F. L. (2011). Soft Landings Curriculum of U.S.-China Entrepreneurship. *China Currents*, 10(2).
- Chen, Y., Watson, E., & Azevedo, R.F.L. (2011). Soft Landings Curriculum of U.S.-China Entrepreneurship. *China Currents*, 10(2).
- Chen, Y., Watson, E., Liu, C., Cornachione, E., & Wu, S. (2010, June 25-29). Soft Landing Curriculum of Entrepreneurship in Emerging Markets. *Proceedings of the Academy of International Business 2010 Annual Meeting*, Rio de Janeiro, Brazil.

Compilation of References

- Chen, Y., Watson, E., Liu, C., Cornachione, E., & Wu, S. (2010, June 25-29). Soft Landing Curriculum of Entrepreneurship in Emerging Markets. *Proceedings of the Academy of International Business 2010 Annual Meeting*, Rio de Janeiro, Brazil.
- Chen, C. T. (2000). Extensions of the TOPSIS for group decision-making under fuzzy environment. *Fuzzy Sets and Systems*, 114(1), 1–9. doi:10.1016/S0165-0114(97)00377-1
- Cheng, F. H., Yeh, C. H., & Tu, C. W. (2008). Trust and Knowledge sharing in Green Supply Chains. *Supply Chain Management – International Journal (Toronto, Ont.)*, 13(4), 283–295.
- Cheng, J., Yeh, C., & Tu, C. (2008). Trust and knowledge sharing in green supply chains. *Supply Chain Management: An International Journal*, 13(4), 283–295. doi:10.1108/13598540810882170
- Chen, I. J., & Paulraj, A. (2004). Towards a theory of supply chain management: The constructs and measurements. *Journal of Operations Management*, 22(2), 119–150. doi:10.1016/j.jom.2003.12.007
- Chen, I. J., Paulraj, A., & Lado, A. A. (2004). Strategic purchasing, supply management, and firm performance. *Journal of Operations Management*, 22(5), 505–523. doi:10.1016/j.jom.2004.06.002
- Chen, J., & Ching, R. (2002). A proposed framework for transitioning to an e-business model. *Quarterly Journal of Electronic Commerce*, 3(4), 375–389.
- Chen, K., Shen, J., & Feng, M. (2014). Disruptions management of a supply chain under strategic subsidy policy for the demand-stimulating inventory. *Computers & Industrial Engineering*, 76, 169–182. doi:10.1016/j.cie.2014.07.030
- Chen, L., & Holsapple, C. (2012). E-Business adoption research: analysis and structure. *Proceedings of the 18th Americas Conference on Information Systems (AMICS)*, Seattle, Washington.
- Chen, P.-S., & Wu, M.-T. (2013). A modified failure mode and effects analysis method for supplier selection problems in the supply chain risk environment: A case study. *Computers & Industrial Engineering*, 66(4), 634–642. doi:10.1016/j.cie.2013.09.018
- Chen, S. J., & Huang, E. (2007). A systematic approach for supply chain improvement using design structure matrix. *Journal of Intelligent Manufacturing*, 18(2), 285–299. doi:10.1007/s10845-007-0022-z
- Chen, W. J., Baldwin, J., Dunn, T., Grasselt, M., Hussain, S., Mandelstein, D., & Xu, F. (2013). *A Practical Guide to Managing Reference Data with IBM InfoSphere Master Data Management Reference Data Management Hub*. Armonk, NY: IBM Redbooks.
- Chen, Y., Chen, G., & Wu, S. (2006). *A Simonian Approach to E-business Research: A Study in Netchising*. *Advanced Topics in E-Business Research* (Vol. 1). E-Business Innovation and Process Management.
- Chen, Y., Justis, R. T., & Yang, H. L. (2004, March 5-7). Global E-Business, International Franchising, and Theory of Netchising: A Research Alliance of East and West. *Proceedings of the 18th Annual International Society of Franchising Conference*, Las Vegas, Nevada.
- Chen, Y., Watson, E., & Azevedo, R. F. L. (2013). *E-Strategy and Soft Landings for Franchising in Emerging Markets. Trends in E-Business, E-Services, and E-Commerce: Impact of Technology on Goods, Services, and Business Transactions* (pp. 148–159). Hershey, PA: IGI-Global.
- Chetty, S., & Hamilton, R. T. (1993). Firm-level determinants of export performance. *International Marketing Review*, 10(3), 25–34. doi:10.1108/02651339310040643
- Cheung, C. F., Kwok, S. K., & Heung, C. M. (2012). A knowledge-based customization system for supply chain integration. *Expert Systems with Applications*, 39(4), 3906–3924. doi:10.1016/j.eswa.2011.08.096

Compilation of References

- Cheung, Y. L., Tan, W., Ahn, H. J., & Zhang, Z. (2010). Does corporate social responsibility matter in Asian emerging markets? *Journal of Business Ethics*, 92(3), 401–413. doi:10.1007/s10551-009-0164-3
- Chicken, J. C. (1996). *Risk acceptability and decision-making*. *Risk handbook* (pp. 12–41). London: International Thomson Business Press.
- Chickering, A., & Ehrmann, F. C. (1996). Implementing the Seven Principles: Technology as Lever. *AAHE Bulletin*, (October): 3–6.
- Chien, M. K., & Shih, L. H. (2007). Relationship between Management Practice and Organization Performance under European Directives such as ROHS – A Case Study of the Electrical and Electronics Industry in Taiwan. *African Journal of Environmental Science and Technology*, 1(3), 37–48.
- Chiffolleau, Y., & Touzard, J. M. (2014). Understanding local agri-food systems through advice network analysis. *Agriculture and Human Values*, 31(1), 19–32. doi:10.1007/s10460-013-9446-6
- Childerhouse, P. (2002). *Enabling seamless market-orientated supply chains* [Doctoral thesis]. Cardiff University, Wales, UK. Retrieved from <http://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.273642>
- Child, J. (2001). Trust: The fundamental bond in global collaboration. *Organizational Dynamics*, 29(4), 274–288. doi:10.1016/S0090-2616(01)00033-X
- Child, J., & Faulkner, D. (1998). *Strategies of co-operation: Managing alliances, networks and joint ventures*. Oxford: Oxford University Press.
- Chini, A. R., & Valdez, H. E. (2003). ISO 9000 and the U.S. construction industry. *Journal of Management Engineering*, 19(2), 69–77. doi:10.1061/(ASCE)0742-597X(2003)19:2(69)
- Choi, T. Y., Dooley, K. J., & Rungtusanatham, M. (2001). Supply networks and complex adaptive systems: Control versus emergence. *Journal of Operations Management*, 19(3), 351–366. doi:10.1016/S0272-6963(00)00068-1
- Choi, T. Y., & Hong, Y. (2002). Unveiling the structure of supply networks: Case studies in Honda, Acura, and DaimlerChrysler. *Journal of Operations Management*, 20(5), 469–493. doi:10.1016/S0272-6963(02)00025-6
- Choi, T. Y., & Kim, Y. (2008). Structural embeddedness and supplier management: A network perspective. *Journal of Supply Chain Management*, 44(4), 5–13. doi:10.1111/j.1745-493X.2008.00069.x
- Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of Operations Management*, 24(5), 637–652. doi:10.1016/j.jom.2005.07.002
- Choi, T. Y., & Wu, Z. (2009). Taking the leap from dyads to triads: Buyer–supplier relationships in supply networks. *Journal of Purchasing and Supply Management*, 15(4), 263–266. doi:10.1016/j.pursup.2009.08.003
- Choo, C. W. (1996). The knowing organization: How organizations use information to construct meaning, create knowledge and make decisions. *International Journal of Information Management*, 16(5), 329–340. doi:10.1016/0268-4012(96)00020-5
- Choon Tan, K., Lyman, S. B., & Wisner, J. D. (2002). Supply chain management: A strategic perspective. *Journal of Operations and Production Management*, 22(6), 614–631. doi:10.1108/01443570210427659
- Chopra, S., & Meindl, P. (2010). *Supply Chain Management: Strategy, Planning and Operation*. Hoboken, NJ: Prentice Hall.
- Chopra, S., & Sodhi, M. S. (2004, Fall). Managing Risk to Avoid Supply-Chain Breakdown. *MIT Sloan Management Review*, 46(1), 53–61.

Compilation of References

- Chorn, B., Sisco, C., & Pruzan-Jorgensen, P. M. (2010). *The Business Case for Supply Chain Sustainability: A Brief for Business leaders* (pp. 1–10). Retrieved from <http://www.bsr.org/en/our-insights/report-view/the-business-case-for-supply-chain-sustainability-a-brief-for-business-lead>
- Chou, S.-Y., & Chang, Y.-H. (2008). A decision support system for supplier selection based on a strategy-aligned fuzzy SMART approach. *Expert Systems with Applications*, 34(4), 2241–2253. doi:10.1016/j.eswa.2007.03.001
- Choy, K. L., Lee, W. B., Lau, H. C., Lu, W. D., & Lo, V. (2004, December). Design of an intelligent supplier relationship management system for new product development. *International Journal of Computer Integrated Manufacturing*, 17(8), 692–715. doi:10.1080/0951192042000237483
- Christiansen, B. (2015). *Handbook of Research on Global Business Opportunities*. Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6551-4
- Christopher, M. (2005). *Logistics and supply chain management: creating value-adding networks*. Harlow: Financial Times Prentice Hall.
- Christopher, M. (2012). *Logistics and supply chain management: Creating value-adding networks*. Dorchester, UK: Financial Times Prentice–Hall.
- Christopher, M. (1992). *Logistics: The strategic issues*. London: Chapman and Hall.
- Christopher, M. (1997). *Marketing Logistics*. Oxford: Butterworth-Heinemann.
- Christopher, M. (2000). The agile supply chain-competing in volatile markets. *Industrial Marketing Management*, 29(1), 37–44. doi:10.1016/S0019-8501(99)00110-8
- Christopher, M. (2005). *Logistics and supply chain management: Creating value-adding networks*. London: Prentice Hall.
- Christopher, M. G. (1992). *Logistics and supply chain management*. London: Pitman Publishing.
- Christopher, M., & Jüttner, U. (2000). Developing strategic partnership in the supply chain: A practitioner perspective. *European Journal of & Supply Management*, 6(2), 117–127. doi:10.1016/S0969-7012(99)00038-6
- Christopher, M., & Lee, H. (2004). Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, 34(5), 388–396. doi:10.1108/09600030410545436
- Christopher, M., Lawson, R., & Peck, H. (2004). Creating agile supply chains in the fashion industry. *International Journal of Retail & Distribution Management*, 32(8), 367–376. doi:10.1108/09590550410546188
- Christopher, M., & Peck, H. (2004). Building the resilient supply chain. *The International Journal of Logistics Management*, 15(2), 1–14. doi:10.1108/09574090410700275
- Christopher, M., & Rutherford, C. (2004). Creating supply chain resilience through agile six sigma. *Critical Eye*, 24, 28.
- Christopher, M., & Ryals, L. (1999). Supply chain strategy: Its impact on shareholders' value. *International Journal of Logistics Management*, 10(1), 1–10. doi:10.1108/09574099910805897
- Christopher, M., & Towill, D. (2001). An integrated model for the design of agile supply chains. *International Journal of Physical Distribution & Logistics Management*, 31(4), 235–246. doi:10.1108/09600030110394914
- Christopher, M., & Towill, D. R. (2002). Developing market specific supply chain strategies. *International Journal of Logistics Management*, 13(1), 1–14. doi:10.1108/09574090210806324
- CI-Brasil. (2014). Retrieved from <http://www.ci-brasil.gov.br/index.php/pt/>

Compilation of References

- Clay, K. (2013, August 9). *Forbes*. Retrieved from <http://www.forbes.com/sites/kellyclay/2013/08/19/amazon-com-goes-down-loses-66240-per-minute/>
- Cloos, D. J., & Mollenkopf, D. A. (2004). A global supply chain framework. *Industrial Marketing Management*, 33(1), 37–44. doi:10.1016/j.indmarman.2003.08.008
- Closs, D. J., Speier, C., & Meacham, N. (2011). Sustainability to support end-to-end value chains: The role of supply chain management. *Journal of the Academy of Marketing Science*, 39(1), 101–116. doi:10.1007/s11747-010-0207-4
- Clulow, V., Gerstman, J., & Barry, C. (2003). The resource-based view and sustainable competitive advantage: The case of a financial services firm. *Journal of European Industrial Training*, 27(5), 220–232. doi:10.1108/03090590310469605
- Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386–405. doi:10.1111/j.1468-0335.1937.tb00002.x
- Coates, J. (2003, July). Sourcing in emerging markets. *World Trade*, 16(7), 40.
- Cockburn, A. (2002). *Agile Software Development*. Boston: Addison-Wesley.
- Cockburn, A. (2006). *Agile software development: the cooperative game*. New York: Addison-Wesley Professional.
- Cohen, S. G., & Mankin, D. (2002). Complex collaborations in the new global economy. *Organizational Dynamics*, 31(2), 117–133. doi:10.1016/S0090-2616(02)00096-7
- Collier, D. A. (1982). Aggregate Safety Stock Levels and Component Part Commonality. *Management Science*, 28(11), 1296–1303. doi:10.1287/mnsc.28.11.1296
- Collins English Dictionary. (2014). Retrieved from <http://www.collinsdictionary.com/dictionary/english>
- Collins, A., & Burt, S. (2006). Private brands, governance, and relational exchange within retailer-manufacturer relationships: Evidence from Irish food manufacturer supplying the Irish and British grocery markets. *Agribusiness*, 22(1), 1–20. doi:10.1002/agr.20068
- Columbus, L. (2014, May 12). Gartner's ERP Market Share Update Shows The Future Of Cloud ERP Is Now. *Forbes*. Retrieved from <http://www.forbes.com/sites/louiscolombus/2014/05/12/gartners-erp-market-share-update-shows-the-future-of-cloud-erp-is-now/>
- Commons, J. R. (1934). *Institutional Economics*. Madison: University of Wisconsin Press.
- Connelly, B. L., Ketchen, D. J., & Hult, G. T. M. (2013). Global supply chain management: Toward a theoretically driven research agenda. *Global Strategy Journal*, 3(3), 227–243. doi:10.1111/j.2042-5805.2013.01041.x
- Conversi, D. (2010). The limits of cultural globalization. *Journal of Critical Globalisation Studies*, 2010(3), 36-59. Retrieved from http://www.criticalglobalisation.com/Issue3/36_59_LIMITS_CULTURAL_GLOBALISATION_JCGS3.pdf
- Cooper, H. (2009). *Research synthesis and meta-analysis: A step-by-step approach* (4th ed.). Thousand Oaks, CA: Sage Publication. doi:10.4135/9781483348858.n11
- Cooperhouse, L. (2014). Kitchen Incubation. *Proceedings of the National Business Incubation Association 28th Conference*, New Orleans.
- Cooperhouse, L., & Surgi, M. L. (2014). Maximizing Your Food Incubation Program. *National Business Incubation Association 28th Conference*, New Orleans.
- Cooper, M. C., & Ellram, L. M. (1993). Characteristics of supply chain management and the implications for purchasing and logistics strategy. *International Journal of Logistics Management*, 4(2), 13–24. doi:10.1108/09574099310804957

Compilation of References

- Cooper, M. C., Lambert, D. M., & Pagh, J. D. (1997). Supply chain management: More than a new name for logistics. *International Journal of Logistics Management*, 8(1), 1–14. doi:10.1108/09574099710805556
- Copeland, M. A. (1930). Psychology and the natural science point of view. In M.A. Copeland (Ed.), *Psychological Review* (461-487). Westpoint, CN: Greenwood Press. doi:10.1037/h0072054
- Cordeau, J., Pasin, F., & Solomon, M.M. (2006). An integrated model for logistics network design. *Ann Oper Res* (2006).
- Cordon, C., Seifert, R. W., & Lang, G. (2013). LEGO: Consolidating distribution (Abridged). *Supply Chain Forum: An International Journal*, 14(1), 42-49.
- Corey, E. R. (1962). *Industrial marketing: cases and concepts*. Englewood Cliffs, NJ: Prentice-Hall.
- Corey, E. R. (1976). *Industrial Marketing*. Englewood Cliffs, NJ: Prentice-Hall.
- Corsten, D., & Kumar, M. (2005). Do suppliers benefit from collaborative relationships with large retailers? An empirical investigation of efficient consumer response adoption. *Journal of Marketing*, 69(3), 80–94. doi:10.1509/jmkg.69.3.80.66360
- Cotterill, R. W., & Mueller, W. F. (1979). *The Food Retailing Industry: Market Structure, Profits, and Prices*. New York: Praeger.
- Council of Supply Chain Management Professionals. (2013, August). Supply Chain Management Terms and Glossary. *Cscmp.org*. Retrieved from http://cscmp.org/sites/default/files/user_uploads/resources/downloads/glossary-2013.pdf
- Cousins, P. D. (2002). A conceptual model for managing long-term inter-organisational relationships. *European Journal of Purchasing & Supply Management*, 8(2), 71–82. doi:10.1016/S0969-7012(01)00006-5
- Cova, B., & Salle, R. (2007). The industrial /consumer marketing dichotomy revisited: A case of outdated justification? *Journal of Business and Industrial Marketing*, 23(1), 3–11. doi:10.1108/08858620810841443
- Cox, A. (1996). Relational competence and strategic procurement management. *European Journal of Purchasing Supply Management*, 2(1), 57–70. doi:10.1016/0969-7012(95)00019-4
- Cox, A. (1997). *Business success – a way of thinking about strategic, critical supply chain assets and operational best practice*. London: Earlsgate Press.
- Cox, A. (1999). Power, value and supply chain management. *Supply Chain Management: An International Journal*, 4(4), 167–175. doi:10.1108/13598549910284480
- Craighead, C. W., Hult, G. T. M., & Ketchen, D. J. Jr. (2009). The effects of innovation–cost strategy, knowledge, and action in the supply chain on firm performance. *Journal of Operations Management*, 27(5), 405–421. doi:10.1016/j.jom.2009.01.002
- Cranwell, M. R., Kolodinsky, J. M., Donnelly, C. W., Downing, D. L., & Padilla-Zakour, O. I. (2005). A model food entrepreneur assistance and education program: The Northeast Center for Food Entrepreneurship. *Journal of Food Science Education*, 4(4), 56–65. doi:10.1111/j.1541-4329.2005.tb00063.x
- Crick, D., & Spence, M. (2005). The internationalisation of ‘high performing’ UK high-tech SMEs: A study of planned and unplanned strategies. *International Business Review*, 14(2), 167–185. doi:10.1016/j.ibusrev.2004.04.007
- Crocker, K. J., & Masten, S. E. (1996). Regulation and administered contracts revisited: Lessons from transaction cost economics for public utility regulation. *Journal of Regulatory Economics*, 9(1), 5–39. doi:10.1007/BF00134817
- Crook, T. R., & Combs, J. G. (2007). Sources and consequences of bargaining power in supply chains. *Journal of Operations Management*, 25(2), 546–555. doi:10.1016/j.jom.2006.05.008

Compilation of References

- Croom, S., Romano, P., & Giannakis, M. (2000). Supply chain management: An analytical framework for critical literature review. *European Journal of Purchasing & Supply Management*, 6(1), 67–83. doi:10.1016/S0969-7012(99)00030-1
- Crostack, H.-A., ten Hompel, M., Zellerhoff, J., Pelka, M., Mathis, J., & Strothotte, D. (2010). Strategien für die flexible auftragsweise Kommissionierung mit integrierter Prüfung mit dem Ziel einer hohen Kapazitätsauslastung eingesetzter Ressourcen. *Endbericht AiF-Vorhaben*, 15811.
- Crowley, L. G., & Karim, A. (1995). Conceptual model of partnering. *Journal of Management Engineering*, 11(5), 33–39. doi:10.1061/(ASCE)0742-597X(1995)11:5(33)
- Croxton, K. L., Garcia-Dastugue, S. J., Lambert, D. M., & Rogers, D. S. (2001). The supply chain management processes. *International Journal of Logistics Management*, 12(2), 13–36. doi:10.1108/09574090110806271
- Cruijssen, F., Dullaert, W., & Fleuren, H. (2007, Summer). Horizontal cooperation in transport and logistics: a literature review. *Transportation Journal*.
- Cumming, G. (2011). *Understanding the new statistics: Effect sizes, confidence intervals, and Meta-analysis*. New York: Routledge.
- Curry, J., & Kenney, M. (1999). Beating the clock: Corporate response to rapid change in the PC industry. *California Management Review*, 42(1), 8–36. doi:10.2307/41166017
- CWPPRA. (1997). Wetland Loss in Louisiana (Government Publication). *LA Coast*. Retrieved from <http://lacoast.gov/reports rtc/1997/5.htm>
- Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- DA, M. (2009). The DAMA guide to the data management body of knowledge.
- Dakup, K., Fulford, H., & Sutherland, B. J. (2014). Investigating the adoption of sustainable green initiatives in Scottish food and drink SMEs. *Proceedings of the 9th European Conference on Innovation and Entrepreneurship*. Academic Conferences and Publishing International.
- Damodaran, L., & Olphert, W. (2000). Barriers and facilitators to the use of knowledge management systems. *Behaviour & Information Technology*, 19(6), 405–413. doi:10.1080/014492900750052660
- Danese, P. (2011). Towards a contingency theory of collaborative planning initiatives in supply networks. *International Journal of Production Research*, 49(4), 1081–1103. doi:10.1080/00207540903555510
- Dapiran, P. (1992). Benetton—global logistics in action. *International Journal of Physical Distribution & Logistics Management*, 22(6), 7–11. doi:10.1108/EUM00000000000416
- Darroch, J., & McNaughton, R. (2002). Examining the link between knowledge management practices and types of innovation. *Journal of Intellectual Capital*, 3(3), 210–222. doi:10.1108/14691930210435570
- Das, A., Narasimhan, R., & Talluri, S. (2006). Supplier integration: Finding an optimal configuration. *Journal of Operations Management*, 24(5), 563–582. doi:10.1016/j.jom.2005.09.003
- Das, T. K. (2006). Strategic alliance temporalities and partner opportunism. *British Journal of Management*, 17(1), 1–21. doi:10.1111/j.1467-8551.2006.00482.x
- Das, T. K., & Teng, B. S. (1998). Between trust and control: Developing confidence in partner cooperation alliances. *Academy of Management Review*, 23(3), 491–512.

Compilation of References

- Das, T. K., & Teng, B. S. (1998). Between trust and control: Developing confidence in partner cooperation in alliances. *Academy of Management Review*, 23, 491–512.
- Das, T. K., & Teng, B.-S. (1998). Between Trust and Control: Developing Confidence in Partner Cooperation in Alliances. *Academy of Management Review*, 23(3), 491–512.
- Das, T. K., & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, 26(1), 31–61. doi:10.1177/014920630002600105
- Daugherty, P. J., Richey, R. G., Roath, A. S., Min, S., Chen, H., Arndt, A. D., & Genchev, S. E. (2006). Is collaboration paying off for firms? *Business Horizons*, 49(1), 61–70. doi:10.1016/j.bushor.2005.06.002
- Davenport, T. H. (1994, March-April). Saving IT's Soul: Human Centered Information Management. *Harvard Business Review*, 72(2), 119–131.
- Davenport, T. H., & Harris, J. G. (2007). *Competing with Analytics: the new science of winning*. Boston: Harvard Business Press.
- Davenport, T. H., & Short, J. E. (1990). The new industrial engineering information technology and business process re-design. *Sloan Management Review*, 31, 11–27.
- Davis, J. H., Schoorman, F. D., & Donaldson, L. (1997). Toward a stewardship theory of management. *Academy of Management Review*, 22(1), 20–47.
- Davis, T. (1993). Effective supply chain management. *Sloan Management Review*, 35, 46.
- Dawson, J. (2004). Food retailing, wholesaling and catering. *Food supply chain management*, 116-35.
- De Boer, L., Labro, E., & Morlacchi, P. (2001). A review of methods supporting supplier selection. *European Journal of Purchasing & Supply Management*, 7(2), 75–89. doi:10.1016/S0969-7012(00)00028-9
- De Koster, R., Le-Duc, T., & Roodbergen, K. J. (2007). Design and control of warehouse order picking: A literature review. *European Journal of Operational Research*, 182(2), 481–501. doi:10.1016/j.ejor.2006.07.009
- de Oliveira Wilk, E., & Evaldo Fensterseifer, J. (2003). Use of resource-based view in industrial cluster strategic analysis. *International Journal of Operations & Production Management*, 23(9), 995–1009. doi:10.1108/01443570310491747
- Dedrick, J., Xu, S. X., & Zhu, K. X. (2008). How Does Information Technology Shape Supply-Chain Structure? Evidence on the Number of Suppliers. *Journal of Management Information Systems*, 25(2), 41–72. doi:10.2753/MIS0742-1222250203
- Defee, C. C., & Stank, T. P. (2005). Applying the strategy-structure-performance paradigm to the supply chain environment. *International Journal of Logistics Management*, 16(1), 28–50. doi:10.1108/09574090510617349
- Defee, C. C., Stank, T. P., Esper, T. L., & Mentzer, J. T. (2009). The role of followers in supply chains. *Journal of Business Logistics*, 30(2), 65–84. doi:10.1002/j.2158-1592.2009.tb00112.x
- DeGroot, S. E., & Marx, T. G. (2013). The impact of IT on supply chain agility and firm performance: An empirical investigation. *International Journal of Information Management*, 33(6), 909–916. doi:10.1016/j.ijinfomgt.2013.09.001
- Delen, D., Hardgrade, B. C., & Sharda, R. (2007). RFID for Better Supply-Chain Management through Enhanced Information Visibility. *Production and Operations Management*, 16(5), 613–624. doi:10.1111/j.1937-5956.2007.tb00284.x
- Deloitte (2013). *Executive summary, formula for growth: Innovation – big data & analytics*. Retrieved from http://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-da-executivesummary_gma_big_data_041913.pdf

Compilation of References

- Deloitte (2014). 2014 outlook on retail. Retrieved from http://www.deloitte.com/view/en_US/us/Industries/29ec5a5bd-c5ea310VgnVCM2000003356f70aRCRD.htm
- Deloitte (2014). *Global powers of retailing - Retail beyond begins*. Retrieved from <http://www2.deloitte.com/content/dam/Deloitte/global/Documents/Consumer-Business/dttl-CB-GPR14STORES.pdf>
- Deloitte (2014). *The new digital divide*. Retrieved from <http://www2.deloitte.com/content/dam/Deloitte/us/Documents/consumer-business/us-rd-thenewdigitaldivide-041814.pdf>
- Demarest, M. (1997). Understanding knowledge management. *Long Range Planning*, 30(3), 374–384. doi:10.1016/S0024-6301(97)90250-8
- Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods* (2nd ed.). New York: McGraw-Hill.
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (1998). *Strategies of qualitative inquiry*. London: Sage Publications.
- Deshpande, R. (1983). Paradigms lost: On theory method in research in marketing. *Journal of Marketing*, 47(4), 101–110. doi:10.2307/1251403
- Deterding, S., & Dixon, D. (2011). From Game Design Elements to Gamefulness : Defining Gamification. *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). doi:10.1145/2181037.2181040
- Devaraj, S., Krajewski, L., & Wei, J. (2007). Impact of ebusiness technologies on operational performance: The role of production information integration in the supply chain. *Journal of Operations Management*, 25(6), 1199–1216. doi:10.1016/j.jom.2007.01.002
- Dhar, S. K., Hoch, S. J., & Kumar, N. (2001). Effective category management depends on the role of the category. *Journal of Retailing*, 77(2), 165–184. doi:10.1016/S0022-4359(01)00045-8
- Dias, C. (2001). Corporate portals: A literature review of a new concept in Information Management. *International Journal of Information Management*, 21(4), 269–287. doi:10.1016/S0268-4012(01)00021-4
- DIGBR. (2014, July 15). Incubating Perfection, Dig Baton Rouge. Retrieved from <http://digbatonrouge.com/incubating-perfection-lsu-ag-center-incubator>
- Dinh, H. T., Lee, C., Niyato, D., & Wang, P. (2011). A survey of mobile cloud computing: Architecture, applications, and approaches. *Wireless Communications and Mobile Computing*, 1587-1611.
- Dischinger, J. S., Karwatowski, C. D., & Raina, A. (2012). Supplier Connection: A supply-chain ecosystem for small business job growth. *IBM Journal of Research and Development*, 56(6), 11–1. doi:10.1147/JRD.2012.2218071
- Disney, S. M., & Towill, D. R. (2003). The effect of vendor managed inventory (VMI) dynamics on the bullwhip effect in supply chains. *International Journal of Production Economics*, 85(2), 199–215. doi:10.1016/S0925-5273(03)00110-5
- Dittmann, J.P. (2012). *Supply chain transformation: Building and executing an integrated supply chain strategy*. New York: McGraw-Hill Professional.
- Dixon, P., & Gorecki, J. (2010). *Sustainability: How Smart Innovation and Agile Companies will Help Protect our Future*. London: Kogan Page.
- Dodds, R., & Venables, R. (2005). *Engineering for Sustainable Development: Guiding Principles*. London: The Royal Academy of Engineering.

Compilation of References

- Doney, P. M., Cannon, J. P., & Mullen, M. R. (1998). Understanding the influence of national culture on the development of trust. *Academy of Management Review*, 23(4), 601–620.
- Donlon, J. P. (1996). Maximizing value in the supply chain. *Chief Executive*, 117, 54–63.
- Doring, S., Fischer, S., Kiessling, W., & Preisinger, T. (2005, April). Optimizing the catalog search process for e-procurement platforms. *Proceedings of Data Engineering Issues in E-Commerce 2005 International Workshop* (pp. 39-48). IEEE. doi:10.1109/DEEC.2005.15
- Douglas, S., & Craig, C. (1989). The evolution of global marketing strategy: Scale scope and synergy. *The Columbia Journal of World Business*, 1(Fall), 47–58.
- Drucker, P. E. (1995). The information executives truly need. *Harvard Business Review*, January-February, 54–62.
- Drucker, P. F. (1954). *The practice of management*. New York: Harper & Row Publishers, Inc.
- Drucker, P. F. (2000). Management Challenges for the 21st Century. *International Journal of Contemporary Hospitality Management*, 12(6), 238–247.
- Duclos, L. K., Vokurka, R. J., & Lummus, R. R. (2003). A conceptual model of supply chain flexibility. *Industrial Management & Data Systems*, 103(6), 446–456. doi:10.1108/02635570310480015
- Duffy, R., & Fearn, A. (2004). Partnerships and alliances in UK supermarket supply networks. *Food supply chain management*, 136-52.
- Duhon, B. (1998, September). It's all in our Heads. *Inform (Silver Spring, Md.)*, 12(8), 8–13.
- Du, L. (2007). Acquiring competitive advantage in industry through supply chain integration: A case study of Yue Yuen Industrial Holdings Ltd. *Journal of Enterprise Information Management*, 20(5), 527–543. doi:10.1108/17410390710823680
- Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, 19(1), 1–31. doi:10.1057/palgrave.jibs.8490372
- DuPont. (2014). DuPont Green Living Survey: India 2014; Consumer Awareness and Adoption of Biobased Products. Retrieved from <http://www.dupont.co.in/corporate-functions/media/press-releases/Green-living-india-press-release.html>
- Duriscic, D., Staron, M., Tichy, M., & Hansson, J. (2014). *Evolution of Long-Term Industrial Meta-Models--An Automotive Case Study of AUTOSAR*. Proceedings of IEEE 40th Conference on Software Engineering and Advanced Applications (SEAA).
- Duriscic, D., Nilsson, M., Staron, M., & Hansson, J. (2013). Measuring the impact of changes to the complexity and coupling properties of automotive software systems. *Journal of Systems and Software*, 86(5), 1275–1293. doi:10.1016/j.jss.2012.12.021
- Durugbo, C., Tiwari, A., & Alcock, J. R. (2013). Modelling information flow for organizations: A review of approaches and future challenges. *International Journal of Information Management*, 33(3), 597–610. doi:10.1016/j.ijinfomgt.2013.01.009
- Dussart, C. (1998). Category management: Strengths, limits and developments. *European Management Journal*, 16(1), 50–62. doi:10.1016/S0263-2373(97)00073-X
- Dwyer, F. R., Schurr, P. H., & Oh, S. (1987). Developing buyer-seller relationships. *Journal of Marketing*, 51(2), 11–27. doi:10.2307/1251126
- Dyché, J., & Levy, E. (2011). *Customer data integration: Reaching a single version of the truth* (Vol. 7). New York: John Wiley & Sons.

Compilation of References

- Dye, R., & Stephenson, E. (2010, May). *Five forces reshaping the global economy: McKinsey Global Survey results*. McKinsey & Company. Retrieved from http://www.mckinsey.com/insights/globalization/five_forces_reshaping_the_global_economy_mckinsey_global_survey_results
- Dyer, J. H. (1996). Specialized supplier networks as a source of competitive advantage: Evidence from the auto industry. *Strategic Management Journal*, 17(4), 271–291. doi:10.1002/(SICI)1097-0266(199604)17:4<271::AID-SMJ807>3.0.CO;2-Y
- Dyer, J. H. (1997). Effective Interfirm collaboration: How firms minimize Transaction Cost and maximize transaction value. *Strategic Management Journal*, 18(7), 535–556. doi:10.1002/(SICI)1097-0266(199708)18:7<535::AID-SMJ885>3.0.CO;2-Z
- Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge sharing network: The Toyota case. *Strategic Management Journal*, 21(1), 345–367. doi:10.1002/(SICI)1097-0266(200003)21:3<345::AID-SMJ96>3.0.CO;2-N
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and source of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- Dyer, J. H., & Singh, H. (1998). The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage. *Academy of Management Review*, 23(4), 660–679.
- Dyer, J., & Singh, H. (1998). The Relational View: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23(4), 660–679.
- Easterby-Smith, M., Thorpe, R., & Lowe, A. (1991). *Management research: An introduction*. London: Sage Publications.
- Ebert, C., & De Neve, P. (2001). Surviving global software development. *Software, IEEE*, 18(2), 62–69. doi:10.1109/52.914748
- Edward J. Bloustein School of Planning and Public Policy. (2012). Community Food Hubs. Retrieved from <http://rwv.rutgers.edu/wp-content/uploads/2013/07/FoodHubFinalReport.pdf>
- Egan, J. (1998). *Rethinking construction. The Report of the Construction Industry Task Force*. London: DETR.
- Ehrgott, M., Reinmann, F., Kaufmann, L., & Carter, C. R. (2013). Environmental development of emerging economy suppliers: Antecedents and outcomes. *Journal of Business Logistics*, 34(2), 131–147. doi:10.1111/jbl.12015
- Eisenhardt, K. M. (1985). Control: Organizational and economic approaches. *Management Science*, 31(2), 134–149. doi:10.1287/mnsc.31.2.134
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eisenhardt, K. M. (1989). Building theory from case study research. *Academy of Management Review*, 14(4), 532–550.
- Eisenhardt, K. M. (1989a). Agency Theory: An Assessment and Review. *Academy of Management Review*, 14(1), 57–74.
- Eklund, U., & Bosch, J. (2012). Applying agile development in mass-produced embedded systems. *Agile Processes in Software Engineering and Extreme Programming* (pp. 31-46). New York: Springer.
- Eklund, U., Jonsson, N., Eriksson, A., & Bosch, J. (2012). *A reference architecture template for software-intensive embedded systems. Proceedings of the WICSA/ECSA 2012 Companion*. ACM. doi:10.1145/2361999.2362022
- El-Ansary, A. I., & Stern, L. W. (1972). Power measurement in the distribution channel. *JMR, Journal of Marketing Research*, 9(1), 47–52. doi:10.2307/3149605

Compilation of References

- Elbashir, M. Z., Collier, P. A., & Davern, M. J. (2008). Measuring the effects of business intelligence systems: The relationship between business process and organizational performance. *International Journal of Accounting Information Systems*, 9(3), 135–153. doi:10.1016/j.accinf.2008.03.001
- Eliashberg, J., & Michie, D. A. (1984). Interorganizational competitive advantage. *Academy of Management Review*, 23(4).
- Ellinger, A. E., Ellinger, A. D., & Keller, S. B. (2002). Logistics managers' learning environments and firm performance. *Journal of Business Logistics*, 23(1), 19–37. doi:10.1002/j.2158-1592.2002.tb00014.x
- Ellram, L. M. (1991). Supply-Chain Management: The Industrial Organisation Perspective. *International Journal of Physical Distribution & Logistics Management*, 21(1), 13–22. doi:10.1108/09600039110137082
- Ellram, L. M., & Carr, A. (1994). Strategic purchasing: A history and review of the literature. *International Journal of Purchasing and Materials Management*, 30(2), 10–18.
- Ellram, L. M., & Cooper, M. C. (1990). Supply chain management, partnership, and the shipper-third party relationship. *The International Journal of Logistics Management*, 1(2), 1–10. doi:10.1108/95740939080001276
- Ellram, L. M., & Cooper, M. C. (2014). Supply chain management: It's all about the journey, not the destination. *Journal of Supply Chain Management*, 50(1), 8–20. doi:10.1111/jscm.12043
- Ellram, L. M., & Hendrick, T. E. (1995). Partnering characteristics: A dyadic perspective. *Journal of Business Logistics*, 16(1), 41–64.
- Ellram, L. M., & Krause, D. R. (1994). Supplier partnership in manufacturing versus non-manufacturing firms. *The International Journal Management*, 5(1), 43–54.
- Emberson, C., & Storey, J. (2006). Buyer-supplier collaborative relationships: Beyond the normative accounts. *Journal of Purchasing and Supply Management*, 12(5), 236–245. doi:10.1016/j.pursup.2006.10.008
- Emerson, R. M. (1962). Power-Dependence Relations. *American Sociological Review*, 27(1), 31–41. doi:10.2307/2089716
- Emmett, S., & Sood, V. (2010). *Green Supply Chains: An Action Manifesto*. London: Wiley.
- Enkvist, P., Naucler, T., & Rosander, J. (2007). A Cost Curve for Greenhouse Gas Reduction. *The McKinsey Quarterly*, (1): 34–45.
- Environmental Performance Index (EPI). (2014). Retrieved from <http://www.epi.yale.edu/epi>
- Eppen, G. D. (1979). Effects of Centralization on Expected Costs in A Multi-Location Newsboy Problem. *Management Science*, 25(5), 498–501. doi:10.1287/mnsc.25.5.498
- Eriksson, P. E. (2010). Partnering: What is it, when should be used, and how should it be implemented? *Construction Management and Economics*, 28(9), 905–917. doi:10.1080/01446190903536422
- Ernst and Young (2013). Review of petroleum wholesalers and retailers margins.
- Esper, T. L., Defee, C. C., & Mentzer, J. T. (2010). A framework of supply chain orientation. *International Journal of Logistics Management*, 21(2), 161–179. doi:10.1108/09574091011071906
- Evers, P. T. (1995). Expanding the Square Root Law: An Analysis of Both Safety and Cycle Stocks. *Logistics and Transportation Review*, 31(1), 1–20.
- Evers, P. T. (1998). Operational Aspects of Inventory Consolidation Making. *Journal of Business Logistics*, 19(1), 173–189.

Compilation of References

- Evers, P. T., & Beier, F. J. (1993). The Portfolio Effect and Multiple Consolidation Points: A Critical Assessment of the Square Root Law. *Journal of Business Logistics*, 14(2), 109–125.
- Faisal, M. N., Banwet, D. K., & Shankar, R. (2007). Quantification of risk mitigation environment of supply chains using graph theory and matrix methods. *European Journal of Industrial Engineering*, 1(1), 22–39. doi:10.1504/EJIE.2007.012652
- Fan, C., Olorunniwo, F. O., Jolayem, J., & Li, X. (2013). A characterization of lower-tier supplier visibility practices in supplier relationship management. *Supply Chain Forum: An International Journal*, 14(1), 2-14.
- Fan, J. P. H., Huang, J., Morck, R., & Yeung, B. (2014). Institutional determinants of vertical integration in China. *Journal of Corporate Finance*. doi:10.1016/j.jcorpfin.2014.05.013
- Farahani, R. Z., Rezapour, S., Drezner, T., & Fallah, S. (2014). Competitive supply chain network design: An overview of classifications, models, solution techniques and applications. *Omega: The International Journal of Management Science*, 45, 92–118. doi:10.1016/j.omega.2013.08.006
- Farughi, H., Azar, S., Sadeghi, H., Naseri, H., & Hajebi, S. (2011). Using multi criteria decision making models to evaluate suppliers in outsourcing process of supply chain management. *Australian Journal of Basic and Applied Sciences*, 5(12), 1999–2009.
- Farzin, M. R., Kahreh, M. S., Hesan, M., & Khalouei, A. (2014). A Survey of Critical Success Factors for Strategic Knowledge Management Implementation: Applications for Service Sector. *Procedia: Social and Behavioral Sciences*, 109, 595–599. doi:10.1016/j.sbspro.2013.12.512
- Fawcett, S. E., Allred, C., Magnan, G. M., & Ogden, J. (2009). Benchmarking the viability of SCM for entrepreneurial business model design. *Benchmarking: An International Journal*, 16(1), 5–29. doi:10.1108/14635770910936496
- Fawcett, S. E., & Magnan, G. M. (2002). The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution & Logistics Management*, 32(5), 339–361. doi:10.1108/09600030210436222
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008). Benefits, barriers, and bridges to effective supply chain management. *Supply Chain Management: An International Journal*, 13(1), 35–48. doi:10.1108/13598540810850300
- Fawcett, S. E., Magnan, G. M., & McCarter, M. W. (2008b). A three-stage implementation model for supply chain collaboration. *Journal of Business Logistics*, 29(1), 93–112. doi:10.1002/j.2158-1592.2008.tb00070.x
- Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. (2007). Information Sharing and Supply Chain Performance: The Role of Connectivity and Willingness. *Supply Chain Management: an International Journal*, 12(5), 358–368. doi:10.1108/13598540710776935
- Fayezi, S., Zutshi, A., & O'Loughlin, A. (2010, December). *Collaboration and risk mitigation capability in supply chains: A conceptual framework*. Paper presented at the 24th Australian and New Zealand Academy of Management, Adelaide, Australia. Retrieved from <http://dro.deakin.edu.au/view/DU:30032189>
- Federal Office for Spatial Development ARE. (2004). *Sustainability assessment Conceptual framework and basic methodology* (pp. 1–67). Retrieved from <http://www.are.ch>
- Feldt, R., Staron, M., & Hult, E. Hult, & Liljegren, T. (2013). Supporting Software Decision Meetings: Heatmaps for Visualising Test and Code Measurements. *Proceedings of the 39th Euromicro conference on Software Engineering and Advanced Applications*, Santander, Spain (pp. 62-69). IEEE. doi:10.1109/SEAA.2013.61
- Felea, M., & Albastroiu, I. (2013). Managing supply chain risks. *Supply Chain Management Journal*, 4(2), 1–11.

Compilation of References

- Fenton, N. E., & Pfleeger, S. E. (1996). *Software metrics: a rigorous and practical approach*. London: International Thomson Computer Press.
- Fenwick, T. J., & Parsons, J. (2000). *The Art of Evaluation: A Handbook for Educators and Trainers*. Niagara Falls, NY, USA: Thompson Educational Publishers.
- Ferdows, K., Lewis, M. A., & Machuca, J. A. (2004). Rapid-fire fulfillment. *Harvard Business Review*, 82(11), 104–117.
- Ferguson, Y. (2014, March 7). The history and dynamics of globalization. *Diplomacy and Statecraft*, 25(1), 135–155. doi:10.1080/09592296.2014.873615
- Fernie, J. (1994). Quick response: An international perspective. *International Journal of Physical Distribution & Logistics Management*, 24(6), 38–46. doi:10.1108/09600039410066178
- Fernie, J., & Sparks, L. (2004). *Logistics and retail management: Insights into current practice and trends from leading experts*. London: Kogan Page.
- Fernie, J., Sparks, L., & McKinnon, A. C. (2010). Retail logistics in the UK: Past, present and future. *International Journal of Retail & Distribution Management*, 38(11/12), 894–914. doi:10.1108/09590551011085975
- Ferrali, R. (2012). The Maghribi industrialists: Contract enforcement in the Moroccan industry 1956-1982. Working Papers No.162/12, Department of Economic History, London School of Economics.
- Fiksel, J. (2010). Evaluating Supply Chain Sustainability. *Chemical Engineering Progress*, 106(5), 28–36.
- Filipe Lages, L., & Montgomery, D. B. (2004). Export performance as an antecedent of export commitment and marketing strategy adaptation: Evidence from small and medium-sized exporters. *European Journal of Marketing*, 38(9/10), 1186–1214. doi:10.1108/03090560410548933
- Fillis, I. (2001). Small firm internationalisation: An investigative survey and future research directions. *Management Decision*, 39(9), 767–783. doi:10.1108/00251740110408683
- Fisher, M. L. (1997). What is the right supply chain for your product? *Harvard Business Review*, March–April, 105–116.
- Fisher, M. L. (1997, March–April). What is the right supply chain for your product. *Harvard Business Review*, 75(2), ●●●.
- Fisher, T. (2009). *The data asset: how smart companies govern their data for business success* (Vol. 24). New York: John Wiley & Sons.
- Fitzgerald, G., & Willcocks, L. (1994, December 9). Contract and partnerships in the outsourcing of IT. *Proceedings of the Fifteenth International Conference on Information Systems*, Vancouver, British Columbia (pp. 1-98).
- Fleisher, C. S. (1991). Using an agency-based approach to analyze collaborative federated interorganizational relationships. *The Journal of Applied Behavioral Science*, 27(1), 116–130. doi:10.1177/0021886391271006
- Flint, D. J., Blocker, C. P., & Boutin, P. J. Jr. (2011). Customer value anticipation, customer satisfaction and loyalty: An empirical examination. *Industrial Marketing Management*, 40(2), 219–230. doi:10.1016/j.indmarman.2010.06.034
- Flynn, B. B., Sakakibara, S., Schroeder, R. G., Bates, K. A., & Flynn, E. J. (1990). Empirical research methods in operations management. *Journal of Operations Management*, 9(2), 250–284. doi:10.1016/0272-6963(90)90098-X
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219–245. doi:10.1177/1077800405284363
- Ford, I. D. (1982). The development of buyer-seller relationships in industrial markets. In H. Håkansson (Ed.), *International Marketing and Purchasing of Industrial Goods: An Interaction Approach* (pp. 288–304). New York: John Wiley.

Compilation of References

- Forrester, J. W. (1961). *Industrial dynamics*. Cambridge, MA: MIT Press.
- Forsgren, M. (2002). The concept of learning in the Uppsala internationalisation process model: A critical review. *International Business Review*, 11(3), 257–277. doi:10.1016/S0969-5931(01)00060-9
- Forslund, H. (2006). Performance gaps in the dyadic order fulfillment process. *International Journal of Physical Distribution & Logistics Management*, 36(8), 580–595. doi:10.1108/09600030610702871
- Forsman, S. (2008). How do small rural food-processing firms compete? A resource-based approach to competitive strategies. *Agricultural and food science*, 13(Supplement), 129.
- Fox, M. S., Barbuceanu, M., & Teigen, R. (2000). Agent-Oriented Supply-Chain Management. *International Journal of Flexible Manufacturing Systems*, 12(2-3), 165–188. doi:10.1023/A:1008195614074
- Frazelle, E. (2001). *Supply chain strategy: the logistics of supply chain management*. New York: McGraw-Hill Professional.
- Frederico, G. F., & Martins, R. A. (2014). Performance measurement systems for supply chain management: How to manage its maturity. *International Journal of Supply Chain Management*, 3(2), 24–30.
- Friedman, G. (2011). *The Next Decade: Where We've Been...And Where We're Going*. New York: Doubleday.
- Frohlich, M., & Westbrook, R. (2001). Arcs of integration: An international study of supply chain strategies. *Journal of Operations Management*, 19(2), 185–200. doi:10.1016/S0272-6963(00)00055-3
- Fu, D., Ionescu, C. M., Aghezzaf, E. H., & De Keyser, R. (2014). Decentralized and centralized model predictive control to reduce the bullwhip effect in supply chain management. *Computers & Industrial Engineering*, 73, 21–31. doi:10.1016/j.cie.2014.04.003
- Führer, C., & Michel, J. (2004). An Empirical Study of Firm Size and Competitiveness in German Life Insurance. *Zeitschrift für die gesamte Versicherungswissenschaft*, 93(2), 251-267. doi:10.1007/BF03191410
- Fynes, B., De Búrca, S., & Marshall, D. (2004). Environmental uncertainty, supply chain relationship quality and performance. *Journal of Purchasing and Supply Management*, 10(4-5), 179–190. doi:10.1016/j.pursup.2004.11.003
- Gadde, L. E., & Dubois, A. (2010). Partnering in the construction industry: Problems and opportunities. *Journal of Purchasing and Supply Management*, 16(4), 254–263. doi:10.1016/j.pursup.2010.09.002
- Gadde, L.-E., & Håkansson, H. (2001). *Supply network strategies*. Chichester, UK: Wiley.
- Gajdzik, B., & Grzybowska, K. (2012). Example Models of Building Trust in Supply Chains of Metallurgical Enterprises. *Metalurgija*, 51(4), 563–566.
- Ganesan, S., George, M., Jap, S., Palmatier, R. W., & Weitz, B. (2009). Supply chain management and retailer performance: Emerging trends, issues, and implications for research and practice. *Journal of Retailing*, 85(1), 84–94. doi:10.1016/j.jretai.2008.12.001
- Ganguly, A., Nilchiani, R., & Farr, J. V. (2009). Evaluating agility in corporate enterprises. *International Journal of Production Economics*, 118(2), 410–423. doi:10.1016/j.ijpe.2008.12.009
- Gartner Inc. (2014, May 12). Gartner Says Worldwide Supply Chain Management and Procurement Software Market Grew 7.3 Percent in 2013. *Gartner*. Stamford, CN. Retrieved from <http://www.gartner.com/newsroom/id/2735618>
- Gaukler, G. M., Seifert, R. W., & Hausman, W. H. (2007). Item-Level RFID in the retail supply chain. *Production and Operations Management*, 16(1), 65–76. doi:10.1111/j.1937-5956.2007.tb00166.x

Compilation of References

- Gavetti, G., & Levinthal, D. (2000). Looking forward and looking backward: Cognitive and experiential search. *Administrative Science Quarterly*, 45(1), 113–137. doi:10.2307/2666981
- Geere, D. (2010). Health Month is a self-improvement RPG. Wired UK. Retrieved from <http://www.wired.co.uk/news/archive/2010-09/07/health-month-rpg>
- Gelderman, C. J. (2003). *A portfolio approach to the development of differentiated purchasing strategies* [Doctoral dissertation]. Eindhoven University of Technology.
- Gelderman, C. J., & Van Weele, A. J. (2005). Purchasing portfolio models: A critique and update. *The Journal of Supply Chain Management*, 41(3), 19–28. doi:10.1111/j.1055-6001.2005.04103003.x
- Gençtürk, E., & Kotabe, M. (2001). The effect of export assistance program usage on export performance: A contingency explanation. *Journal of International Marketing*, 9(2), 51–72. doi:10.1509/jimk.9.2.51.19886
- George, M., Kumar, V., & Grewal, D. (2013). Maximizing profits for a multi-category catalog retailer. *Journal of Retailing*, 89(4), 374–396. doi:10.1016/j.jretai.2013.05.001
- Gereffi, G. (2005). The Global Economy: Organization, Governance, and Development. In N.J. Smelser, & R. Swedberg (Eds.), *The Handbook of Economic Sociology* (2nd ed., pp. 160-182). Princeton and Oxford: Princeton University Press; New York: Russell Sage Foundation.
- Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of Political Economy*, 128(1), 78-104.
- Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy*, 12(1), 78–104. doi:10.1080/09692290500049805
- Gergen, K. (1999). *An Invitation to social construction*. London: SAGE Publications.
- Geringer, J. M. (1991). Strategic determinants of partner selection criteria in international joint ventures. *Journal of International Business Studies*, 22(1), 41–62. doi:10.1057/palgrave.jibs.8490291
- Geyskens, I., Steenkamp, J.-B. E. M., & Kumar, N. (2006). Make, buy, or ally: A transaction cost meta-analysis. *Academy of Management Journal*, 49(3), 519–543. doi:10.5465/AMJ.2006.21794670
- Ghadge, A., Dani, S., & Kalawsky, R. (2012). Supply chain risk management: Present and future scope. *International Journal of Logistics Management*, 23(3), 313–339. doi:10.1108/09574091211289200
- Gheidar Kheljani, J., Ghodsypour, S. H., & O'Brien, C. (2009). Optimizing whole supply chain benefit versus buyer's benefit through supplier selection. *International Journal of Production Economics*, 121(2), 482–493. doi:10.1016/j.ijpe.2007.04.009
- Ghobakhloo, M., Tang, S. H., Zulkifli, N., & Ariffin, M. K. A. (2013). An Integrated Framework of Green Supply Chain Management Implementation. *International Journal of Innovation, Management and Technology*, 4(1), 86.
- Giannakis, M., & Croom, S. R. (2004). Toward the Development of a Supply Chain Management Paradigm: A Conceptual Framework. *The Journal of Supply Chain Management*, 40(2), 27–37. doi:10.1111/j.1745-493X.2004.tb00167.x
- Gibbert, M., Ruigrok, W., & Wicki, B. (2008). What passes as a rigorous case study. *Strategic Management Journal*, 29(13), 1465–1474. doi:10.1002/smj.722
- Gibson, R. B. (2006). Sustainability assessment: Basic components of a practical approach. *Impact Assessment and Project Appraisal*, 24(3), 170–182. doi:10.3152/147154606781765147

Compilation of References

- Gielens, K., & Dekimpe, M.G. (2007). The entry strategy of retail firms into transition economies. *Journal of Marketing*, April(71), 196–212.
- Gimenez, C. (2004). Supply chain management implementation in the Spanish grocery sector: An exploratory study. *International Journal of Integrated Supply Management*, 1(1), 98–114. doi:10.1504/IJISM.2004.004600
- Gimenez, C., & Sierra, V. (2013). Sustainable Supply Chains: Governance Mechanisms to Greening Suppliers. *Journal of Business Ethics*, 116(1), 189–203. doi:10.1007/s10551-012-1458-4
- Giménez, C., & Ventura, E. (2003). Supply chain management as a competitive advance in the Spanish grocery sector. *International Journal of Logistics Management*, 14(1), 77–88. doi:10.1108/09574090310806558
- Giri, S., & Rai, S. S. (2013). Dynamics of garment supply chain. *International Journal of Managing Value and Supply Chains*, 4(4), 29–42. doi:10.5121/ijmvsc.2013.4403
- Giunipero, L. C., Hooker, R. E., & Denslow, D. (2012). Purchasing and supply management sustainability: Drivers and barriers. *Journal of Purchasing and Supply Management*, 18(4), 258–269. doi:10.1016/j.pursup.2012.06.003
- Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York: Aldine de Gruyter.
- Glavas, C., & Mathews, S. (2014). How international entrepreneurship characteristics influence Internet capabilities for the international business processes of the firm. *International Business Review*, 23(1), 228–245. doi:10.1016/j.ibusrev.2013.04.001
- Glavič, P., & Lukman, R. (2007). Review of sustainability terms and their definitions. *Journal of Cleaner Production*, 15(18), 1875–1885. doi:10.1016/j.jclepro.2006.12.006
- Global Reporting Initiative. (2002). *Sustainability reporting guidelines*. Boston, MA: Global Reporting Initiative.
- Godfray, H. C. J., & Garnett, T. (2014). Food security and sustainable intensification. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 369(1639), 20120273. doi:10.1098/rstb.2012.0273 PMID:24535385
- Goetschalckx, M., & Ashayeri, J. (1989). Classification and Design of Order Picking. *Logistics Information Management*, 2(2), 99–106.
- Goffin, K., Lemke, F., & Szejczewski, M. (2006). An exploratory study of ‘close’ supplier-manufacturer relationships. *Journal of Operations Management*, 24(2), 189–209. doi:10.1016/j.jom.2005.05.003
- Goffman, E. (1959). *The presentation of self in everyday life*. New York: Doubleday.
- Goh, A. (2006). A strategic management framework for leveraging knowledge innovation. *International Journal of the Computer the Internet and Management*, 14(3), 32–49.
- Goh, S. C. (2002). Managing effective knowledge transfer: An integrative framework and some practice implications. *Journal of Knowledge Management*, 6(1), 23–30. doi:10.1108/13673270210417664
- Gökay Emel, G., & Petriçli, G. (2013). An Approach for Determining Corporate Strategy Based Supplier Selection Criteria. *Proceedings of the XI Balkan Conference on Operational Research*. Belgrade & Zlatibor.
- Golda, J., & Philippi, C. (2007). Managing new technology risk in the supply chain. *Intel Technology Journal*, 11(2).
- Golini, R., & Kalchschmidt, M. (2011). Moderating the impact of global sourcing on inventories through supply chain management. *International Journal of Production Economics*, 133(1), 86–94. doi:10.1016/j.ijpe.2010.06.011

Compilation of References

- Golmohammadi, D., Creese, R., Valian, H., & Kolassa, J. (2009). Supplier Selection Based on a Neural Network Model Using Genetic Algorithm. *IEEE Transactions on Neural Networks*, 20(9), 1504–1519. doi:10.1109/TNN.2009.2027321 PMID:19695996
- Goodman, P., & Darr, E. (1999). Computer-aided systems and communities: Mechanisms for organisational learning in distributed environments. *Management Information Systems Quarterly*, 22(4), 417–440. doi:10.2307/249550
- Gosain, S., Malhotra, A., & Sawy, O. A. E. L. (2004). Coordinating for Flexibility in e-Business Supply Chains. *Journal of Management Information Systems*, 21(3), 7–45.
- Govil, M., & Proth, J. (2002). *Supply chain design and management: strategic and tactical perspectives*. San Diego, CA: Academic.
- Graham, G., & Hardaker, G. (2000). Supply-chain management across the Internet. *International Journal of Physical Distribution & Logistics Management*, 30(3/4), 286–295. doi:10.1108/09600030010326055
- Grandori, A., & Furlotti, M. (2010, June 17-19). Flexible formalization: a study on the components of contractual and extra formal organization. Proceedings of the 14th Annual Conference of the International Society for New Institutional Economics at the University of Stirling, Scotland, UK.
- Granoveter, M. S. (1985). Economic action and social structure: The problem of embeddedness. *Journal of Sociology (Melbourne, Vic.)*, 91, 481–510.
- Granovetter, M. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91(3), 481–510. doi:10.1086/228311
- Grant, R. M. (1991). The Resource-based Theory of Competitive Advantage: Implications for Strategy Formulation. *California Management Review*, 33(3), 114–135. doi:10.2307/41166664
- Grant, R. M. (1996). Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17(S2), 109–122. doi:10.1002/smj.4250171110
- Grant, R. M., & Baden-Fuller, C. (2004). A knowledge-accessing theory of strategic alliances. *Journal of Management Studies*, 41(1), 61–84. doi:10.1111/j.1467-6486.2004.00421.x
- Graves, S. C., & Willems, S. P. (2005, August). Optimizing the supply chain configuration for new products. *Management Science*, 51(8), 1165–1180. doi:10.1287/mnsc.1050.0367
- Greater Baton Rouge Business Report. (2014). LSU incubator helps entrepreneurs bring new culinary products to store shelves. Retrieved from <http://www.businessreport.com/article/business-report-lsu-incubator-helps-entrepreneurs-bring-new-culinary-products-to-store-shelves>
- Green, G. P., & Phillips, R. G. (Eds.). (2014). *Local Food and Community Development*. Routledge.
- Green, K. W. Jr, Zelbst, P. J., Meacham, J., & Bhadauria, V. S. (2012). Green Supply Chain Management Practices: Impact on Performance. *Supply Chain Management*, 17(3), 290–305. doi:10.1108/13598541211227126
- Greeno, J. G., Pearson, P. D., & Schoenfeld, A. H. (1999). Achievement and theories of knowing and learning. *Learning and Knowledge*, 136-53.
- Grewal, D., & Levy, M. (2007). Retailing research: Past, present and future. *Journal of Retailing*, 83(4), 447–464. doi:10.1016/j.jretai.2007.09.003
- Grewal, D., & Levy, M. (2009). Emerging issues in retailing research. *Journal of Retailing*, 85(4), 522–526. doi:10.1016/j.jretai.2009.09.007

Compilation of References

- Griffith, D.A., Myers, M.B., & Harvey, M.G. (2006). An investigation of national culture's influence on relationship and knowledge resources in interorganisational relationships between Japan and US. *Journal of International Marketing*, 14(3).
- Grosse, C. U. (2002). Managing communication within virtual intercultural teams. *Business Communication Quarterly*, 65(4), 22–38. doi:10.1177/108056990206500404
- Grover, V., Cheon, M. J., & Teng, J. T. C. (1996). The effect of service quality and partnership on the outsourcing of information systems functions. *Journal of Management Information Systems*, 12(4), 89–116.
- Grover, V., & Malhotra, M. K. (2003). Transaction cost framework in operations and supply chain management research: Theory and measurement. *Journal of Operations Management*, 21(4), 457–473. doi:10.1016/S0272-6963(03)00040-8
- Gruen, T. W., & Shah, R. H. (2000). Determinants and outcomes of plan objectivity and implementation in category management relationships. *Journal of Retailing*, 76(4), 483–510. doi:10.1016/S0022-4359(00)00041-5
- GSS. (2014). *Ghana economic performance*. Accra- Ghana: Ghana Statistical Services Retrieved on September 4, 2014, from: <http://statsghana.gov.gh/>
- Guang Shi, V., Lenny Koh, S. C., Baldwin, J., & Cucchiella, F. (2012). Natural Resource-based Green Supply Chain Management. *Supply Chain Management*, 17(1), 54–67. doi:10.1108/13598541211212203
- Gudehus, T. (2010). *Logistik*. Berlin, Germany: Springer. doi:10.1007/978-3-540-89389-9
- Guide, V. Jr, & Van Wassenhove, L. N. (2009). The Evolution of Closed-Loop Supply Chain Research. *Operations Research*, 57(1), 10–18. doi:10.1287/opre.1080.0628
- Gulati, R. (1995). Does familiarity breed trust? The implications of repeated ties for contractual choice in alliances. *Academy of Management Journal*, 38(1), 85–112. doi:10.2307/256729
- Gulati, R., & Singh, H. (1998). The architecture of cooperation: Managing coordination costs and appropriation concerns in strategic alliances. *Administrative Science Quarterly*, 43(4), 781–814. doi:10.2307/2393616
- Gummesson, E. (2000). *Qualitative methods in management reserach*. London: Sage Publications.
- Gunasekaran, A., & Ngai, E. W. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), 269–295. doi:10.1016/j.ejor.2003.08.016
- Gunasekaran, A., Patel, C., & McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, 87(3), 333–347. doi:10.1016/j.ijpe.2003.08.003
- Gunasekaran, A., Patel, C., & Tirtiroglu, E. (2001). Performance measures and metrics in a supply chain environment. *International Journal of Operations & Production Management*, 21(1/2), 71–87. doi:10.1108/01443570110358468
- Gunasekaran, A., & Yusuf, Y. Y. (2002). Agile manufacturing: A taxonomy of strategic and technological imperatives. *International Journal of Production Research*, 40(6), 1357–1385. doi:10.1080/00207540110118370
- Günthner, W. A., & Rammelmeier, T. (2012). Vermeidung von Kommissionierfehlern mit Pick-by-Vision. *Forschungsbericht AiF-Vorhaben*, 16398.
- Günthner, W. A., Blomeyer, N., Reif, R., & Schedlbauer, M. (2009). *Pick-by-Vision: Augmented Reality unterstützte Kommissionierung*. Munich, Germany: TUM.
- Günthner, W. A., & Walch, D. (2010). Nachhaltige Ergonomie für die Logistik. *Logistik für Unternehmen*, 24(3/4), 44–47.
- Gupta, V. K. (2006). *Firm Strategy and Knowledge Management in Strategic Supply Chain Relationships: A Knowledge-Based View* [Dissertation]. University of Missouri-Columbia.

Compilation of References

- Gupta, N. (2011). Globalization does lead to change in consumer behavior. *Asia Pacific Journal of Marketing and Logistics*, 23(3), 251–269. doi:10.1108/13555851111143204
- Gurnani, H., Gümüş, M., Ray, S., & Ray, T. (2012). Optimal procurement strategy under supply risk. *Asia Pacific Journal of Operational Research*, 29(1), 1–31. doi:10.1142/S0217595912400064
- Gustafson, K. (2014). What Nordstrom can learn from Target's Canadian experiment. Retrieved from <http://www.cnb.com/id/101481503>
- Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). *Global food losses and food waste: Extent, causes and prevention*. Retrieved from www.fao.org/docrep/014/mb060e/mb060e.pdf
- Gutierrez, R. M. V., & Leal, C. F. C. (2004). Estratégias para uma Indústria de Circuitos Integrados no Brasil. *BNDES Setorial*, 19, 3-22.
- Gutierrez, R. M. V., & Mendes, L. R. (2009) Complexo Eletrônico: Projeto em Microeletrônica no Brasil. *BNDES Setorial*, 30, 157-209.
- Haans, H., & Gijbrecchts, E. (2011). One-deal-fits-all? On category sales promotion effectiveness in smaller versus larger supermarkets. *Journal of Retailing*, 87(4), 427–443. doi:10.1016/j.jretai.2011.05.001
- Hagekhalil, A. (2012). Adel Hagekhalil on Significance of South LA's Wetlands Park. *The Planning Report*. Retrieved from <http://www.planningreport.com/2012/02/26/adel-hagekhalil-significance-south-la-s-wetlands-park>
- Håkansson, H. (1982). *International Marketing and Purchasing of Industrial Goods*. Chichester, UK: Wiley.
- Håkansson, H. (1987). *Industrial technological development: A network approach*. London: Croom Helm.
- Haksöz, Ç. (2013). *Risk Intelligent Supply Chains: How Leading Turkish Companies Thrive in the Age of Fragility*. London and New York: CRC Press.
- Halldorsson, A., Kotzab, H., Mikkola, J. H., & Skjøtt-Larsen, T. (2007). Complementary theories to supply chain management. *Supply Chain Management: An International Journal*, 12(4), 284–296. doi:10.1108/13598540710759808
- Halldórsson, Á., Larson, P. D., & Poist, R. F. (2008). Supply chain management: A comparison of Scandinavian and American perspectives. *International Journal of Physical Distribution & Logistics Management*, 38(2), 126–142. doi:10.1108/09600030810861206
- Halldórsson, Á., & Skjøtt-Larsen, T. (2006). Dynamics of relationship governance in TPL arrangements: A dyadic perspective. *International Journal of Physical Distribution & Logistics Management*, 36(7), 490–506. doi:10.1108/09600030610684944
- Hall, E. T. (1976). *Beyond culture*. Garden City, NY: Anchor Press/Doubleday.
- Hammer, M. (1996). *Beyond Reengineer*. Harper Business.
- Hampson, K. D., & Kwok, T. (1997). Strategic alliances in building construction: A tender evaluation tool for the public sector. *Journal of Construction Procurement*, 3(1), 28–41.
- Handfield, R. B., & Nichols, E. L. (2002). *Supply chain redesign*. Upper Saddle River, NJ: Financial Times Prentice Hall.
- Handfield, R. B., & Bechtel, C. (2002). The role of trust and relationship structure in improving supply chain responsiveness. *Industrial Marketing Management*, 31(4), 367–382. doi:10.1016/S0019-8501(01)00169-9
- Handfield, R. B., Krause, D., Scannell, T., & Moczka, R. M. (2000). Avoid the pitfalls in supplier development. *Sloan Management Review*, 41(2), 37–49.

Compilation of References

- Handfield, R. B., & Nichols, E. L. (1999). *Introduction to supply chain management*. Upper Saddle River, NJ: Prentice–Hall.
- Handley, S. M., & Angst, C. M. (2015). The impact of culture on the relationship between governance and opportunism in outsourcing relationships. *Strategic Management Journal*, 36(9), 1412–1434. doi: 10.1002/smj.2300
- Handley, S. M., & Benton, W. C. Jr. (2012). The influence of exchange hazards and power on opportunism in outsourcing relationships. *Journal of Operations Management*, 30(1-2), 55–68. doi:10.1016/j.jom.2011.06.001
- Hansen, M. T., Nohria, N., & Tierney, T. (1999). What's your strategy for managing knowledge? *The Knowledge Management Yearbook 2000–2001*.
- Hansen, T., Wilke, R., & Zaichkowsky, J. (2010). Managing customer complaints: Differences and similarities among heterogeneous retailers. *International Journal of Retail & Distribution Management*, 38(1), 6–23. doi:10.1108/09590551011016304
- Hardt, L. (2006). Transaction cost economics as a three dimensional externally driven research program. *Studia Ekonomiczne*, 1(2), 7–31.
- Hardt, L. (2009). The history of transaction cost economics and its recent developments. *Erasmus Journal of Philosophy and Economics*, 2(1), 29–51.
- Harland, C. M., Lamming, R. C., Zheng, J., & Johnsen, T. E. (2001). A taxonomy of supply networks. *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, 37(4), 21–27.
- Harland, C. M. (1996). Supply chain management: Relationships, chains and networks. *British Journal of Management*, 7(1), 63–80. doi:10.1111/j.1467-8551.1996.tb00148.x
- Harland, C. M., Brenchley, R., & Walker, H. (2003). Risk in supply networks. *Journal of Purchasing and Supply Management*, 9(2), 51–62. doi:10.1016/S1478-4092(03)00004-9
- Harland, C. M., Lamming, R. C., & Cousins, P. D. (1999). Developing the concept of supply strategy. *International Journal of Operations & Production Management*, 19(7), 650–674. doi:10.1108/01443579910278910
- Harland, C., Zheng, J., Johnsen, T., & Lamming, R. (2004). A conceptual model for researching the creation and operation of supply networks. *British Journal of Management*, 15(1), 1–21. doi:10.1111/j.1467-8551.2004.t01-1-00397.x
- Harrigan, K. P. (1988). Joint ventures and competitive strategy. *Strategic Management Journal*, 9(2), 141–158. doi:10.1002/smj.4250090205
- Harrison & Hoek. (2011). *Logistics Management & Strategy* (4th ed.). New York: Prentice Hall.
- Harrison, J., Hitt, M., Hoskisson, R., & Ireland, R. (2001). Resource Complementarity in Business Combinations: Extending the Logic to Organizational Alliances. *Journal of Management*, 27(6), 679–690. doi:10.1177/014920630102700605
- Hart, (1988). Kinship, contract and trust: The economic organisation of migrants in an African city slum. In D. Gambeta (Ed.), *Trust: Making and Breaking Cooperative Relations* (pp. 176–193). Oxford: Blackwell.
- Hartmann, J., & Moeller, S. (2014). Chain liability in multitier supply chains? Responsibility attributions for unsustainable supplier behavior. *Journal of Operations Management*, 32(5), 281–294. doi:10.1016/j.jom.2014.01.005
- Hartmann, M. (2011). Corporate social responsibility in the food sector. *European Review of Agriculture Economics*, 38(3), 297–324. doi:10.1093/erae/jbr031
- Hartono, E., Li, X., Na, K. S., & Simpson, J. T. (2010). The role of the quality of shared information in inter-organizational systems use. *International Journal of Information Management*, 30(5), 399–407. doi:10.1016/j.ijinfomgt.2010.02.007

Compilation of References

- Harvard Business School. (1998). *Harvard business review on measuring corporate performance*. Boston: Harvard Business School Press.
- Harzing, A. W., Koster, K., & Magner, U. (2011). Babel in business: The language barrier and its solutions in the HQ-subsidiary relationship. *Journal of World Business, 46*(3), 279–287. doi:10.1016/j.jwb.2010.07.005
- Haseman, W. D., Nazareth, D. L., & Paul, S. (2005). Implementation of a group decision support system utilizing collective memory. *Information & Management, 42*(4), 591–605. doi:10.1016/S0378-7206(04)00074-6
- Hashiura, H., Matsuura, S., & Komiya, S. (2010). *A tool for diagnosing the quality of java program and a method for its effective utilization in education*. Proceedings of the 9th WSEAS international conference on Applications of computer engineering, World Scientific and Engineering Academy and Society (WSEAS).
- Haslinda, A., & Sarinah, A. (2009). A Review of Knowledge Management Models. *Journal of International Social Research, 2*(9).
- Haug, A., & Stentoft Arlbjørn, J. (2011). Barriers to master data quality. *Journal of Enterprise Information Management, 24*(3), 288–303. doi:10.1108/17410391111122862
- Hausman, W. H., Lee, H. L., Napier, G. R. F., Thompson, A., & Zheng, Y. (2010). A process analysis of global trade management—an inductive approach. *Journal of Supply Chain Management, 46*(2), 5–29. doi:10.1111/j.1745-493X.2010.03187.x
- Hawkins, T. G., Wittmann, C. M., & Beyerlein, M. M. (2008). Antecedents and consequences of opportunism in buyer–supplier relations: Research synthesis and new frontiers. *Industrial Marketing Management, 37*(8), 895–909. doi:10.1016/j.indmarman.2007.05.005
- Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: Competing through manufacturing*. New York: John Wiley & Sons.
- Hayes, R. H., & Wheelwright, S. C. (1984). *Restoring our competitive edge: competing through manufacturing*. New York: John Wiley.
- Hazen, B. T., Boone, C. A., Ezell, J. D., & Jones-Farmer, L. A. (2014). Data quality for data science, predictive analytics, and big data in supply chain management: An introduction to the problem and suggestions for research and applications. *International Journal of Production Economics, 154*, 72–80. doi:10.1016/j.ijpe.2014.04.018
- Heaidari, M., Moghimi, S. M., & Khanifar, H. (2011). The critical success factors in implementing knowledge management: Agricultural organization in Islamic Republic of Iran. *British Journal of Science, 1*(2), 54–75.
- Heberling, M. E. (1993). The rediscovery of modern purchasing. *International Journal of Purchasing and Material Management, 29*(4), 48–53.
- Heckert, J. B., & Miner, R. B. (1940). *Distribution costs*. New York: Ronald Press.
- Heide, J. B. (1994). Interorganizational Governance in Marketing Channels. *Journal of Marketing, 58*(1), 71–85. doi:10.2307/1252252
- Heide, J. B., & John, G. (1992). Do norms matter in marketing relationships? *Journal of Marketing, 56*(2), 32–44. doi:10.2307/1252040
- Heide, J. B., Kumar, A., & Wathne, K. H. (2014). Concurrent sourcing, governance mechanisms, and performance outcomes in industrial value chains. *Strategic Management Journal, 35*(8), 1164–1185. doi:10.1002/smj.2145
- Heide, J., & Stump, R. (1995). Performance implications of buyer-supplier relationships in industrial markets: A transaction cost explanation. *Journal of Business Research, 32*(1), 57–66. doi:10.1016/0148-2963(94)00010-C

Compilation of References

- Heikkila, J. (2002). From supply to demand chain management: Efficiency and customer satisfaction. *Journal of Operations Management*, 20(6), 747–767. doi:10.1016/S0272-6963(02)00038-4
- Hellström, D., & Saghir, M. (2007). Packaging and logistics interactions in retail supply chains. *Packaging Technology and Science*, 20(3), 197–216. doi:10.1002/pts.754
- Helman, D., & Chernatony, L. D. (1999). Exploring the development of lifestyle retail brands. *Service Industries Journal*, 19(2), 49–68. doi:10.1080/02642069900000018
- Helo, P., & Szekely, B. (2005). Logistics information systems: An analysis of software solutions for supply chain coordination. *Industrial Management & Data Systems*, 105(1), 5–18. doi:10.1108/02635570510575153
- Hendricks, K. B., & Singhal, V. R. (2003). The effect of supply chain glitches on shareholder wealth. *Journal of Operations Management*, 21(5), 501–522. doi:10.1016/j.jom.2003.02.003
- Hendricks, K. B., & Singhal, V. R. (2005). An Empirical Analysis of the Effect of Supply Chain Disruptions on Long-Run Stock Price Performance and Equity Risk of the Firm. *Production and Operations Management*, 14(1), 35–52. doi:10.1111/j.1937-5956.2005.tb00008.x
- Hendricks, K., & Singhal, V. (2005). Association between supply chain glitches and operating performance. *Management Science*, 51(5), 695–711. doi:10.1287/mnsc.1040.0353
- Hense, J., Klevers, M., Sailer, M., Horenburg, T., & Günthner, W. A. (2013). Using gamification to enhance staff motivation in logistics. *Proceedings of the 44th Conference of the International Simulation and Gaming Association* (pp. 1–8).
- He, Q., Gallear, D., & Ghobadian, A. (2011). Knowledge transfer: The facilitating attributes in supply-chain partnerships. *Information Systems Management*, 28(1), 57–70. doi:10.1080/10580530.2011.536114
- He, Q., Ghobadian, A., & Gallear, D. (2013). Knowledge acquisition in supply chain partnerships: The role of power. *International Journal of Production Economics*, 141(2), 605–618. doi:10.1016/j.ijpe.2012.09.019
- Heras, I., & Arana, G. (2010). Alternative Models for Environmental Management in SMEs: The Case of Ecoscan vs. ISO 14001. *Journal of Cleaner Production*, 18(8), 726–735. doi:10.1016/j.jclepro.2010.01.005
- Heras-Saizarbitoria, I., Molina-Azorín, J. F., & Dick, G. P. M. (2011). ISO 14001 certification and financial performance: Selection-effect versus treatment-effect. *Journal of Cleaner Production*, 19(1), 1–12. doi:10.1016/j.jclepro.2010.09.002
- Herbon, A., Levner, E., & Cheng, T. C. E. (2014). Perishable inventory management with dynamic pricing using time-temperature indicators linked to automatic detecting devices. *International Journal of Production Economics*, 147(1), 605–613. doi:10.1016/j.ijpe.2013.07.021
- Herbsleb, J. D., & Mockus, A. (2003). An empirical study of speed and communication in globally distributed software development. *Software Engineering. IEEE Transactions*, 29(6), 481–494.
- Hervani, A. A., Helms, M. M., & Sarkis, J. (2005). Performance Measurement for Green Supply Chain Management. *Benchmarking*, 12(4), 330–353. doi:10.1108/14635770510609015
- Heskett, J. L., Glaskowsky, N. A., & Ivie, R. M. (1974). *Business Logistics*. New York: Ronald Press.
- He, W., Qiao, Q., & Wei, K. K. (2009). Social relationship and its role in knowledge management systems usage. *Information & Management*, 46(3), 175–180. doi:10.1016/j.im.2007.11.005
- Hicks, B. J. (2007). Lean information management: Understanding and eliminating waste. *International Journal of Information Management*, 27(4), 233–249. doi:10.1016/j.ijinfomgt.2006.12.001

Compilation of References

- Hicks, J. (1935). A suggestion for simplifying the theory of money. *Economica*, 2(5), 1–19. doi:10.2307/2549103
- Hill, T. J. (1993). *Manufacturing Strategy* (2nd ed.). London: Macmillan. doi:10.1007/978-1-349-22664-1
- Hines, T. (2013). *Supply chain strategies: demand driven and customer focused* (2nd ed.). Oxford, England: Routledge.
- Hingley, M. K. (2005). Power imbalanced relationships: Cases from UK fresh food supply. *International Journal of Retail & Distribution Management*, 33(8), 551–569. doi:10.1108/09590550510608368
- Hingley, M., Taylor, S., & Ellis, C. (2007). Radio frequency identification tagging. *International Journal of Retail & Distribution Management*, 35(10), 803–820. doi:10.1108/09590550710820685
- Hittle, B., & Moustafa Leonard, K. (2011). Decision making in advance of a supply chain crisis. *Management Decision*, 49(7), 1182–1193. doi:10.1108/00251741111151208
- Hitt, M. A., Ireland, R. D., Sirmon, D. G., & Trahms, C. A. (2011). Strategic Entrepreneurship: Creating Value for Individuals, Organizations, and Society. *The Academy of Management Perspectives*, 25(2), 57–75. doi:10.5465/AMP.2011.61020802
- Ho, D. C. K., Au, K. F., & Newton, E. (2002). Empirical research on supply chain management: A critical review and recommendations. *International Journal of Production Research*, 40(17), 4415–4430. doi:10.1080/00207540210157204
- Hoejmose, S. U., & Adrien-Kirby, A. J. (2012). Socially and environmentally responsible procurement: A literature review and future research agenda of a managerial issue in the 21st century. *Journal of Purchasing and Supply Management*, 18(4), 232–242. doi:10.1016/j.pursup.2012.06.002
- Hoenen, S. J., & Omta, S. W. F. (2012). Fundamental perspectives on supply chain management. *Journal on Chain and Network Science*, 12(2), 199–214.
- Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*. Beverly Hills, CA: Sage.
- Hofstede, G. (1985). The Interaction between national and organizational value systems. *Journal of Management Studies*, 22(4), 347–357. doi:10.1111/j.1467-6486.1985.tb00001.x
- Hofstede, G. (1991). *Cultures and Organisations: Software of the Mind*. London: McGraw-Hill.
- Hofstede, G. (1991). *Cultures and organizations: Software of the mind*. Maidenhead: McGraw Hill.
- Hofstede, G. (2001). *Culture's Consequences: Comparing Values, Behaviours, Institutions, and Organizations across Nations* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Holland, C., Lockett, G., & Blackman, I. (1992). Planning for Electronic Data Interchange. *Strategic Management Journal*, 13(7), 539–550. doi:10.1002/smj.4250130706
- Holloway, G. J. (1991). The farm-retail price spread in an imperfectly competitive food industry. *American Journal of Agricultural Economics*, 73(4), 979–989. doi:10.2307/1242425
- Holmberg, S. (2000). A systems perspective on supply chain measurements. *International Journal of Physical Distribution & Logistics Management*, 30(10), 847–868. doi:10.1108/09600030010351246
- Holmström, J., Främling, K., Kaipia, R., & Saranen, J. (2002). Collaborative planning forecasting and replenishment: New solutions needed for mass collaboration. *Supply Chain Management: an International Journal*, 7(3), 136–145. doi:10.1108/13598540210436595
- Holweg, M., Disney, S., Holmstrom, J., & Smaros, J. (2005). Supply chain collaboration: Making sense of the strategy continuum. *European Management Journal*, 23(2), 170–181. doi:10.1016/j.emj.2005.02.008

Compilation of References

- Hong, J. F., & Snell, R. S. (2013). Developing New Capabilities across a Supplier Network through Boundary Crossing: A Case Study of a China-Based MNC Subsidiary and its Local Suppliers. *Organization Studies*, 34(3), 377–406. doi:10.1177/0170840612467154
- Hong, Y., Chan, D. W. M., Chan, A. P. C., & Yeung, J. F. Y. (2012). Critical Analysis of Partnering Research Trend in Construction Journals. *Journal of Management Engineering*, 28(2), 82–95. doi:10.1061/(ASCE)ME.1943-5479.0000084
- Horvath, L. (2001). Collaboration: The key to value creation in supply chain management. *Supply Chain Management: An International Journal*, 6(5), 205–207. doi:10.1108/EUM0000000006039
- Hoskisson, R. E., Eden, L., Lau, C. M., & Wright, M. (2000). Strategy in emerging economies. *Academy of Management Journal*, 43(3), 249–267. doi:10.2307/1556394
- Hosseinzadeh, F. L., Allahviranloo, T., Alimardani, M., & Kiani, N. A. (2007). A New method for complex decision making based on TOPSIS for complex decision making problems with fuzzy data. *Applied Mathematical Sciences*, 1(60), 2981–2987.
- Hou, J., & Su, D. (2007). EJB–MVC oriented supplier selection system for mass customization. *Journal of Manufacturing Technology Management*, 18(1), 54–71. doi:10.1108/17410380710717643
- Houlihan, J. B. (1987). International supply chain management. *International Journal of Physical Distribution & Logistics Management*, 17(2), 51–66. doi:10.1108/eb014652
- Ho, W., Xu, X., & Dey, P. (2010). Multi-criteria decision making approaches for supplier evaluation and selection. *European Journal of Operational Research*, 202(1), 16–24. doi:10.1016/j.ejor.2009.05.009
- Hoyt, J., & Huq, F. (2000). From arms-length to collaborative relationships in the supply chain. *International Journal of Physical Distribution & Logistics Management*, 30(9), 750–764. doi:10.1108/09600030010351453
- Hsu, C. W., & Hu, A. H. (2008). Green Supply Chain Management in the Electronic Industry. *International Journal of Science & Technology*, 5(2), 205–216. doi:10.1007/BF03326014
- Hu, A. H., & Hsu, C. W. (2010). Critical Factors for Implementing Green Supply Chain Management Practice – An Empirical Study of Electrical and Electronics Industries in Taiwan. *Management Research Review*, 33(6), 586–608. doi:10.1108/01409171011050208
- Huang, C. C., & Lin, S. (2010). Sharing knowledge in a supply chain using the semantic web. *Expert Systems with Applications*, 37(4), 3145–3316. doi:10.1016/j.eswa.2009.09.067
- Huang, G. Q., & Mak, K. L. (2000). WeBid: A web-based framework to support early supplier involvement in new product development. *Robotics and Computer-integrated Manufacturing*, 16(2-3), 169–179. doi:10.1016/S0736-5845(00)00005-3
- Hughes, J. (2008). From vendor to partner: Why and how leading companies collaborate with suppliers for competitive advantage. *Global Business and Organizational Excellence*, 27(3), 21–37. doi:10.1002/joe.20201
- Hult, G. T. M., Craighead, C. W., & Ketchen, D. J. Jr. (2010). Risk, uncertainty and supply chain decisions: Option perspective. *Decision Sciences*, 41(3), 435–458. doi:10.1111/j.1540-5915.2010.00276.x
- Hultman, J., Johnsen, T., Johnsen, R., & Hertz, S. (2012). An interaction approach to global sourcing: A case study of IKEA. *Journal of Purchasing and Supply Management*, 18(1), 9–21. doi:10.1016/j.pursup.2011.11.001
- Hultman, M., Katsikeas, C., & Robson, M. J. (2011). Export promotion strategy and performance: The role of international experience. *Journal of International Marketing*, 19(4), 17–39. doi:10.1509/jim.11.0022

Compilation of References

- Humphrey, J., & Schmitz, H. (2000). *Governance and Upgrading: Linking Industrial Cluster and Global Value Chain Research* (IDS Working Paper 120). Brighton: Institute of Development Studies, University of Sussex.
- Humphrey, W. S. (2000). *Introduction to the team software process(sm)*. Reading, MA: Addison-Wesley.
- Humphries, A. S., & Wilding, R. D. (2004). Long term collaborative business relationships: The impact of trust and C3 behaviour. *Journal of Marketing Management*, 9(10), 1107–1122. doi:10.1362/0267257042405240
- Hung Lau, K., & Zhang, J. (2006). Drivers and obstacles of outsourcing practices in China. *International Journal of Physical Distribution & Logistics Management*, 36(10), 776–792. doi:10.1108/09600030610714599
- Hung, Y. C., Huang, S. M., Lin, Q. P., & -Tsai, M.-L. (2005). Critical factors in adopting a knowledge management system for the pharmaceutical industry. *Industrial Management & Data Systems*, 105(2), 164–183. doi:10.1108/02635570510583307
- Hunt, S. D., & Morgan, R. M. (1996). The Resource-Advantage Theory of Competition: Dynamics, Path Dependencies, and Evolutionary Dimensions. *Journal of Marketing*, 60(4), 107–114. doi:10.2307/1251905
- Hutzschenreuter, T., & Horstkotte, J. (2010). Knowledge transfer to partners: A firm level perspective. *Journal of Knowledge Management*, 14(3), 428–448. doi:10.1108/13673271011050148
- Hwang, C. L., & Yoon, K. (1981). *Multiple attribute decision making methods and applications*. Berlin, Heidelberg: Springer. doi:10.1007/978-3-642-48318-9
- IBM. (2014). IBM's Corporate Service Corps. Retrieved from http://www.ibm.com/ibm/responsibility/corporateservicecorps/wwa_turkey.html
- ICChemE. (2002). The sustainability metrics: sustainable development progress metrics recommended for use in the process industries. Warwickshire, UK: Institution of Chemical Engineers.
- IEEE. (2007). *IEEE Std 15939–2007 IEEE Systems and Software Engineering—Measurement Process*. IEEE–SA.
- IHS. (2011). Asian Paints Minimizes Environmental Impact and Maximizes New Operational Efficiencies. Retrieved from http://www.ihs.com/pdfs/Asian_Paints-2011_Excellence_Award-2.pdf
- Insider, B. (2014). What It's Like Inside The Factory Where Samsung Builds Your Galaxy Phone. Retrieved from <http://www.businessinsider.com/samsung-gumi-factory-2014-5#ixzz3JWDncR1s>
- International Development Research Center (IDRC). (1997). *Assessment Tools*. Ottawa, Canada.
- International Standards Organization (ISO). (2014). Environmental Management (ISO 14000) and Social Responsibility (ISO 26000). Retrieved from <http://www.iso.org/iso/home/standards.htm>
- Ireland, R. D., & Webb, J. W. (2007). A multi-theoretic perspective on trust and power in strategic supply chains. *Journal of Operations Management*, 25(2), 482–497. doi:10.1016/j.jom.2006.05.004
- Isaksson, M., & Nikolausson, H. (2014). Establishing an Environmentally Friendly Organizational Culture.
- Ishikawa, K. (1991). *Guide to quality control*. Clearwater, USA: Quality Resources.
- ISO/IEC. (2007). *ISO/IEC 15939 Software engineering – Software measurement process*. Geneva: International Standard Organization / International Electrotechnical Commission.
- Ittner, C., Larcker, D., Nagar, V., & Rajan, M. (1999). Supplier selection, monitoring practices, and firm performance. *Journal of Accounting and Public Policy*, 18(3), 253–281. doi:10.1016/S0278-4254(99)00003-4

Compilation of References

- Ivanov, D., & Sokolov, B. (2012). The inter-disciplinary modeling of supply chains in the context of collaborative multi-structural cyber-physical networks. *Journal of Manufacturing Technology Management*, 23(8), 976–997. doi:10.1108/17410381211276835
- Jablonski, B. B. (2014). ‘Better Butter’ opportunities for Local Food and Entrepreneurship. *Journal of Food Distribution Research*, 45(3).
- Jacobs, B. W., Singhal, V. R., & Subramanian, R. (2010). An empirical investigation of environmental performance and the market value of the firm. *Journal of Operations Management*, 28(5), 430–441. doi:10.1016/j.jom.2010.01.001
- Jahangirian, M., Eldabi, T., Naseer, A., Stergioulas, L. K., & Young, T. (2010). Simulation in manufacturing and business: A review. *European Journal of Operational Research*, 203(1), 1–13. doi:10.1016/j.ejor.2009.06.004
- Jain, V. K., & Sharma, S. (2014). Drivers Affecting the Green Supply Chain Management Adaptation: A Review. *IUP Journal of Operations Management*, 13(1), 54–63.
- Jalalvand, F., Teimoury, E., Makui, A., Aryanezhad, M. B., & Jolai, F. (2011). A method to compare supply chains of an industry. *Supply Chain Management: An International Journal*, 16(2), 82–97. doi:10.1108/13598541111115347
- Jap, S. D. (2001). “Pie Sharing” in Complex Collaboration Contexts. *JMR, Journal of Marketing Research*, 38(1), 86–99. doi:10.1509/jmkr.38.1.86.18827
- Jap, S. D. (2001). Perspectives on joint competitive advantages in buyer-supplier relationships. *International Journal of Research in Marketing*, 18(2), 19–35. doi:10.1016/S0167-8116(01)00028-3
- Jarvenpaa, S. L., Knoll, K., & Leidner, D. E. (1998). Is anybody out there? Antecedents of trust in global virtual teams. *Journal of Management Information Systems*, 14(4), 29–64.
- Jarvenpaa, S. L., & Leidner, D. E. (1999). Communication and trust in global virtual teams. *Organization Science*, 10(6), 791–815. doi:10.1287/orsc.10.6.791
- Jean, R. J. B., Sinkovics, R. R., & Kim, D. (2010). Drivers and Performance Outcomes of Relationship Learning for Suppliers in Cross-Border Customer-Supplier Relationships: The Role of Communication Culture. *Journal of International Marketing*, 18(1), 63–85. doi:10.1509/jimk.18.1.63
- Jean, R. J., Sinkovics, R. R., & Cavusgil, S. T. (2010). Enhancing international customer-supplier relationships through IT resources: A study of Taiwanese electronics suppliers. *Journal of International Business Studies*, 41(7), 1218–1239. doi:10.1057/jibs.2010.4
- Jedermann, R., Emond, J.-P., & Lang, W. (2008). Shelf life prediction by intelligent RFID – Technical limits of model accuracy. In H.-J. Kreowski, B. Scholz-Reiter, & H.-D. Haasis (Eds.), *Dynamics in Logistics* (pp. 231–238). Berlin: Springer. doi:10.1007/978-3-540-76862-3_22
- Jennings, P., & Zandbergen, P. (1995). Ecologically sustainable organizations: An institutional approach. *Academy of Management Review*, 20(4), 1015–1052. Retrieved from <http://amr.aom.org/content/20/4/1015.short>
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. doi:10.1016/0304-405X(76)90026-X
- Jia, N. (2013). Competition, governance, and relationship-specific investments: Theory and implications for strategy. *Strategic Management Journal*, 34(13), 1551–1567. doi:10.1002/smj.2077

Compilation of References

- Jiang, W. Y., Quan, X., & Zhou, S. (2010). Historical, Entrepreneurial and Supply Chain Management Perspectives On The Semiconductor Industry. *International Journal of Innovation and Technology Management*, 7(1), 1–18. doi:10.1142/S0219877010001805
- Johanson, J., & Mattsson, G. L. (1998). In N. Hood & J.-E. Vahlne (Eds.), *Internationalization in industrial systems - A network approach*. London: Croom Helm.
- John, G. (1984). An empirical investigation of some antecedents of opportunism in a marketing channel. *JMR, Journal of Marketing Research*, 21(3), 278–289. doi:10.2307/3151604
- John, G., & Weitz, B. A. (1988). Forward integration into distribution: An empirical test of transaction cost analysis. *Journal of Law Economics and Organization*, 4, 121–139.
- Johnson, P. M. (2007). Requirement and Design Trade-offs in Hackystat: An In-Process Software Engineering Measurement and Analysis System. *Proceedings of the First International Symposium on Empirical Software Engineering and Measurement* (pp. 81-90). IEEE Computer Society. doi:10.1109/ESEM.2007.36
- Johnson, P. M., Kou, H., Agustin, J. M., Zhang, Q., Kagawa, A., & Yamashita, T. (2004). Practical automated process and product metric collection and analysis in a classroom setting: Lessons learned from Hackystat-UH. *Empirical Software Engineering - Proceedings of the 2004 International Symposium ISESE'04*. IEEE.
- Johnson, P.F., Leenders, M., & Flynn, A. (2011). *Purchasing and Supply Management* (14th ed.). New York: McGraw Hill.
- Johnson-Laird, P. N. (1982). Ninth Bartlett memorial lecture. Thinking as a skill. *The Quarterly Journal of Experimental Psychology*, 34(1), 1–29. doi:10.1080/14640748208400855 PMID:6291097
- Johnson-Laird, P. N. (1983). *Mental models: Towards a cognitive science of language, inference, and consciousness* (No. 6). Cambridge, MA: Harvard University Press.
- Jones, P., Comfort, D., & Hillier, D. (2007). Marketing and corporate social responsibility within food stores. *British Food Journal*, 109(8), 582–593. doi:10.1108/00070700710772381
- Jones, P., Hillier, D., & Comfort, D. (2005). The benefits, challenges and impacts of radio frequency identification technology (RFID) for retailers in the UK. *Marketing Intelligence & Planning*, 23(4), 395–402. doi:10.1108/02634500510603492
- Jones, P., Hillier, D., Comfort, D., & Eastwood, I. (2005). Sustainable retailing and consumerism. *Management Research News*, 28(1), 34–44. doi:10.1108/01409170510784760
- Jones, T. C., & Riley, D. W. (1985). Using inventory for competitive advantage through supply chain management. *International Journal of Physical Distribution & Logistics Management*, 15(5), 16–26. doi:10.1108/eb014615
- Joshi, M., Ravindranath, S., Jain, G. K., & Nazareth, K. (2007). *Sustainable Development: An Introduction*. Centre for Environment Education. Retrieved from <http://www.sayen.org/Volume-I.pdf>
- Joshi, A. W., & Stump, R. L. (1999). Determinants of Commitment and Opportunism: Integrating and Extending Insights from Transaction Cost Analysis and Relational Exchange Theory. *Canadian Journal of Administrative Sciences*, 16(4), 334–352. doi:10.1111/j.1936-4490.1999.tb00693.x
- Julian, C. (2003). Export marketing performance: A study of Thailand firms. *Journal of Small Business Management*, 41(2), 213–221. doi:10.1111/1540-627X.00077
- Julian, C., & Ahmed, Z. (2005). The impact of barriers to export on export marketing performance. *Journal of Global Marketing*, 19(1), 71–94. doi:10.1300/J042v19n01_05
- Jünemann, R. (1989). *Materialfluß und Logistik*. Berlin, Germany: Springer. doi:10.1007/978-3-662-08532-5

Compilation of References

- Jung, K., Lim, Y., & Oh, J. (2011). A Model for Measuring supplier risk: Do operational capability indicators enhance the prediction accuracy of supplier risk? *British Journal of Management*, 22(4), 609–627. doi:10.1111/j.1467-8551.2010.00697.x
- Juras, P. (2008). The hidden costs of outsourcing. *Journal of Corporate Accounting & Finance*, 19(6), 7–15. doi:10.1002/jcaf.20428
- Jüttner, U. (2005). Supply chain risk management: Understanding the business requirements from a practitioner perspective. *International Journal of Logistics Management*, 16(1), 120–141. doi:10.1108/09574090510617385
- Jüttner, U., Peck, H., & Christopher, M. (2003). Supply chain risk management: Outlining an agenda for future research[Literature review / Semi-structured interview with SC professionals / Purposive or theoretical sampling plan]. *International Journal of Logistics: Research and Applications*, 6(4), 197–210. doi:10.1080/13675560310001627016
- Kahn, K. B., & Mentzer, J. T. (1996). Logistics and interdepartmental integration. *International Journal of Physical Distribution & Logistics Management*, 26(8), 6–14. doi:10.1108/09600039610182753
- Kahre, M.S. (2011). Economics of Strategic Knowledge Management: A New Model for Assessment. *International Journal of Trade, Economics & Finance*, 2(3).
- Kampstra, R. P., Ashayeri, J., & Gattorna, J. L. (2006). Realities of supply chain collaboration. *The International Journal of Logistics Management*, 17(3), 312–330. doi:10.1108/09574090610717509
- Kang, M. P., Mahoney, J. T., & Tan, D. (2009). Why firms make unilateral investments specific to other firms: The case of OEM suppliers. *Strategic Management Journal*, 30(2), 117–135. doi:10.1002/smj.730
- Kaplan, S. (1997). The words of risk analysis. *Risk Analysis*, 17(4), 407–417. doi:10.1111/j.1539-6924.1997.tb00881.x
- Kaplan, S., & Garrick, B. J. (1981). On the quantitative definition of risk. *Risk Analysis*, 1(1), 11–27. doi:10.1111/j.1539-6924.1981.tb01350.x PMID:11798118
- Kaplinsky, R., & Morris, M. L. (2001). A Handbook for Value Chain Research. Institute of Development Studies, University of Sussex and School of Development Studies, University of Natal, Retrieved from www.ids.ac.uk/global
- Kapo, I. (2013). Gold Key: The Match.com of Exporting, Global Outreach, U.S. Census Bureau (<http://globalreach.blogs.census.gov/2013/01/30/gold-key>)
- Kärkkäinen, M. (2003). Increasing efficiency in the supply chain for short shelf life goods using RFID tagging. *International Journal of Retail & Distribution Management*, 31(10), 529–536. doi:10.1108/09590550310497058
- Kasemsap, K. (2013b). Synthesized framework: Establishing a causal model of organizational learning, knowledge management, knowledge-sharing behavior, and organizational performance. *International Journal of the Computer, the Internet and Management*, 21(2), 29–34.
- Kasemsap, K. (2015a). Developing a framework of human resource management, organizational learning, knowledge management capability, and organizational performance. In P. Ordoñez de Pablos, L. Turró, R. Tennyson, & J. Zhao (Eds.), *Knowledge management for competitive advantage during economic crisis* (pp. 164–193). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6457-9.ch010
- Kasemsap, K. (2013a). Innovative framework: Formation of causal model of organizational culture, organizational climate, knowledge management, and job performance. *Journal of International Business Management & Research*, 4(12), 21–32.

Compilation of References

- Kasemsap, K. (2014a). Unifying a framework of organizational culture, organizational climate, knowledge management, and job performance. In R. Perez-Castillo & M. Piattini (Eds.), *Uncovering essential software artifacts through business process archeology* (pp. 336–362). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4667-4.ch013
- Kasemsap, K. (2014b). The role of social media in the knowledge-based organizations. In I. Lee (Ed.), *Integrating social media into business practice, applications, management, and models* (pp. 254–275). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6182-0.ch013
- Kasemsap, K. (2014c). Strategic innovation management: An integrative framework and causal model of knowledge management, strategic orientation, organizational innovation, and organizational performance. In P. Ordóñez de Pablos & R. Tennyson (Eds.), *Strategic approaches for human capital management and development in a turbulent economy* (pp. 102–116). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4530-1.ch007
- Kasemsap, K. (2014d). The role of knowledge sharing on organisational innovation: An integrated framework. In L. Al-Hakim & C. Jin (Eds.), *Quality innovation: Knowledge, theory, and practices* (pp. 247–271). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4769-5.ch012
- Kasemsap, K. (2014e). The role of social networking in global business environments. In P. Smith & T. Cockburn (Eds.), *Impact of emerging digital technologies on leadership in global business* (pp. 183–201). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6134-9.ch010
- Kasemsap, K. (2014f). The role of social capital in higher education institutions. In N. Baporikar (Ed.), *Handbook of research on higher education in the MENA region: Policy and practice* (pp. 119–147). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6198-1.ch007
- Kasemsap, K. (2014g). The role of knowledge management on job satisfaction: A systematic framework. In B. Tripathy & D. Acharjya (Eds.), *Advances in secure computing, Internet services, and applications* (pp. 104–127). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-4940-8.ch006
- Kasemsap, K. (2014h). Constructing a unified framework and a causal model of occupational satisfaction, trainee reactions, perception of learning, and perceived training transfer. In S. Hai-Jew (Ed.), *Remote workforce training: Effective technologies and strategies* (pp. 28–52). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-5137-1.ch003
- Kasemsap, K. (2014i). The role of performance management practices on organizational performance: A functional framework. In N. Ray & K. Chakraborty (Eds.), *Handbook of research on strategic business infrastructure development and contemporary issues in finance* (pp. 62–85). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-5154-8.ch006
- Kasemsap, K. (2015b). The role of data mining for business intelligence in knowledge management. In A. Azevedo & M. Santos (Eds.), *Integration of data mining in business intelligence systems* (pp. 12–33). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6477-7.ch002
- Kasemsap, K. (2015c). The role of information system within enterprise architecture and their impact on business performance. In M. Wadhwa & A. Harper (Eds.), *Technology, innovation, and enterprise transformation* (pp. 262–284). Hershey, PA: IGI Global. doi:10.4018/978-1-4666-6473-9.ch012
- Kasilingam, R. G., & Lee, C. P. (1996). Selection of vendors—a mixed integer programming approach. *Computers & Industrial Engineering*, 31(1-2), 347–350. doi:10.1016/0360-8352(96)00148-9
- Kasper, H., Muhlbacher, J., & Muller, B. (2008). Intra-organizational knowledge sharing in MNCs depending on the degree of decentralization and communities of practice. *Journal of Global Business and Technology*, 4(1), 59–68.
- Katie, J. (2013). *A Report on Horizontal and Vertical Business Integration*. California: GRIN Verlag.

Compilation of References

- Katona, G. (1951). *Psychological analysis of economic behavior*. New York: McGraw-Hill.
- Katsikeas, C. (1996). Ongoing export motivation: Differences between regular and sporadic exporters. *International Marketing Review*, 13(2), 4–19. doi:10.1108/02651339610115737
- Kaufman, A., Wood, C. H., & Theyel, G. (2000). Collaboration and technology linkages: A strategic supplier typology. *Strategic Management Journal*, 21(6), 649–663. doi:10.1002/(SICI)1097-0266(200006)21:6<649::AID-SMJ108>3.0.CO;2-U
- Kaufmann, L., & Saw, A. A. (2014). Using a multiple-informant approach in SCM research. *International Journal of Physical Distribution & Logistics Management*, 44(6), 511–527. doi:10.1108/IJPDLM-05-2013-0099
- Kazaz, A., Talat Birgonul, M., & Ulubeyli, S. (2005). Cost-based analysis of quality in developing countries: A case study of building projects. *Building and Environment*, 40(10), 1356–1365. doi:10.1016/j.buildenv.2004.11.010
- Kenichi, O. (1991). *The Mind of the Strategist: The Art of Japanese Business*. New York: McGraw-Hill.
- Kent, J. L., & Mentzer, J. T. (2003). The effect of investment in interorganizational information technology in a retail supply chain. *Journal of Business Logistics*, 24(2), 155–175. doi:10.1002/j.2158-1592.2003.tb00050.x
- Keough, M. (1993). Buying your way to the top. *The McKinsey Quarterly*, 2, 41–62.
- Kessler, J. B., & Leider, S. (2012). Norms and contracting. *Management Science*, 58(1), 62–77. doi:10.1287/mnsc.1110.1341
- Ketchen, D. J. Jr, & Hult, G. T. M. (2007). Bridging organization theory and supply chain management: The case of best value supply chains. *Journal of Operations Management*, 25(2), 573–580. doi:10.1016/j.jom.2006.05.010
- Ketchen, D. J. Jr, & Hult, G. T. M. (2007b). Toward greater integration of insights from organization theory and supply chain management. *Journal of Operations Management*, 25(2), 455–458. doi:10.1016/j.jom.2006.05.001
- Kettinger, J. W., Teng, J. T. C., & Guha, S. (1997). Business process change: A study of methodologies techniques and tools. *Management Information Systems Quarterly*, 21(1), 55–80. doi:10.2307/249742
- Kettinger, W. J., & Grover, V. (1997). The use of computer-mediated communication in an interorganizational context. *Decision Sciences*, 28(3), 513–555. doi:10.1111/j.1540-5915.1997.tb01321.x
- Ketzenberg, M., Bloemhof, J., & Gaukler, G. (2015). Managing perishables with time and temperature history. *Production and Operations Management*, 24(1), 54–70. doi:10.1111/poms.12209
- Khaled, M. (2007, June 28-29). *Globalization and religion*. Proceedings of the Conference on Globalization Conflict & the Experience of Localities: Retrieved from <http://www.ihmsaw.org/resourcefiles/1260067215.pdf>
- Khalil, E. L. (2004). What is altruism? *Journal of Economic Psychology*, 25(1), 97–123. doi:10.1016/S0167-4870(03)00075-8
- Khanduja, J. (2013). *Shared Tastes* [Doctoral dissertation]. Columbia University.
- Khanna, T., & Palepu, K. (2006). Emerging giants. *Harvard Business Review*, October, 60–69.
- Khanna, T., Palepu, K., & Sinha, J. (2005). Strategies that fit emerging markets. *Harvard Business Review*, 83, 6–15. PMID:15938439
- Khan, O., & Burnes, B. (2007). Risk and Supply Chain Management; Creating a Research Agenda. *International Journal of Logistics Management*, 18(2), 197–216. doi:10.1108/09574090710816931
- Khatri, V., & Brown, C. V. (2010). Designing data governance. *Communications of the ACM*, 53(1), 148–152. doi:10.1145/1629175.1629210

Compilation of References

- Ki Fiona Cheung, Y., & Rowlinson, S. (2011). Supply Chain Sustainability: A Relationship Management Approach. *International Journal of Managing Projects in Business*, 4(3), 480–497. doi:10.1108/17538371111144184
- Kim, Y. (1997). Technological Capabilities and Samsung Electronics' International Production Network in Asia (Working Paper 106). BRIE
- Kim, S. H., & Netessine, S. (2013). Collaborative cost reduction and component procurement under information asymmetry. *Management Science*, 59(1), 189–206. doi:10.1287/mnsc.1120.1573
- Kim, Y., Choi, T. Y., Yan, T., & Dooley, K. (2011). Structural investigation of supply networks: A social network analysis approach. *Journal of Operations Management*, 29(3), 194–211. doi:10.1016/j.jom.2010.11.001
- King, W. R., & Marks, P. V. Jr. (2008). Motivating knowledge sharing through a knowledge management system. *Omega*, 36(1), 131–146. doi:10.1016/j.omega.2005.10.006
- Kirchmer, M. (2004). E-business process networks - successful value chains through standards. *Journal of Enterprise Information Management*, 17, 20-30.
- Kittilaksanawong, W. (2015). How do emerging economy firms learn to evolve from contract manufacturing to own brand management? In A. A. Camillo (Ed.), *Global Enterprise Management: A New Perspective on Challenges and Future Development* (pp. 1-18). New York: Palgrave MacMillan. doi:10.1057/9781137510709.0003
- Klassen, R., & Vachon, S. (2003). Collaboration and Evaluation in the Supply Chain: The Impact on Plant-Level Environmental Investment. *Production and Operations Management*, 12(3), 336–352. doi:10.1111/j.1937-5956.2003.tb00207.x
- Klaus, B. (1996). *Kommissioniersystem, Grundlagen und Systemfindung. Kommissionierung heute - Warum Outsourcing „in“ ist*. Düsseldorf, Germany: VDI.
- Kleijnen, J. P. C. (2005). Supply chain simulation, tools and techniques: A survey. *International Journal of Simulation and Process Modeling*, 1(1/2), 82–89. doi:10.1504/IJSPM.2005.007116
- Kleinbaum, A. M. (2012). Organizational misfits and the origins of brokerage in intrafirm networks. *Administrative Science Quarterly*, 57(3), 407–452. doi:10.1177/0001839212461141
- Klein, R., & Rai, A. (2009). Inter-firm strategic information flows in logistics supply chain relationships. *Management Information Systems Quarterly*, 33(4), 735–762.
- Kline, C., Shah, N., & Rubright, H. (2014). Applying the Positive Theory of Social Entrepreneurship to Understand Food Entrepreneurs and Their Operations. *Tourism Planning & Development*, 1-13.
- Knemeyer, A. M., Zinn, W., & Eroglu, C. (2009). Proactive planning for catastrophic events in supply chains. *Journal of Operations Management*, 27(2), 141–153. doi:10.1016/j.jom.2008.06.002
- Knight, F. (1921). *Risk*. Boston, New York: Uncertainty and Profit.
- Knoppen, D., & Christiaanse, E. (2007). Supply chain partnering: A temporal multidisciplinary approach. *Supply Chain Management: An International Journal*, 12(2), 164–171. doi:10.1108/13598540710737343
- Koçtaş, Ö., & Tek, Ö.B. (2013). Construction supply chains: a proposal to develop a new conceptual model. *Proceedings of the XI International Logistics & Supply Chain Congress*. Kayseri & Cappadokia, Turkey.
- Koenig, M. E. (2012). What is KM? Knowledge management explained. Retrieved from <http://www.kmworld.com/Articles/Editorial/What-Is-.../What-is-KM-Knowledge-Management-Explained-82405.aspx>.

Compilation of References

- Kogut, B., & Zander, U. (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. *Organization Science*, 3(3), 383–397. doi:10.1287/orsc.3.3.383
- Koh, L., Demirbag, M., Bayraktar, E., Tatoglu, E., & Zaim, S. (2007). The impact of supply chain management practices on performance of SMEs. *Industrial Management & Data Systems*, 107(1), 103–124. doi:10.1108/02635570710719089
- Koh, S. C. L., Gunasekaran, A., & Tseng, C. S. (2012). Cross-Tier Ripple and Indirect Effects of Directives WEEE and RoHS on Greening a Supply Chain. *International Journal of Production Economics*, 140(1), 305–317. doi:10.1016/j.ijpe.2011.05.008
- Kolavalli, S., Robinson, E., Diao, X., Alpuerto, V., Follo, R., & Slavova, M. (2012). Economic transformation in Ghana: Where will the path lead? *IFPRI Discussion Paper*. Retrieved from <http://dspace.cigilibrary.org/jspui/bitstream/123456789/32682/1/IFPRI%20Discussion%20Paper%2001161.pdf?1>
- Kong, D. (2012). Does corporate social responsibility matter in the food industry? Evidence from a nature experiment in China. *Food Policy*, 37(3), 323–334. doi:10.1016/j.foodpol.2012.03.003
- Koraltan, S. B., & Dikbaş, A. (2002). An assessment of the applicability of partnering in the Turkish construction sector. *Construction Management and Economics*, 20(4), 315–321. doi:10.1080/01446190210125554
- Kostopoulos, A., & Grapsa, T. (2009). Self-scaled conjugate gradient training algorithms. *Neurocomputing*, 72(13-15), 3000–3019. doi:10.1016/j.neucom.2009.04.006
- Kotabe, M., Martin, X., & Domoto, H. (2003). Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance improvement in the US. and Japanese automotive industries. *Strategic Management Journal*, 24(4), 293–316. doi:10.1002/smj.297
- Kotabe, M., & Omura, G. S. (1989). Sourcing strategies of European and Japanese multinationals: A comparison. *Journal of International Business Studies*, 20(1), 113–130. doi:10.1057/palgrave.jibs.8490354
- Kotelnikova, Z. (2013). Structural embeddedness and contractual relationships of chain stores and their suppliers in Russian emerging markets (Working Paper). Basic Research Program.
- Kotler, P. (1976). *Marketing management: analysis, planning and control* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Kotler, P. (1967). *Marketing management*. Englewood Cliffs, NJ: Prentice-Hall.
- Kotler, P. (1972). *Marketing management: analysis, planning and control*. Englewood Cliffs, NJ: Prentice-Hall.
- Kotler, P. (2000). *Marketing Management Millennium Edition* (10th ed.). New York: Prentice-Hall.
- Kotler, P., Ang, S. H., Leong, S. M., & Tan, C. T. (2003). *Marketing Management: An Asian Perspective*. Singapore: Prentice Hall.
- Kotzab, H. (2005). Retailing in the context of IT and distribution. In H. Kotzab & M. Bjerre (Eds.), *Retailing in a scm-perspective*. Denmark: Copenhagen Business School Press.
- Kotzab, H., Teller, C., Grant, D. G., & Sparks, S. (2011). Antecedents for the adoption and execution of supply chain management. *Supply Chain Management: An International Journal*, 16(4), 231–245. doi:10.1108/13598541111139053
- Kouvelis, P., Chambers, C., & Wang, H. (2006, Fall). Supply chain management research and production and operations management: Review, trends, and opportunities. *Production and Operations Management*, 15(3), 449-469.
- Kraljic, P. (1983, September-October). Purchasing must become supply management. *Harvard Business Review*.
- Kraljic, P. (1983). Purchasing must become supply management. *Harvard Business Review*, 61(5), 109–117.

Compilation of References

- Kraljic, P. (1983, September-October). (. Purchasing must become supply management. *Harvard Business Review*.
- Lamming, R. (1996). Squaring lean supply with supply chain management. *International Journal of Operations & Production Management*, 16(2), 183–196.
- Krause, D., Ragatz, G., & Hughley, S. (1999). Supplier Development from the Minority Supplier's Perspective. *Journal of Supply Chain Management*, 35(4), 33–41. doi:10.1111/j.1745-493X.1999.tb00242.x
- Kristiansen, S. (2004). Social networks and business success. The role of subculture on business success. *American Journal of Economics and Sociology*, 63(5), 1149–1171. doi:10.1111/j.1536-7150.2004.00339.x
- Kuada, J. (2008). Power asymmetries and relationships between MNCs and local firms in Africa. *African Journal of Business and Economic Research*, 3(2-3), 92–105.
- Kuhn, T. S. (1970). *The structure of scientific revolutions* (2nd ed.). Chicago: University of Chicago Press.
- Kull, T. J., Ellis, S. C., & Narasimhan, R. (2013). Reducing behavioral constraints to supplier integration: A socio-technical systems perspective. *Journal of Supply Chain Management*, 49(1), 64–86. doi:10.1111/jscm.12002
- Kull, T., Oke, A., & Dooley, K. (2014). Supplier selection behavior under uncertainty: Contextual and cognitive effects on risk perception and choice. *Decision Sciences*, 45(3), 467–505. doi:10.1111/dec.12078
- Kumar, P., Reinitz, H. W., Simunovic, J., Sandeep, K. P., & Franzon, P. D. (2009). Overview of RFID technology and its applications in the food industry. *Journal of Food Science*, 74(8), 101–106. doi:10.1111/j.1750-3841.2009.01323.x PMID:19799677
- Kundu, A., Jain, V., Kumar, S., & Chandra, C. (2015). A journey from normative to behavioral operations in supply chain management: A review using Latent Semantic Analysis. *Expert Systems with Applications*, 42(2), 796–809. doi:10.1016/j.eswa.2014.08.035
- Kuo, R., Hong, S., & Huang, Y. (2010). Integration of particle swarm optimization-based fuzzy neural network and artificial neural network for supplier selection. *Applied Mathematical Modelling*, 34(12), 3976–3990. doi:10.1016/j.apm.2010.03.033
- Kurbel, K. E. (2013). *Enterprise Resource Planning and Supply Chain Management: Functions, Business Processes and Software for Manufacturing Companies*. New York: Springer. doi:10.1007/978-3-642-31573-2
- Kusaba, K., Moser, R., & Rodrigues, A. (2011). Low cost country sourcing competence: A conceptual framework and empirical analysis. *Journal of Supply Chain Management*, 47(4), 73–93. doi:10.1111/j.1745-493X.2011.03242.x
- La Londe, B. J., & Masters, J. M. (1994). Emerging logistics strategies: Blueprints for the next century. *International Journal of Physical Distribution & Logistics Management*, 24(7), 35–47. doi:10.1108/09600039410070975
- Lacity, M. C., & Hirschheim, R. (1993). *Information systems Outsourcing: Myths, Metaphors and Realities*. New York: John Wiley and Sons.
- Lado, A. A., Dant, R. R., & Tekleab, A. G. (2008). Trust-opportunism paradox, relationalism, and performance in inter-firm relationships: Evidence from the retail industry. *Strategic Management Journal*, 29(4), 401–423. doi:10.1002/smj.667
- Lado, N., Martinez-Ros, E., & Valenzuela, A. (2004). Identifying successful marketing strategies by export regional destination. *International Marketing Review*, 21(6), 573–597. doi:10.1108/02651330410568024
- LAFI. (2014). LSU AgCenter Food Incubator Retrieved from http://www.lsuagcenter.com/en/our_offices/departments/food_science/extension_outreach/incubator

Compilation of References

- Lages, F., & Jap, S. D. (2002). Marketing mix adaptation and performance in international marketing relationships. *European Union Working Paper*, 411.
- Lages, F., & Montgomery, D. B. (2001). Export assistance, price adaptation to the foreign market, and annual export performance improvement: A structural model examination. Stanford University, Graduate School of Business, 1-45.
- Lages, F., Jap, S. D., & Griffith, D. A. (2008). The role of past performance in export ventures: A short-term reactive approach. *Journal of International Business Studies*, 39(2), 304–325. doi:10.1057/palgrave.jibs.8400339
- Lahiri, S., & Kedia, B. L. (2011). Co-evolution of institutional and organizational factors in explaining offshore outsourcing. *International Business Review*, 20(3), 252–263. doi:10.1016/j.ibusrev.2011.01.005
- Lambert, D. M. (2008). *Supply chain management: Processes, partnerships, performance*. Sarasota, Florida. London: Supply Chain Management Institute.
- Lambert, D. M., & Cooper, M. C. (2000). Issues in supply chain management. *Industrial Marketing Management*, 29(1), 65–83. doi:10.1016/S0019-8501(99)00113-3
- Lambert, D. M., Cooper, M. C., & Pagh, J. D. (1998). Supply chain management: Implementation issues and research opportunities. *International Journal of Logistics Management*, 9(2), 1–19. doi:10.1108/09574099810805807
- Lambert, D. M., Garcia-Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of process-oriented supply chain management frameworks. *Journal of Business Logistics*, 26(1), 25–51. doi:10.1002/j.2158-1592.2005.tb00193.x
- Lambert, D. M., Knemeyer, A. M., & Gardner, J. T. (2004). Supply chain partnerships: Model validation and implementation. *Journal of Business Logistics*, 25(2), 21–42. doi:10.1002/j.2158-1592.2004.tb00180.x
- Lambert, D. M., & Pohlen, T. L. (2001). Supply chain metrics. *International Journal of Logistics Management*, 12(1), 1–19. doi:10.1108/09574090110806190
- Lambert, D. N., Emmelhainz, M. A., & Gardner, J. T. (1996). Developing and implementing supply chain partnerships. *The International Journal of Logistics Management*, 7(2), 1–17. doi:10.1108/09574099610805485
- Lanning, R. C., & Harrison, D. (2001). Smaller customers and larger suppliers: the potential for strategic purchasing approach: A case study. Paper presented at the 10th International IPSE Conference, Jonkoping, Sweden.
- Lancioni, R. A. (2000). New developments in supply chain management for the millennium. *Industrial Marketing Management*, 29(1), 1–6. doi:10.1016/S0019-8501(99)00106-6
- Lancioni, R. A., & Chandran, R. (2009). Managing knowledge in industrial markets: New dimensions and challenges. *Industrial Marketing Management*, 38(2), 148–151. doi:10.1016/j.indmarman.2008.12.002
- Lancioni, R. A., Smith, M. F., & Oliva, T. A. (2000). The role of the Internet in supply chain management. *Industrial Marketing Management*, 29(1), 45–56. doi:10.1016/S0019-8501(99)00111-X
- Landis, K. M., Mishra, S., & Porrello, K. (2005). *Calling a Change in the Outsourcing Market: The Realities for the World's Largest Organizations*. New York: Deloitte Consulting.
- Lane, C., & Bachman, R. (Eds.). (1998). *Trust within and between organizations: Conceptual issues and empirical applications*. Oxford: Oxford University Press.
- Langhorne, R. (2001). *The Coming of Globalization: Its Evolution and Contemporary Consequences*. New York: Palgrave. doi:10.1057/9780333985564

Compilation of References

- Laosirihongthong, T., Adebajo, D., & Choon Tan, K. (2013). Green Supply Chain Management Practices and Performance. *Industrial Management & Data Systems*, 113(8), 1088–1109. doi:10.1108/IMDS-04-2013-0164
- Larson, A. (1992). Network Dyads in Entrepreneurial Settings: A Study of the Governance of Exchange Relationships. *Administrative Science Quarterly*, 37(1), 76–104. doi:10.2307/2393534
- Larson, E. (1995). Project Partnering: Results of study of 280 construction projects. *Journal of Management Engineering*, 11(2), 30–35. doi:10.1061/(ASCE)0742-597X(1995)11:2(30)
- Latham, M. (1994). *Constructing the team: Final Report on Joint Review of Procurement and Contractual Agreements in the UK Construction Industry*. London: HMSO.
- Laura Sidali, K., & Hemmerling, S. (2014). Developing an authenticity model of traditional food specialties: Does the self-concept of consumers matter? *British Food Journal*, 116(11), 1692–1709. doi:10.1108/BFJ-02-2014-0056
- Lavie, D. (2006). The Competitive Advantage of Interconnected Firms: An Extension of the Resource-Based View. *Academy of Management Review*, 31(3), 638–658. doi:10.5465/AMR.2006.21318922
- Lawler, J., & Kitchenham, B. (2003). Measurement modeling technology. *IEEE Software*, 20(3), 68–75. doi:10.1109/MS.2003.1196324
- LBTC. (2014). Louisiana Business and Technology Center. Retrieved from <http://www.lbtc.lsu.edu>
- Leal Filho, W., & Kovaleva, M. (2014). Food Waste and Sustainable Food Waste Management in the Baltic Sea Region.
- Lechner, F. J., & Boli, J. (2015). *The Globalization Reader* (5th ed.). London: John Wiley & Sons.
- Lederer, M., & Schott, P. (2012). *IT-basiertes Transparenzmanagement für die Analyse von Geschäftsprozessen*. Nuremberg, Germany: University of Erlangen-Nuremberg Chair for Information Systems.
- Lederer, M., Schott, P., Huber, S., & Kurz, M. (2013). Strategic Business Process Analysis: A Procedure Model to Align Business Strategy with Business Process Analysis Methods. *Proceedings of the 5th International Conference S-BPM ONE 2013 Proceedings*, Deggendorf, Germany (pp. 247-263). doi:10.1007/978-3-642-36754-0_16
- Lee, H. L., Padmanabhan, V., & Whang, S. (2004). Information distortion in a supply chain: the bullwhip effect. *Management Science*, 50(12 Supplement), 1875–1886. doi:10.1287/mnsc.1040.0266
- Lee, H.L., & Whang, S. (2001). E-business and supply chain integration. *SGSCMF-W2-2001*.
- Lee, J., & Folkmanis, J. (2013). *Samsung Shifts Plants from China to Protect Margins*. Retrieved from <http://www.bloomberg.com/news/2013-12-11/samsung-shifts-plants-from-china-to-protect-margins.html>
- Lee, A., & Wall, G. (2012). *Food clusters: Towards a creative rural economy*. Martin Prosperity Institute, Rotman School of Management, University of Toronto.
- Lee, C. K., & Chen, S. H. (2010). Selecting the Most Feasible Strategy for Green Supply Chain Management. *The Business Review, Cambridge*, 14(2), 141–146.
- Lee, D., & Park, J. (2008). RFID-based traceability in the supply chain. *Industrial Management & Data Systems*, 108(6), 713–725. doi:10.1108/02635570810883978
- Lee, H. L. (2002). Aligning supply chain strategies with product uncertainties. *California Management Review*, 44(3), 105–119. doi:10.2307/41166135
- Lee, H. L. (2004). The triple-A supply chain. *Harvard Business Review*, 82(10), 102–113. PMID:15559579

Compilation of References

- Lee, H. L., So, K. C., & Tang, C. S. (2000). The Value of Information Sharing in a Two-Level Supply Chain. *Management Science*, 46(5), 626–643. doi:10.1287/mnsc.46.5.626.12047
- Lee, H. L., & Whang, S. (2000). Information sharing in a supply chain. *International Journal of Manufacturing Technology and Management*, 1(1), 79–93. doi:10.1504/IJMTM.2000.001329
- Lee, H., & Özer, Ö. (2007). Unlocking the value of RFID. *Production and Operations Management*, 16(1), 40–64. doi:10.1111/j.1937-5956.2007.tb00165.x
- Lee, I., & Lee, B.-C. (2010). An investment evaluation of supply chain RFID technologies: A normative modeling approach. *International Journal of Production Economics*, 125(2), 313–323. doi:10.1016/j.ijpe.2010.02.006
- Lee, J. (2001). The impact of knowledge sharing, organizational capability and partnership quality on IS outsourcing success. *Information & Management*, 38(5), 323–335. doi:10.1016/S0378-7206(00)00074-4
- Lee, J.-N., & Kim, Y.-G. (1999). Effect of partnership quality on IS outsourcing success: Conceptual framework and empirical validation. *Journal of Management Information Systems*, 15(4), 29–61. doi:10.2307/249407
- Lee, K. (2009). Why and How to Adopt Green Management into Business Organizations? *Management Decision*, 47(7), 110–121.
- Lee, S. (2008). Drivers for the Participation of Small and Medium-Sized Suppliers in Green Supply Chain Initiatives. *Supply Chain Management: An International Journal (Toronto, Ont.)*, 13(3), 185–198.
- Lee, S. M., Tae Kim, S., & Choi, D. (2012). Green Supply Chain Management and Organizational Performance. *Industrial Management & Data Systems*, 112(8), 1148–1180. doi:10.1108/02635571211264609
- Leeuw, S., & Fransoo, J. (2009). Drivers of close supply chain collaboration: One size fits all? *International Journal of Production and Operations Management*, 29(7), 720–739. doi:10.1108/01443570910971397
- Lee, Y. H., Cho, M. K., Kim, S. J., & Kim, Y. B. (2002). Supply chain simulation with discrete-continuous combined modelling. *Computers & Industrial Engineering*, 43(1-2), 375–392. doi:10.1016/S0360-8352(02)00080-3
- Lee, Y. H., Chung, S., Lee, B., & Kang, K. H. (2006). Supply chain model for the semiconductor industry in consideration of manufacturing characteristics. *Production Planning and Control*, 17(5), 518–533. doi:10.1080/09537280600804976
- Lee, Y. W., Pipino, L. L., Funk, J. D., & Wang, R. Y. (2009). *Journey to data quality*. The MIT Press.
- Lehtonen, J. M., Holmström, J., & Slotte, J. (1999). Constraints to quick response systems in the implosive industries. *Supply Chain Management: An International Journal*, 4(1), 51–57. doi:10.1108/13598549910255095
- Leiblein, M. J. (2003). The choice of organizational governance form and performance: Predictions from Transaction Cost, Resource-Based, and Real Options Theories. *Journal of Management*, 29(6), 937–961. doi:10.1016/S0149-2063(03)00085-0
- Lejeune, M. A., & Yakova, N. (2005). On characterizing the 4 C's in supply chain management. *Journal of Operations Management*, 23(1), 81–100. doi:10.1016/j.jom.2004.09.004
- Leonidou, L. (1995). Empirical research on export barriers: Review, assessment, and synthesis. *Journal of International Marketing*, 3(1), 29–43.
- Leonidou, L. (1995). Export barriers: Non-exporters' perceptions. *International Marketing Review*, 12(1), 4–25. doi:10.1108/02651339510080070
- Leonidou, L. (2000). Barriers to export management: An organizational and internationalization analysis. *Journal of International Management*, 6(2), 121–148. doi:10.1016/S1075-4253(00)00022-3

Compilation of References

- Leonidou, L. (2004). An analysis of the barriers hindering small business export development. *Journal of Small Business Management*, 42(3), 279–302. doi:10.1111/j.1540-627X.2004.00112.x
- Leonidou, L., Katsikeas, C., & Piercy, N. F. (1998). Identifying managerial influences on exporting: Past research and future directions. *Journal of International Marketing*, 6(2), 74–102.
- Leonidou, L., Katsikeas, C., & Samiee, S. (2002). Marketing strategy determinants of export performance: A meta-analysis. *Journal of Business Research*, 55(1), 51–67. doi:10.1016/S0148-2963(00)00133-8
- LETC. (2014). Louisiana Emerging Technology Center. Retrieved from <http://laetc.com/the-la-emerging-tech-center>
- Leung, J., Cheung, W., & Chu, S.-C. (2014). Aligning RFID applications with supply chain strategies. *Information & Management*, 51(2), 260–269. doi:10.1016/j.im.2013.11.010
- Levy, D. L. (2008). Political contestation in global production networks. *Academy of Management Review*, 33(4), 943–963. doi:10.5465/AMR.2008.34422006
- Lewis, H. (1940). Industrial purchasing - principles and practice. *Journal of Marketing*, (11): 73–74.
- Lewis, M. A. (2000). Lean production and sustainable competitive advantage. *International Journal of Operations & Production Management*, 20(8), 959–978. doi:10.1108/01443570010332971
- Lewis, W. A. (1957). International Competition in Manufacturers. *The American Economic Review*, 47(2), 578–587.
- Liao, S. H. (2003). Knowledge management technologies and applications—literature review from 1995 to 2002. *Expert Systems with Applications*, 25(2), 155–164. doi:10.1016/S0957-4174(03)00043-5
- Lieberman, M. B. (1991). Determinants of vertical integration: An empirical test. *The Journal of Industrial Economics*, 39(5), 451–466. doi:10.2307/2098455
- Liker, J. K., & Choi, T. Y. (2004). Building deep supplier relationships. *Harvard Business Review*, 82(12), 104–113.
- Liker, J., & Choi, T. (2004). Building Deep Supplier relationships. *Harvard Business Review*, December.
- Li, L. (2002, September). Information sharing in a supply chain with horizontal competition. *Management Science*, 48(9), 1196–1212. doi:10.1287/mnsc.48.9.1196.177
- Li, M., & Richard Ye, L. (1999). Information technology and firm performance: Linking with environmental, strategic and managerial contexts. *Information & Management*, 35(1), 43–51. doi:10.1016/S0378-7206(98)00075-5
- Lin, C. T., Chen, C. B., & Ting, Y. C. (2011). An ERP model for supplier selection in electronics industry. *Expert Systems with Applications*, 38(3), 1760–1765. doi:10.1016/j.eswa.2010.07.102
- Lin, L. C., & Li, T. S. (2010). An integrated framework for supply chain performance measurement using six-sigma metrics. *Software Quality Journal*, 18(3), 387–406. doi:10.1007/s11219-010-9099-2
- Lin, T. C., & Huang, C. C. (2008). Understanding knowledge management system usage antecedents: An integration of social cognitive theory and task technology fit. *Information & Management*, 45(6), 410–417. doi:10.1016/j.im.2008.06.004
- LIP. (2014). LSU Innovation Park. Retrieved from <https://sites01.lsu.edu/wp/innovationpark>
- Li, S., Nathan-Ragu, B., Nathan-Ragu, T. S., & Rao, S. S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *International Journal of Management Sciences*, 34, 107–124.

Compilation of References

- Li, S., Ragu-Nathan, B., Ragu-Nathan, T. S., & Subba Rao, S. (2006). The impact of supply chain management practices on competitive advantage and organizational performance. *Omega*, *34*(2), 107–133. doi:10.1016/j.omega.2004.08.002 PMID:17876965
- Li, T., & Zhang, H. (2015). Information sharing in a supply chain with a make-to-stock manufacturer. *Omega: The International Journal of Management Science*, *50*, 115–125. doi:10.1016/j.omega.2014.08.001
- Liu, J. P. (2007). Case study of picking method selection for cosmetic broken-case picking operation. *Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management* (pp. 357–361). doi:10.1109/IEEM.2007.4419211
- Liu, W. K. (2008). *KFC in China: Secret Recipe for Success*. Singapore: John Wiley & Sons (Asia) PTE LTD.
- Liu, D.-R., & Lai, C.-H. (2011). Mining group-based knowledge flows for sharing task knowledge. *Decision Support Systems*, *50*(2), 370–386. doi:10.1016/j.dss.2010.09.004
- Liu, F. H. F., & Hai, H. L. (2005). The voting analytic hierarchy process method for selecting supplier. *International Journal of Production Economics*, *97*(3), 308–317. doi:10.1016/j.ijpe.2004.09.005
- Liu, Q., & Zhang, D. (2013). Dynamic pricing competition with strategic customers under vertical product differentiation. *Management Science*, *59*(1), 84–101. doi:10.1287/mnsc.1120.1564
- Liu, X., Tang, O., & Huang, P. (2008). Dynamic pricing and ordering decision for the perishable food of the supermarket using RFID technology. *Asia Pacific Journal of Marketing and Logistics*, *20*(1), 7–22. doi:10.1108/13555850810844841
- Liu, Y., Luo, Y., & Liu, T. (2009). Governing buyer–supplier relationships through transactional and relational mechanisms: Evidence from China. *Journal of Operations Management*, *27*(4), 294–309. doi:10.1016/j.jom.2008.09.004
- Li, Y. (2011). Research on the Performance Measurement of Green Supply Management in China. *Journal of Sustainable Development*, *4*(3), 101–107. doi:10.5539/jsd.v4n3p101
- Li, Y. T., Huang, M. H., & Chen, D. Z. (2011). Semiconductor industry value chain: Characters' technology evolution. *Industrial Management & Data Systems*, *111*(3), 370–390. doi:10.1108/02635571111118260
- Li, Y., Xie, E., Teo, H. H., & Peng, M. W. (2010). Formal control and social control in domestic and international buyer–supplier relationships. *Journal of Operations Management*, *28*(4), 333–344. doi:10.1016/j.jom.2009.11.008
- Loane, S. (2006). The role of the internet in the internationalization of small and medium sized companies. *Journal of International Entrepreneurship*, *10*(1), 263–277.
- Loane, S., & Bell, J. (2006). Rapid internalisation among entrepreneurial firms in Australia, Canada and New Zealand. *International Marketing Review*, *23*(5), 467–485. doi:10.1108/02651330610703409
- Lockamy, A. III, & McCormack, K. (2004). Linking SCOR planning practices to supply chain performance; An exploratory study. *International Journal of Operations & Production Management*, *24*(12), 1192–1218. doi:10.1108/01443570410569010
- Lockamy, A. III, & McCormack, K. (2012). Modeling supplier risks using Bayesian networks. *Industrial Management & Data Systems*, *112*(2), 313–333. doi:10.1108/02635571211204317
- Locke, D. (1996). *Global supply management: a guide to international purchasing*. Chicago, IL: Irwin Professional Publishing.
- Logan, M. S. (2000). Using agency theory to design successful outsourcing relationships. *The International Journal of Logistics Management*, *11*(2), 21–32. doi:10.1108/09574090010806137

Compilation of References

- Lolling, A. (2003). *Analyse der menschlichen Zuverlässigkeit bei Kommissioniertätigkeiten* [Dissertation]. Technische Universität München.
- Lönngren, H., Rosenkranz, C., & Kolbe, H. (2010). Aggregated construction supply chains: Success factors in implementation of strategic partnerships. *Supply Chain Management: An International Journal*, 15(5), 404–411. doi:10.1108/13598541011068297
- Lortie, M., Desmarais, L., & Laroche, É. (2012). Knowledge Managers and Transfer Agents: Their Role and Integration in the Development and Implementation of Knowledge Translation Tools. *Proceedings of the 13th European Conference on Knowledge Management* (pp. 217-225).
- Lo, S. M., & Power, D. (2010). An empirical investigation of the relationship between product nature and supply chain strategy. *Supply Chain Management: An International Journal*, 15(2), 139–153. doi:10.1108/13598541011028741
- Loshin, D. (2001). *Enterprise knowledge management: The data quality approach*. London: Morgan Kaufmann.
- Loshin, D. (2010a). *Master data management*. London: Morgan Kaufmann.
- Loshin, D. (2010b). *The practitioner's guide to data quality improvement*. Amsterdam: Elsevier.
- Lowson, B., King, R., & Hunter, A. (1999). *Quick Response: Managing the supply chain to meet consumer demand*. New York: John Wiley & Sons.
- Lowson, R. H. (2001). Retail operational strategies in complex supply chains. *The International Journal of Logistics Management*, 12(1), 97–111. doi:10.1108/09574090110806253
- LSU Ag Center. (2007). Alligator Collagen: New Source for Medical, Cosmetic Uses. *Louisiana Agriculture*. Retrieved from <http://www.lsuagcenter.com/en/communications/publications/agmag/Archive/2007/Winter/Alligator+Collagen+New+Source+for+Medical+Cosmetic+Uses.htm>
- LSU. (2014). International Programs at LSU. Retrieved from <http://international.lsu.edu>
- LSU. (2014). LSU Student Incubator. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/lisu-student-incubator>
- LSU. (2014). Mobile Classroom. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/mobile-classroom>
- LSU. (2014, January 21). Gov. Jindal Announces Funding Hike for Higher Education & New Workforce Incentive Fund. Retrieved from <https://sites01.lsu.edu/wp/lovepurple/2014/01/21/gov-jindal-announces-funding-hike-for-higher-education-new-workforce-incentive-fund>
- LSUAgCenter. (2014). Runway show features student designers. *Headline News, May 16th*. Retrieved from http://www.lsuagcenter.com/news_archive/2014/may/headline_news/Runway-show-features-student-designers.htm
- LSUOREC. (2012). The Constant Pursuit of Discovery. LSU Office of Research & Economic Development. Retrieved from <https://sites01.lsu.edu/wp/lisu2015/files/2013/04/20130409ResearchMtgOREDStrategicPlan.pdf>
- Luhn, H. P. (1958). A business intelligence system. *IBM Journal of Research and Development*, 2(4), 314–319. doi:10.1147/rd.24.0314
- Lumms, R. R., & Vokurka, R. J. (1999). Defining supply chain management: A historical perspective and practical guidelines. *Industrial Management & Data Systems*, 99(1), 11–17. doi:10.1108/02635579910243851
- Lundin, M. (2003). *Indicators for Measuring the Sustainability of Urban Water Systems—a Life Cycle Approach* [Doctoral Thesis]. Department of Environmental Systems Analysis, Chalmers University of Technology, Göteborg, Sweden.

Compilation of References

- Luo, X., Wu, C., Rosenberg, D., & Barnes, D. (2009). Supplier selection in agile supply chains: An information-processing model and an illustration. *Journal of Purchasing and Supply Management*, 15(4), 249–262. doi:10.1016/j.pursup.2009.05.004
- Lu, S., & Yan, H. (2007). A model for evaluating the applicability of partnering in construction. *International Journal of Project Management*, 25(2), 164–170. doi:10.1016/j.ijproman.2006.09.009
- Lu, T. P., Trappey, A. J. C., Chen, Y. K., & Chang, Y. D. (2013). Collaborative design and analysis of supply chain network management key processes model. *Journal of Network and Computer Applications*, 36(6), 1503–1511. doi:10.1016/j.jnca.2013.03.015
- Luthra, S., Garg, D., & Haleem, A. (2013). Identifying and Ranking of Strategies to Implement Green Supply Chain Management in Indian Manufacturing Industry Using Analytical Hierarchy Process. *Journal of Industrial Engineering and Management*, 6(4), 930–962. doi:10.3926/jiem.693
- Luthra, S., Garg, D., & Haleem, A. (2014). Green Supply Chain Management: Implementation and Performance A Literature Review and Some Issues. *Journal of Advances in Management Research*, 11(1), 20–46. doi:10.1108/JAMR-07-2012-0027
- Luzzini, D., Caniato, F., Ronchi, S., & Spina, G. (2012). A transaction costs approach to purchasing portfolio management. *International Journal of Operations & Production Management*, 32(9), 1015–1042. doi:10.1108/01443571211265684
- Lyons, B. R. (1996). Empirical relevance of efficient contract theory: Interfirm contracts. *Oxford Review of Economic Policies*, 12(4), 27–52. doi:10.1093/oxrep/12.4.27
- Lysons, K., & Farrington, B. (2012). *Purchasing and supply chain management* (8th ed.). Harlow: Pearson.
- MacCrimmon, K. R., & Wehrung, D. A. (1986). *Taking risks: The management of uncertainty*. New York: Free Press.
- MacKay, R. B., & Chia, R. (2013). Choice, change, and unintended consequences in strategic change: A process understanding of the rise and fall of Northco Automotive. *Academy of Management Journal*, 56(1), 208–230. doi:10.5465/amj.2010.0734
- Mackelprang, A. W., Robinson, J. L., Bernardes, E., & Webb, G. S. (2014). The relationship between strategic supply chain integration and performance: A meta-analytic evaluation and implications for supply chain management research. *Journal of Business Logistics*, 35(1), 71–96. doi:10.1111/jbl.12023
- Mackenzie, M. L. (2010). Manager communication and workplace trust: Understanding manager and employee perceptions in the E-world. *International Journal of Information Management*, 30(6), 529–541. doi:10.1016/j.ijinfomgt.2010.04.001
- MacNeil, I. R. (1980). Contracts: Adjustment of long-term economic relations under classical, neoclassical and relational contract law. *Northwestern University Law Review*, 72, 854–902.
- Macrae, R., Robinson, R. K., & Sadler, M. J. (Eds.). (1993). *Encyclopaedia of Food Science, Food Technology, and Nutrition: Catering-drying* (Vol. 2). Academic Press.
- Madsen, T. K. (1987). *Empirical export performance studies: A review of conceptualization and findings*. (S. T. Cavusgil, Ed.). Greenwich, CT: JAI Press.
- Magan, J., Lalwani, C., Butcher, T., & Javadpour, R. (2012). *Global logistics and supply chain management*. Chichester, West Sussex: John Wiley & Sons Ltd.
- Magnusson, M. K., Arvola, A., Koivisto Hursti, U.-K., Åberg, L., & Sjöden, P.-O. (2001). Attitudes towards organic foods among Swedish consumers. *British Food Journal*, 103(3), 209–227. doi:10.1108/00070700110386755

Compilation of References

- Mahapatra, S. K., Das, A., & Narasimhan, R. (2012). A contingent theory of supplier management initiatives: Effects of competitive intensity and product life cycle. *Journal of Operations Management*, 30(5), 406–422. doi:10.1016/j.jom.2012.03.004
- Mahindra. (2013). Retrieved from <http://www.mahindra.com/How-We-Help/Environment/Sustainability-Reports>
- Mahmoud, M. M. (1992). Optimal Inventory Consolidation Schemes: A Portfolio Effect Analysis. *Journal Of Business Logistics*, 13(1), 193–214.
- Maister, D. H. (1976). Centralization of Inventories and the Square Root Law. *International Journal of Physical Distribution*, 6(3), 124–134. doi:10.1108/eb014366
- Makani, J. (2008). KM and international organisations: Perspectives on information professionals. *Role. Libri*, 58(4), 144–154.
- Malhotra, A., Gosain, S., & El Sawy, O. A. (2005). Absorptive capacity configurations in supply chains: Gearing for partner-enabled market knowledge creation. *Management Information Systems Quarterly*, 29(1), 145–187.
- Malhotra, D., & Gino, F. (2011). The pursuit of power corrupts: How investing in outside options motivates opportunism in relationships. *Administrative Science Quarterly*, 56(4), 559–592. doi:10.1177/0001839212441350
- Maljers, F. A. (1992). Inside Unilever - the Evolving Transnational Company. *Harvard Business Review*, 70(2), 46–52. PMID:10117368
- Maloni, M. J., & Benton, W. C. (1997). Supply chain partnerships: Opportunities for operations research. *European Journal of Operational Research*, 101(3), 419–429. doi:10.1016/S0377-2217(97)00118-5
- Maloni, M. J., & Brown, M. E. (2006). Corporate social responsibility in the supply chain: An application in the food industry. *Journal of Business Ethics*, 68(1), 35–52. doi:10.1007/s10551-006-9038-0
- Mandal, A., & Deshmukh, S. (1994). Vendor selection using interpretive structural modelling (ISM). *International Journal of Operations & Production Management*, 14(6), 52–59. doi:10.1108/01443579410062086
- Mandal, P., Love, P. E. D., & Irani, Z. (2003). Pre-alliance planning: Development of an information system infrastructure to support strategic alliance activities. *Management Decision*, 41(2), 132–140. doi:10.1108/00251740310457579
- Manthou, V., Vlachopoulou, M., & Folinas, D. (2004). Virtual e-chain (VeC) model for supply chain collaboration. *International Journal of Production Economics*, 87(3), 241–250. doi:10.1016/S0925-5273(03)00218-4
- Mantrala, M. K., Levy, M., Kahn, B. E., Fox, E. J., Gaidarev, P., Dankworth, B., & Shah, D. (2009). Why is Assortment Planning so Difficult for Retailers? A Framework and Research Agenda. *Journal of Retailing*, 85(1), 71–83. doi:10.1016/j.jretai.2008.11.006
- Manuj, I., & Mentzer, J. T. (2008). Global Supply Chain Risk Management. *Journal of Business Logistics*, 29(1), 133–155. doi:10.1002/j.2158-1592.2008.tb00072.x
- Manuj, I., & Sahin, F. (2011). A model of supply chain and supply chain decision-making complexity. *International Journal of Physical Distribution & Logistics Management*, 41(5), 511–549. doi:10.1108/09600031111138844
- Manzini, R. (2012). *Warehousing in the Global Supply Chain: Advanced Models, Tools, and Applications for Storage Systems*. London: Springer-Verlag. doi:10.1007/978-1-4471-2274-6
- March, J. G., & Shapira, Z. (1987). Managerial perspectives on risk and risk taking. *Management Science*, 33(11), 1404–1418. doi:10.1287/mnsc.33.11.1404

Compilation of References

- Markovic, Z. (2010). Modification of TOPSIS method for solving of multi criteria tasks. *Yugoslav Journal of Operations Research*, 20(1), 117–143. doi:10.2298/YJOR1001117M
- Markus, M. L. (2001). Toward a theory of knowledge reuse: Types of knowledge reuse situations and factors in reuse success. *Journal of Management Information Systems*, 18(1), 57–94.
- Marsden, T., Banks, J., & Bristow, G. (2000). Food Supply Chain Approaches: Exploring their Role in Rural Development. *Sociologia Ruralis*, 40(4), 424–438. doi:10.1111/1467-9523.00158
- Marsden, T., & Smith, E. (2005). Ecological entrepreneurship: Sustainable development in local communities through quality food production and local branding. *Geoforum*, 36(4), 440–451. doi:10.1016/j.geoforum.2004.07.008
- Marshall, H. (1994). Discourse analysis in an occupational context. In C. Cassell & G. Symon (Eds.), *Qualitative methods in organizational research: A practical guide* (pp. 91–106). London: Sage Publications.
- Marsillac, E., & Roh, J. J. (2014). Connecting product design, process and supply chain decisions to strengthen global supply chain capabilities. *International Journal of Production Economics*, 147, 317–329. doi:10.1016/j.ijpe.2013.04.011
- Martinez-Sanchez, A., Vela-Jimenez, M. J., Perez-Perez, M., & de-Luis-Carnicer, P. (2009). Inter-organizational cooperation and environmental change: Moderating effects between flexibility and innovation performance. *British Journal of Management*, 20(4), 537–561. doi:10.1111/j.1467-8551.2008.00605.x
- Mason-Jones, R., & Towill, D. R. (1998, September). Shrinking the supply chain uncertainty circle. *Control*, 17-22.
- Massa, S., & Testa, S. (2009). A knowledge management approach to organizational competitive advantage: Evidence from the food sector. *European Management Journal*, 27(2), 129–141. doi:10.1016/j.emj.2008.06.005
- Masson, R., Iosif, L., MacKerron, G., & Fernie, J. (2007). Managing complexity in agile global fashion industry supply chains. *International Journal of Logistics Management*, 18(2), 238–254. doi:10.1108/09574090710816959
- Mathieu, R. G., & Pal, R. (2011). The selection of supply chain management projects: A case study approach. *Operations Management Research*, 4(3-4), 164–181. doi:10.1007/s12063-011-0058-2
- Matopoulos, A., Vlachopoulou, M., Manthou, V., & Manos, B. (2007). A conceptual framework for supply chain collaboration: Empirical evidence from the agri-food industry. *Supply Chain Management*, 12(3), 177–186. doi:10.1108/13598540710742491
- Mattila, H., King, R., & Ojala, N. (2002). Retail performance measures for seasonal fashion. *Journal of Fashion Marketing and Management*, 6(4), 340–351. doi:10.1108/13612020210448637
- MC. (2014). Mobile Classroom at Louisiana State University. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/mobile-classroom>
- McAdam, R., & McCreedy, S. (1999). A critical review of knowledge management models. *The Learning Organization*, 6(3), 91–101. doi:10.1108/09696479910270416
- McAllister, D. J. (1995). Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1), 24–59. doi:10.2307/256727
- McCarthy, T., & Golicic, S. (2005). A proposal for case study methodology in supply chain integration research. In H. Kotzab, S. Seuring, M. Müller, & G. Reiner (Eds.), *Research Methodologies in Supply Chain Management* (pp. 251–266). Heidelberg, Germany: Physica-Verlag. doi:10.1007/3-7908-1636-1_17
- McClain, J. O., Maxwell, W. L., Muckstadt, J. A., Thomas, L. J., & Weiss, E. N. (1984). Comment On Aggregate Safety Stock Levels and Component Part Commonality. *Management Science*, 30(6), 772–773. doi:10.1287/mnsc.30.6.772

Compilation of References

- McDonnell, R., Sweeney, E., & Kenny, J. (2004). The role of information technology in the supply chain. *Logistics Solutions, the Journal of the National Institute for Transport and Logistics*, 7(1), 13–16.
- McFadden, D. T., & Marshall, M. I. (2014). Local Food Systems and Interactions with Entrepreneurship. *Journal of Food Distribution Research*, 45(3).
- McFarlan, B., & Nolan, R. L. (1995). How to manage an IT outsourcing alliance. *Sloan Management Review*, 35(4), 9–23.
- McGarry, J. (2002). *Practical software measurement: objective information for decision makers*. Boston: Addison-Wesley.
- McGee, R. A., Eklund, U., & Lundin, M. (2010). *Stakeholder identification and quality attribute prioritization for a global Vehicle Control System. Proceedings of the Fourth European Conference on Software Architecture: Companion*. ACM. doi:10.1145/1842752.1842765
- McGilvray, D. (2010). *Executing data quality projects: ten steps to quality data and trusted information™*. London: Morgan Kaufmann.
- McGinnis, M. A., & Vallopra, R. (1999). Purchasing and supplier involvement: Issues and insights regarding new product success. *Journal of Supply Chain Management*, 35(3), 4–15. doi:10.1111/j.1745-493X.1999.tb00057.x
- McHugh, M., Humphreys, P., & McIvor, R. (2003). Buyer-supplier relationships and organizational health. *The Journal of Supply Chain Management*, 39(2), 15–25. doi:10.1111/j.1745-493X.2003.tb00151.x
- McIntire, M. J. (2014). *Supply Chain Visibility: From Theory to Practice*. New York: Gower Publishing, Ltd.
- McIntyre, S. L. (2000). The failure of Fordism. *Technology and Culture*, 41(2), 269–299. doi:10.1353/tech.2000.0075
- McMichael, A. J., Powles, J. W., Butler, C. D., & Uauy, R. (2007). Food, livestock production, energy, climate change, and health. *Lancet*, 370(9594), 1253–1263. doi:10.1016/S0140-6736(07)61256-2 PMID:17868818
- McMichael, H., Mackay, D., & Altmann, G. (2000). Quick response in the Australian TCF industry: A case study of supplier response. *International Journal of Physical Distribution & Logistics Management*, 30(7/8), 611–626. doi:10.1108/09600030010346288
- McWilliams, A., & Siegel, D. (2001). Corporate social responsibility: A theory of the firm perspective. *Academy of Management Review*, 26(1), 117–127.
- Meade, L., Liles, D., & Sarkis, J. (1997). Justifying strategic alliances and partnering: A prerequisite for virtual enterprising. *Omega*, 25(1), 29–42. doi:10.1016/S0305-0483(96)00034-5
- Mead, G. H. (1934). *Mind, self and society*. Chicago: University of Chicago Press.
- Meding, W., & Staron, M. (2009). The Role of Design and Implementation Models in Establishing Mature Measurement Programs. In J. Peltonen (Ed.), *Nordic Workshop on Model Driven Engineering*, Tampere, Finland, Tampere University of Technology: 284-299.
- Meixell, M. J., & Gargeya, V. B. (2005). Global Supply Chain Design: A Literature Review and Critique. *Transportation Research Part E, Logistics and Transportation Review*, 41(6), 531–550. doi:10.1016/j.tre.2005.06.003
- Mellat-Parast, M. (2013). Supply Chain Quality Management – An Interorganizational Learning Perspective. *International Journal of Quality & Reliability Management*, 30(5), 511–529. doi:10.1108/02656711311315495
- Mena, C., Humphries, A., & Choi, T. Y. (2013). Toward a theory of multi-tier supply chain management. *Journal of Supply Chain Management*, 49(2), 58–77. doi:10.1111/jscm.12003

Compilation of References

- Mendelson, H. (2000). Organizational architecture and success in the information technology industry. *Management Science*, 46(4), 513–529. doi:10.1287/mnsc.46.4.513.12060
- Menk, J. (1999). *Beitrag zur Planung qualitätsfähiger Kommissioniersysteme - ein humanorientierter Ansatz* [Dissertation]. Technische Universität Dortmund, Germany.
- Mentzer, J. T. (2001). *Supply chain management*. Thousand Oaks, CA: Sage Publications.
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining supply chain management. *Journal of Business Logistics*, 22(2), 1–25. doi:10.1002/j.2158-1592.2001.tb00001.x
- Mentzer, J. T., Flint, D. J., & Kent, J. L. (1999). Developing a logistics service quality scale. *Journal of Business Logistics*, 20(1), 9–32.
- Mentzer, J. T., & Gundlach, G. (2010). Exploring the relationship between marketing and supply chain management: Introduction to the special issue. *Journal of the Academy of Marketing Science*, 38(1), 1–4. doi:10.1007/s11747-009-0150-4
- Mentzer, J. T., Min, S., & Zacharia, Z. G. (2000). The nature of interfirm partnering in supply chain management. *Journal of Business Logistics*, 76(4), 549–568.
- Mentzer, J. T., Min, S., & Zacharia, Z. G. (2000). The nature of interfirm partnering in supply chain management. *Journal of Retailing*, 76(4), 549–568. doi:10.1016/S0022-4359(00)00040-3
- Mentzer, J. T., Stank, T. P., & Myers, M. B. (2006). *Why Global Supply Chain Management? Handbook of Global Supply Chain Management*. Thousand Oaks, CA: Sage Publications.
- Mentzer, J., Stank, T. P., & Myers, M. B. (2007b). *Global Supply Chain Management Strategy. Handbook of Global Supply Chain Management* (pp. 19–38). Thousand Oaks, CA: SAGE. doi:10.4135/9781412976169.n2
- Mercer, A., & Tao, X. (1996). Alternative inventory and distribution policies of a food manufacturer. *The Journal of the Operational Research Society*, 47(6), 755–765. doi:10.1057/jors.1996.96
- Metters, R. (1997). Quantifying the bullwhip effect in supply chains. *Journal of Operations Management*, 15(2), 89–100. doi:10.1016/S0272-6963(96)00098-8
- Michael, K., & McCathie, L. (2005). *The pros and cons of RFID in supply chain management*. Paper presented at the International Conference on Mobile Business. doi:10.1109/ICMB.2005.103
- Michael, S. C. (2000). Investments to create bargaining power: The case of franchising. *Strategic Management Journal*, 21(4), 497–514. doi:10.1002/(SICI)1097-0266(200004)21:4<497::AID-SMJ87>3.0.CO;2-#
- Miemyczyk, J., Johnsen, T.E., & Macquet, M. (2012). Sustainable purchasing and supply management: a structured literature review of definitions and measures at the dyad, chain and network levels, *Supply Chain Management: an international journal*, 17(5), 478-496.
- Mikhailov, L. (2002). Fuzzy analytical approach to partnership selection in formation of virtual enterprises. *Omega*, 30(5), 393–401. doi:10.1016/S0305-0483(02)00052-X
- Miles, M. B., & Huberman, M. A. (1984). *Qualitative data analysis: A sourcebook of new methods*. Beverley Hills, CA: Sage Publications.
- Miles, R. E., & Snow, C. C. (2007). Organization theory and supply chain management: An evolving research perspective. *Journal of Operations Management*, 25(2), 459–463. doi:10.1016/j.jom.2006.05.002

Compilation of References

- Milis, K., & Mercken, R. (2004). The use of the balanced scorecard for the evaluation of Information and Communication Technology projects. *International Journal of Project Management*, 22(2), 87–97. doi:10.1016/S0263-7863(03)00060-7
- Millar, D. (2012). Louisiana alligator industry stages a comeback, thanks to growing demand for skins. *The Times-Picayune*, June 17th. Available at http://www.nola.com/business/index.ssf/2012/06/louisianas_alligator_industry.html
- Miller, S. R., & Ross, A. D. (2003). An exploratory analysis of resource utilization across organizational units: Understanding the resource-based view. *International Journal of Operations & Production Management*, 23(9), 1062–1083. doi:10.1108/01443570310491774
- Miller, T. C. (2002). *Hierarchical Operations And Supply Chain Planning*. London: Springer-Verlag. doi:10.1007/978-1-4471-0305-9
- Mills, J. F., Schmitz, J., & Frizelle, G. D. M. (2004). A strategic review of supply networks. *International Journal of Operations & Production Management*, 24(10), 1012–1036. doi:10.1108/01443570410558058
- Minea, M., & Surugiu, M. C. (2013). Travel information systems in metropolitan supply chains. *Supply Chain Management Journal*, 4(2), 12–22.
- Mingers, J., & Brocklesby, J. (1997). Multimethodology: Towards a framework for mixing methodologies. *International Journal of Management Sciences*, 25(5), 489–509.
- Min, H., & Zhou, G. (2002). Supply chain modeling: Past, present and future. *Computers & Industrial Engineering*, 43(1-2), 231–249. doi:10.1016/S0360-8352(02)00066-9
- Min, S., Mentzer, J. T., & Ladd, R. T. (2007). A market orientation in supply chain management. *Journal of the Academy of Marketing Science*, 35(4), 507–522. doi:10.1007/s11747-007-0020-x
- Min, S., Roath, A. S., Daugherty, P. J., Genchev, S. E., Chen, H., Arndt, A. D., & Glenn Richey, R. (2005). Supply chain collaboration: What's happening? *The International Journal of Logistics Management*, 16(2), 237–256. doi:10.1108/09574090510634539
- Minten, B., & Fafchamps, A. (2000). Returns to social capital among traders, University of Oxford, Queen Elizabeth House (Working Paper No. 145). Development Studies.
- Mitchell, J. C. (1969). The concept and use of social networks. In J. C. Mitchell (Ed.), *Social Networks in Urban Relations: Analyses of Personal Relationships in Central African Towns* (pp. 1–50). Manchester, UK: Manchester University Press.
- Mitchell, V.-W. (1995). Organizational risk perception and reduction: A literature review.[Literature review]. *British Journal of Management*, 6(2), 115–133. doi:10.1111/j.1467-8551.1995.tb00089.x
- Mitnick, B. M. (1973, September). *Fiduciary rationality and public policy: The theory of agency and some consequences*. Paper presented at the Annual Meeting of the American Political Science Association, New Orleans, LA. Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1020859
- Mkandawire, T. (2009). *Institutional monocropping and monotasking in Africa. Democracy, Governance and Well Being Programme, Paper Number 1*. Geneva: United Nations Research for Social Development.
- Mmieh, F., Owusu-Frimpong, N., & Mordi, C. (2012). Evaluating the contribution of the export sector to real GDP growth rate under structural adjustment programme (SAP): The case of Ghana. *Thunderbird International Business Review*, 54(4), 493–507. doi:10.1002/tie.21479
- Mohandas, V. P., & Sankaranarayanan, S. R. (2009). Cost of Quality Analysis: Driving Bottom-line Performance. *International Journal of Strategic Cost Management*, 3(2), 1–8.

Compilation of References

- Moharana, H. S., Murty, J. S., Senapati, S. K., & Khuntia, K. (2011). Importance of Information Technology for Effective Supply Chain Management. *International Journal of Modern Engineering Research*, 1(2), 747–751.
- Mohr, J., & Spekman, R. (1994). Characteristics of partnership success: Partnership attributes, communication behavior and conflict resolution techniques. *Strategic Management Journal*, 15(2), 135–152. doi:10.1002/smj.4250150205
- Mollenkopf, D., Stolze, H., Tate, W. L., & Ueltschy, M. (2010). Green, Lean and Global Supply Chains. *International Journal of Physical Distribution & Logistics Management*, 40(1/2), 14–41. doi:10.1108/09600031011018028
- Møller, M. (1990, November). Scaled conjugate gradient algorithm for fast supervised learning. *Neural Networks*, 6, 525–533. Retrieved from <http://citeseer.ist.psu.edu/viewdoc/download?doi=10.1.1.38.3391&rep=rep1&type=pdf>
- Möller, K., & Törrenen, P. (2003). Business suppliers' value creation potential: A capability-based analysis. *Industrial Marketing Management*, 32(2), 109–118. doi:10.1016/S0019-8501(02)00225-0
- Monczka, R. M., & Morgan, J. P. (1996). Supplier integration: A new level of supply chain management. *Purchasing*, 120(1), 110–113.
- Monin, P., Noorderhaven, N., Vaara, E., & Kroon, D. (2013). Giving sense to and making sense of justice in postmerger integration. *Academy of Management Journal*, 56(1), 256–284. doi:10.5465/amj.2010.0727
- Monteverde, K., & Teece, D. J. (1982a). Supplier switching costs and vertical integration in the automotive industry. *The Bell Journal of Economics*, 13(1), 206–213. doi:10.2307/3003441
- Monteverde, K., & Teece, D. J. (1982b). Appropriate rent and quasi vertical integration. *The Journal of Law & Economics*, 25(2), 321–328. doi:10.1086/467018
- Moore, R. G. (2010). Raising the Bar: An Update of Benchmarking Standards for Corporate Supplier Diversity Programs. *Minority Business Entrepreneur*. Retrieved from www.mbemag.com/index.php/magazine/back-issues/94-2010
- Moore, C., Mosley, D., & Slagle, M. (1992). Partnering guidelines for win-win project management. *Project Management Journal*, 22(1), 18–21.
- Moore, P. G. (1983). *The business of risk*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511582448
- Morgan, R. M., & Hunt, S. D. (1994, July). The commitment-trust theory of relationship marketing. *Journal of Marketing*, 58(3), 20–38. doi:10.2307/1252308
- Morrow, J. L. Jr, Hansen, M. H., & Pearson, A. L. (2004). The cognitive and affective antecedents of general trust within cooperative organizations. *Journal of Managerial Issues*, 16(1), 48–64.
- Mostafa, R. H., Wheeler, C., & Jones, M. V. (2006). Entrepreneurial orientation, commitment to the internet and export performance in small and medium sized exporting firms. *Journal of International Entrepreneurship*, 3(1), 291–302.
- Mudgal, R. K., Shankar, R., Talib, P., & Raj, T. (2010). Modeling the Barriers of Green Supply Chain Practice: An Indian Perspective. *International Journal of Logistics Systems and Management*, 7(1), 81–107. doi:10.1504/IJLSM.2010.033891
- Mueller Loose, S., & Remaud, H. (2013). Impact of corporate social responsibility claims on consumer food choice: A cross-cultural comparison. *British Food Journal*, 115(1), 142–166. doi:10.1108/00070701311289920
- Mulder, K. (2006). *Sustainable development for engineers: A handbook and resource guide*. London: Greenleaf Publishing Limited.
- Muralidharan, C., Anantharaman, N., & Deshmukh, S. G. (2002). A multi-criteria group decision-making model for supplier rating. *Journal of Supply Chain Management*, 38(4), 22–33. doi:10.1111/j.1745-493X.2002.tb00140.x

Compilation of References

- Murray, J. Y., Kotabe, M., & Wildt, A. R. (1995a). Strategic and financial performance implications of global sourcing strategy: A contingency analysis. *Journal of International Business Studies*, 26(1), 181–202. doi:10.1057/palgrave.jibs.8490171
- Murray, J. Y., Wildt, A. R., & Kotabe, M. (1995b). Global sourcing strategies of US subsidiaries of foreign multinationals. *Management International Review*, 35(4), 307–324.
- Muslan, N., Hamid, A. B. A., Tan, H., & Idris, H. (2013). Practices of Green Supply Chain Management (GSCM) Towards Manufacturing Sustainability. *International Proceedings of Economic Development and Research*, 66, 74–80.
- Mutingi, M. (2013). Developing Green Supply Chain Management Strategies: A Taxonomic Approach. *Journal of Industrial Engineering and Management*, 6(2), 525–546. doi:10.3926/jiem.475
- Myers, M. B., & Cheung, M. S. (2008). Sharing Global Supply Chain Knowledge. *Sloan Management Review*, 49(Summer), 67–73.
- Myers, M. B., Griffith, D. A., Daugherty, P. J., & Lusch, R. F. (2004). Maximizing the human capital equation in logistics: Education, experience, and skills. *Journal of Business Logistics*, 25(1), 211–232. doi:10.1002/j.2158-1592.2004.tb00175.x
- Myhr, N., Robert, E., & Spekman, R. E. (2005). Collaborative supply chain partnerships built upon trust and electronically mediated exchange. *Journal of Business and Industrial Marketing*, 20(4-5), 179–186.
- Nair, P. R., Raju, V., & Anbuudayashankar, S. P. (2009). Overview of Information Technology Tools for Supply Chain Management. *CSI Communications*, 33(9), 20–27.
- Najafi, N., Dubois, A., & Hulthen, K. (2013). Opportunism or strategic opportunity seeking? Three approaches to emerging country sourcing. *Journal of Purchasing and Supply Management*, 19(1), 49–57. doi:10.1016/j.pursup.2012.12.002
- Naoum, S. (2003). An overview into the concept of partnering. *International Journal of Project Management*, 21(1), 71–76. doi:10.1016/S0263-7863(01)00059-X
- Narasimhan, R., & Jayaram, J. (1998). Causal linkage in supply chain management: An exploration study of North American manufacturing companies. *Decision Sciences*, 29(3), 579–605. doi:10.1111/j.1540-5915.1998.tb01355.x
- Narasimhan, R., & Talluri, S. (2009). Perspectives on risk management in supply chains. *Journal of Operations Management*, 27(2), 114–118. doi:10.1016/j.jom.2009.02.001
- NASA. (2014). 3D-printing. Retrieved from <http://www.nasa.gov/3Dprinting/>
- Nassar, S. H. (2011). *Supply chain visibility and sustainable competitive advantage: An integrated model* [Unpublished doctoral dissertation]. University of Bath, United Kingdom.
- Nasser H. Zaied, A., Soliman Hussein, G., & M. Hassan, M. (2012). The Role of Knowledge Management in Enhancing Organizational Performance. *International Journal of Information Engineering and Electronic Business*, 4(5), 27. doi:10.5815/ijieeb.2012.05.04
- Natarajarathinam, M., Capar, I., & Narayanan, A. (2009). Managing supply chain in times of crisis: A review of literature and insights. *International Journal of Physical Distribution & Logistics Management*, 39(7), 535–573. doi:10.1108/09600030910996251
- National Association of Countries. (2014). *2012 Emerging Sustainability Strategies in America's Counties*. Retrieved from http://www.naco.org/newsroom/pubs/Documents/2012_Emerging_Sustainability_Strategies_Publication.pdf
- Navarro, A., Acedo, F. J., Robson, M. J., Ruzo, E., & Losada, F. (2010). Antecedents and consequences of firms' export commitment: An empirical study. *Journal of International Marketing*, 18(3), 41–61. doi:10.1509/jimk.18.3.41

Compilation of References

- Navarro, A., Losada, F., Ruzo, E., & Díez, J. A. (2010). Implications of perceived competitive advantages, adaptation of marketing tactics and export commitment on export performance. *Journal of World Business*, 45(1), 49–58. doi:10.1016/j.jwb.2009.04.004
- NBIA. (2014). National Business Incubation Association (http://www.nbia.org/member_services/soft_landings)
- NBIA. (2014). National Business Incubation Association. Retrieved from www.nbia.org/member_services/soft_landings
- Ndinguri, E., Prieto, L., Phipps, S., & Katsioloudes, V. (2013). The Synergy between Minority Business Enterprises and Corporations: A Proposed Supplier Diversity Relationship Framework. *International Journal of Supply Chain Management*, 2(3).
- Neef, D. (2001). *E-procurement: From strategy to implementation*. London: FT press.
- Neiger, D., Rotaru, K., & Churilov, L. (2009). Supply chain risk identification with value-focused process engineering. *Journal of Operations Management*, 27(2), 154–168. doi:10.1016/j.jom.2007.11.003
- Ness, B., Urbel-Piirsalu, E., Anderberg, S., & Olsson, L. (2007). Categorising tools for sustainability assessment. *Ecological Economics*, 60(3), 498–508. doi:10.1016/j.ecolecon.2006.07.023
- New, S. J., & Payne, P. (1995). Research frameworks in logistics – three models, seven dinners and a survey. *International Journal of Physical Distribution & Logistics Management*, 25(10), 60–77. doi:10.1108/09600039510147663
- Ng, D., Sonka, S., & Westgren, R. (2003). Co-evolutionary processes in supply chain networks. *Journal on Chain and Network Science*, 3(1), 45–58. doi:10.3920/JCNS2003.x029
- Nicholas, P. K., Mandolesi, S., Naspetti, S., & Zanolli, R. (2014). Innovations in low input and organic dairy supply chains—What is acceptable in Europe? *Journal of Dairy Science*, 97(2), 1157–1167. doi:10.3168/jds.2013-7314 PMID:24359835
- Nielsen. (2013). Retrieved from <http://www.nielsen.com/us/en/press-room/2013/nielsen-50-percent-of-global-consumers-surveyed-willing-to-pay-more-fo.html>
- Niimi, M., Wakes, S. J., & McGuire, M. H. (2014). Design for Sustainability: Addressing Food Waste Behaviour Through Social Practice Approaches. *Food Design on the Edge*, 29.
- Nkya, E. J. (2002). *Entrepreneurial response to the reform of institutional framework: The case of small scale enterprises in Tanzania*. Mzumbe University Adger Collaboration Research.
- NLAFI. (2014). To Market, to Market...., News - LSU AgCenter Food Incubator, November 9 (<http://www.lsu.edu/departments/nfs/outreach/incubator.htm>)
- Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, 69(6), 96–104.
- Nonaka, I. (1994). A Dynamic Theory of Organisational Knowledge Creation. *Organization Science*, 5(1), 14–37. doi:10.1287/orsc.5.1.14
- Nonaka, I., & Takeuchi, K. (1995). *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford: Oxford University Press.
- Nonaka, I., Toyama, R., & Konno, N. (2000). SECI, Ba and Leadership: A Unified Model of Dynamic Knowledge Creation. *Long Range Planning*, 33(1), 5–34. doi:10.1016/S0024-6301(99)00115-6
- Nonaka, I., Umemoto, K., & Senoo, D. (1996). From information processing to knowledge creation: A paradigm shift in business management. *Technology in Society*, 18(2), 203–218. doi:10.1016/0160-791X(96)00001-2

Compilation of References

- Noordewier, T. G., John, G., & Nevin, J. R. (1990). Performance outcomes of purchasing arrangements in industrial buyer-vendor relationships. *Journal of Marketing*, 54(4), 80–93. doi:10.2307/1251761
- Noori, H. (2004, February). Collaborative continuous improvement programs in supply chain. *Problems and Perspectives in Management*.
- Noorzadeh, A., Mahdilo, M., & Saen, R. (2012). Using DEA cross efficiency evaluation for suppliers ranking in the presence of dual-role factors. *Trends in Applied Sciences Research*, 7(4), 313-323. Retrieved from <http://scialert.net/qredirect.php?doi=tasr.2012.314.323&linkid=pdf>
- Nooteboom, B. (2002). *Trust: Forms, foundations, functions, failures and figures*. Cheltenham, UK: Edward Elgar. doi:10.4337/9781781950883
- Norrman, A., & Jansson, U. (2004). Ericson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal of Physical Distribution & Logistics Management*, 34(5), 431–456. doi:10.1108/09600030410545463
- Norrman, A., & Lindroth, R. (2004). Categorization of supply chain risk and risk management. In C. Brindley (Ed.), *Supply chain risk*. Hampshire: Aghgate Publishing Limited.
- North, D. C. (1986). The new institutional economics. *Journal of Institutional and Theoretical Economics*, 142(1), 230–237.
- Novack, R. A., Rinehart, L. M., & Langley, C. J. (1996). A comparative assessment of senior and logistics executives' perceptions of logistics value. *Journal of Business Logistics*, 17(1), 135–178.
- Novack, R. A., & Simco, S. W. (1991). The industrial procurement process: A supply chain perspective. *Journal of Business Logistics*, 12(1), 145–167.
- Novack, R. A., & Thomas, D. J. (2004). The challenges of implementing the perfect order concept. *Transportation Journal*, 43(1), 5–17.
- Obloj, T., & Zemsky, P. (2015). Value creation and value capture under moral hazard: Exploring the micro-foundations of buyer-supplier relationships. *Strategic Management Journal*, 36(8), 1146-1163. doi: 10.1002/smj.2271
- O'Brien, J. A. (2006). *Management Information Systems* (4th ed.). New York: McGraw Hill.
- Ocasio, W. (1997). Towards an Attention-Based View of the Firm. *Strategic Management Journal*, 18(S1), 187–206. doi:10.1002/(SICI)1097-0266(199707)18:1+<187::AID-SMJ936>3.3.CO;2-B
- Oerke, E. C., Dehne, H. W., Schönbeck, F., & Weber, A. (2012). *Crop production and crop protection: estimated losses in major food and cash crops*. Elsevier.
- Ojala, M., & Hallikas, J. (2006). Investment decision-making in supplier networks: Management of risk. *International Journal of Production Economics*, 104(1), 201–213. doi:10.1016/j.ijpe.2005.03.006
- Okello, J. O., & Were, S. (2014). Influence of supply chain management practices on performance of the Nairobi Securities Exchange's listed, food manufacturing companies in Nairobi. *International Journal of Social Sciences and Entrepreneurship*, 1(11), 107–128.
- Oliveira, A., & Gimeno, A. (2014). *Supply chain management strategy: using SCM to create greater corporate efficiency and profits*. Upper Saddle River, NJ: Pearson FT Press.
- Oliver, R. K., & Webber, M. D. (1982). Supply-chain management: Logistics catches up with strategy. In M. Christopher (Ed.), *Logistics: The strategic issue* (pp. 63–75). London: Chapman & Hall.

Compilation of References

- Olsson, H. H., & Bosch, J. (2013). Post-deployment Data Collection in Software-Intensive Embedded Products. *Software Business. From Physical Products to Software Services and Solutions* (pp. 79-89). New York: Springer.
- Olsson, H., Sandberg, A., Bosch, J., & Alahyari, H. (2013). *Customers Are All the Same--But Different: A case study on customer-specific teams for solving the conflict between scale and responsiveness in large-scale software development*.
- Om, K., Lee, J., & Chang, J. (2007). Using supply chain management to enhance industry–university collaborations in IT higher education in Korea. *Scientometrics*, 71(3), 455–471. doi:10.1007/s11192-007-1690-3
- Oosterhuis, M., Molleman, E., & van der Vaart, T. (2013). Differences in buyers' and suppliers' perceptions of supply chain attributes. *International Journal of Production Economics*, 142(1), 158–171. doi:10.1016/j.ijpe.2012.11.001
- Osland, G. E., Taylor, C. R., & Zou, S. (2001). Selecting international modes of entry and expansion. *Marketing Intelligence & Planning*, 19(3), 153–161. doi:10.1108/02634500110391690
- Osterwalder, A., & Pigneur, Y. (2004). An ontology for e-Business models. In W. Currie (Ed.), *Value creation from e-business models* (pp. 65–97). Oxford, UK: Elsevier. doi:10.1016/B978-075066140-9/50006-0
- Otto, B. (2013). On the Evolution of Data Governance in Firms: The Case of Johnson & Johnson Consumer Products North America. In *Handbook of Data Quality* (pp. 93–118). Berlin, Heidelberg: Springer. doi:10.1007/978-3-642-36257-6_5
- Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833–848. doi:10.1287/mnsc.25.9.833
- Overby, E., Bharadwaj, A., & Sambamurthy, V. (2006). Enterprise agility and the enabling role of information technology. *European Journal of Information Systems*, 15(2), 120–131. doi:10.1057/palgrave.ejis.3000600
- Oxford Dictionaries. (2015). Definition of Knowledge. Retrieved from <http://www.oxforddictionaries.com/definition/english/knowledge>
- Oztemel, E., & Tekez, E. K. (2009). Interactions of agents in performance based supply chain management. *Journal of Intelligent Manufacturing*, 20(2), 159–167. doi:10.1007/s10845-008-0229-7
- P Vlachos, I., Skoumpopoulou, D., & Gutnik, S. (2014). Electronic Supply Chain Management Tools in International Business: Evidence from Austrian Food Clusters. *E-commerce Platform Acceptance: Suppliers, Retailers, and Consumers*, 3-21.
- Padilla-Zakour, O. I. (2004). Promoting the Development of Value-added Specialty Foods through University-based Food Venture Centers. *Journal of Food Science*, 69(3), CRH110–CRH112.
- Pagell, M., & Krause, D. (2002). Strategic consensus in the internal supply chain: Exposing the manufacturing-purchasing link. *International Journal of Production Research*, 40(13), 3075–3092. doi:10.1080/00207540210136540
- Pagell, M., & Shevchenko, A. (2014). Why research in sustainable supply chain management should have no future. *Journal of Supply Chain Management*, 50(1), 44–55. doi:10.1111/jscm.12037
- Pagell, M., Wu, Z., & Murthy, N. (2007). The Supply Chain Implications of Recycling. *Business Horizons*, 50(2), 133–143. doi:10.1016/j.bushor.2006.08.007
- Pagh, J. D., & Cooper, M. C. (1998). Supply chain postponement and speculation strategies: How to choose the right strategy. *Journal of Business Logistics*, 19, 13–34.
- Pahl, J., & Voß, S. (2014). Integrating deterioration and lifetime constraints in production and supply chain planning: A survey. *European Journal of Operational Research*, 238(3), 654–674. doi:10.1016/j.ejor.2014.01.060

Compilation of References

- Paladino, B. (2007). *Five key principles of corporate performance management*. Hoboken, NJ: John Wiley & Sons.
- Palma-Mendoza, J. A. (2014). Analytical hierarchy process and SCOR model to support supply chain re-design. *International Journal of Information Management*, 34(5), 634–638. doi:10.1016/j.ijinfomgt.2014.06.002
- Palma-Mendoza, J. A., Neailey, K., & Roy, R. (2014). Business process re-design methodology to support supply chain integration. *International Journal of Information Management*, 34(2), 167–176. doi:10.1016/j.ijinfomgt.2013.12.008
- Palmer, M. (2005). Retailing multinational learning: A case study of Tesco. *International Journal of Retail & Distribution Management*, 33(1), 23–48. doi:10.1108/09590550510577110
- Paloviita, A. and Järvelä, M. (2015), *Climate Change Adaptation and Food Supply Chain Management*. Routledge Advances in Climate Change Research.
- Panchal, G., Ganatra, A., Kosta, Y., & Panchal, D. (2011). Behaviour analysis of multilayer perceptrons with multiple hidden neurons and hidden layers. *International Journal of Computer Theory and Engineering*, 3(2), 332–337. doi:10.7763/IJCTE.2011.V3.328
- Pandza, K., Horsburgh, S., Gorton, K., & Polajnar, A. (2003). A real options approach to managing resources and capabilities. *International Journal of Operations & Production Management*, 23(9), 1010–1032. doi:10.1108/01443570310491756
- Pandza, K., Polajnar, A., Buchmeister, B., & Thorpe, R. (2003). Evolutionary perspectives on the capability accumulation process. *International Journal of Operations & Production Management*, 23(8), 822–849. doi:10.1108/01443570310486310
- Pang, Z., Chen, Q., Han, W., & Zheng, L. (2012). Value-centric design of the internet-of-things solution for food supply chain: Value creation, sensor portfolio and information fusion. *Information Systems Frontiers*, 17(2), 1–31.
- Papadopoulou, E., Manthou, V., & Vlachopoulou, M. (2013). 4PL network partnerships: The pre-selection phase. *International Journal of Logistics Research and Applications: Leading Journal of Supply Chain Management*, 16(3), 175–192. doi:10.1080/13675567.2013.809708
- Papargyropoulou, E., Lozano, R. K., Steinberger, J., Wright, N., & Ujang, Z. B. (2014). The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76, 106–115. doi:10.1016/j.jclepro.2014.04.020
- Park, Y. (2011). A pedagogical framework for mobile learning: Categorizing educational applications of mobile technologies into four types. *International Review of Research in Open and Distance Learning*, 12(2), 78–102.
- Parmigiani, A. (2007). Why do firms both make and buy? An investigation of concurrent sourcing. *Strategic Management Journal*, 28(3), 285–311. doi:10.1002/smj.580
- Partida, B. (2013). Supply chain talent development is a work in progress. *Supply Chain Management Review*, September/October, 55–57.
- Patil, S. K., & Kant, R. (2014). A fuzzy AHP-TOPSIS framework for ranking the solutions of knowledge management adoption in supply chain to overcome its barriers. *Expert Systems with Applications*, 41(2), 679–693. doi:10.1016/j.eswa.2013.07.093
- Paul, D. L., & McDaniel, R. R. (2004). A field study of the effect of interpersonal trust on virtual collaborative relationship performance. *Management Information Systems Quarterly*, 28(2), 183–227.
- Pauleen, D. J., & Yoong, P. (2001). Relationship building and the use of ICT in boundary-crossing virtual teams: A facilitator's perspective. *Journal of Information Technology*, 16(4), 205–220. doi:10.1080/02683960110100391
- Paull, J. (2008). Green food in China. *Elementals: Journal of Bio-Dynamics Tasmania*, 91, 48–53.

Compilation of References

- Paulraj, A., & Chen, I. (2007). Environmental Uncertainty and Strategic Supply Management: A Resource Dependence Perspective and Performance Implications. *Journal of Supply Chain Management*, 43(3), 29–42. doi:10.1111/j.1745-493X.2007.00033.x
- Paulraj, A., & de Jong, P. (2011). The effect of ISO 14001 certification announcements on stock performance. *International Journal of Operations & Production Management*, 31(7), 765–788. doi:10.1108/01443571111144841
- Paulraj, A., Lado, A., & Chen, I. (2008). Inter-organizational Communication as a Relational Competency: Antecedents and Performance Outcomes in Collaborative Buyer-Supplier Relationships. *Journal of Operations Management*, 26(1), 45–64. doi:10.1016/j.jom.2007.04.001
- Paulsson, U. (2007). *On managing disruption risks in the supply chain – The DRISC model*. Lund, Sweden: Lund University.
- PBTI. (2014). Pennington BioTech Initiative. Retrieved from <http://www.lsu.edu/ur/ocur/lusunews/MediaCenter/News/2013/08/item62883.html>
- Pearson, M., Masson, R., & Swain, A. (2010). Process control in an agile supply chain network. *International Journal of Production Economics*, 128(1), 22–30. doi:10.1016/j.ijpe.2010.01.027
- Peck, H. (2005). Drivers of supply chain vulnerability: An integrated framework. *International Journal of Physical Distribution & Logistics Management*, 35(4), 210–232. doi:10.1108/09600030510599904
- Peck, H. (2006). Reconciling supply chain vulnerability, risk and supply chain management. *International Journal of Logistics: Research and Applications*, 9(2), 127–142. doi:10.1080/13675560600673578
- Pedroso, M. C., & Nakano, D. (2009). Knowledge and information flows in supply chains: A study on pharmaceutical companies. *International Journal of Production Economics*, 122(1), 376–384. doi:10.1016/j.ijpe.2009.06.012
- Penrose, E. T. (1959). *The Theory of the Growth of the Firm*. New York: Wiley.
- PepsiCo India. (2011). Retrieved from <http://pepsicoindia.co.in/Download/environment%20Sustainability.pdf>
- Pereira, J. V. (2009). The new supply chain's frontier: Information management. *International Journal of Information Management*, 29(5), 372–379. doi:10.1016/j.ijinfomgt.2009.02.001
- Perez-Franco, R. (2014). Is your supply chain strategy holding back innovation? *Supply Chain Management Review*, July/August, 8-9.
- Perrons, R., & Platts, K. (2005). Outsourcing strategies for radical innovations: Does industry clockspeed make a difference? *Journal of Manufacturing Technology Management*, 16(8), 842–863. doi:10.1108/17410380510627852
- Petersen, K., & Wohlin, C. (2011). Measuring the flow in lean software development. *Software, Practice & Experience*, 41(9), 975–996. doi:10.1002/spe.975
- Peterson, R. A., & Balasubramanian, S. (2002). Retailing in the 21st century: Reflections and prologue to research. *Journal of Retailing*, 78(1), 9–16. doi:10.1016/S0022-4359(01)00062-8
- Peuhkuri, T. (2002). Knowledge and interpretation in environmental conflict: Fish farming and eutrophication in the Archipelago Sea, SW Finland. *Landscape and Urban Planning*, 61(2), 157–168. doi:10.1016/S0169-2046(02)00110-X
- Pfeffer, J., & Davis-Blake, A. (1987). Understanding Organizational Wage Structures: A Resource Dependence Approach. *Academy of Management Journal*, 30(3), 437–455. doi:10.2307/256008
- Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. New York, NY: Harper & Row.

Compilation of References

- Pfeffer, J., & Salancik, G. R. (1978). *The External Control of Organizations: A Resource Dependence Perspective*. New York: Harper and Row.
- Pfohl, H. C. (2004). *Logistikmanagement – Konzeption und Funktionen*. Berlin, Germany: Springer.
- Pham, D. T., & Thomas, A. J. (2012). Fit manufacturing: A framework for sustainability. *Journal of Manufacturing Technology Management*, 23(1), 103–123. doi:10.1108/17410381211196311
- Phillips, N., & Hardy, C. (2002). *Discourse analysis: Investigating processes of social construction*. London: Sage.
- Piacentini, M., MacFadyen, L., & Eadie, D. (2000). Corporate social responsibility in food retailing. *International Journal of Retail & Distribution Management*, 28(11), 459–469. doi:10.1108/09590550010356822
- Pickett, D. (2013). A blueprint for supply chain. *Supply Chain Management Review*, September/October, 30-39.
- Pietrobelli, C., & Rabellotti, R. (2004, January) Upgrading in clusters and value chains in Latin America: The role of policies. Best Practices Series MSM-124. Washington, DC: Inter-American Development Bank.
- Pietrobelli, C., & Rabellotti, R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries? *World Development*, 39(7), 1261–1269. doi:10.1016/j.worlddev.2010.05.013
- Pilbeam, C., Alvarez, G., & Wilson, H. (2012). The governance of supply network: a systematic literature review. *Supply Chain Management: an international journal*, 17(4), 358-376.
- Pil, F. K., & Fujimoto, T. (2007). Lean and reflective production: The dynamic nature of production models. *International Journal of Production Research*, 45(16), 3741–3761. doi:10.1080/00207540701223659
- Pilling, B. K., Crosby, L. A., & Jackson, D. W. Jr. (1994). Relational bonds in industrial exchange: An experimental test of the transaction cost economic framework. *Journal of Business Research*, 30(3), 237–251. doi:10.1016/0148-2963(94)90054-X
- Piskorski, M. J. (2014). Finn Brunton: Spam: A shadow history of the Internet. *Administrative Science Quarterly*, 59(3), 29–30. doi:10.1177/0001839213518029
- Pivato, S., Misani, N., & Tencati, A. (2008). The impact of corporate social responsibility on consumer trust: The case of organic food. *Business Ethics (Oxford, England)*, 17(1), 3–12. doi:10.1111/j.1467-8608.2008.00515.x
- Plunkett, J. J., & Dale, B. G. (1988). Quality costs: A critique of some ‘economic cost of quality’ models. *International Journal of Production Research*, 26(11), 1713–1726. doi:10.1080/00207548808947986
- Polanyi, M. (1958). *Personal Knowledge*. New York: Routledge & Kegan Paul.
- Polanyi, M. (1966). *The tacit dimension*. London: Routledge and Kegan Paul.
- Polat, I. H., Akser, M., & Uzunoglu, S. (2014, November 3–5). The Impacts of Tablet Use for Eliminating the Time-Space Barriers in University Education: A Turkish Experience. *Proceedings of the 13th World Conference on Mobile and Contextual Learning mLearn 2014, Istanbul, Turkey* (pp. 212-221). Springer.
- Politis, J. D. (2003). The connection between trust and knowledge management: What are its implications for team performance. *Journal of Knowledge Management*, 7(5), 55–66. doi:10.1108/13673270310505386
- Ponis, S. T., & Koronis, E. (2012). Supply chain resilience: Definition of concept and its formative elements. *Journal of Applied Business Research*, 28(5), 921–930.
- Ponomarov, S. Y., & Holcomb, M. C. (2009). Understanding the concept of supply chain resilience. *The International Journal of Logistics Management*, 20(1), 124–143. doi:10.1108/09574090910954873

Compilation of References

- Popa, V., & Barna, M. (2013). The financial supply chain management. *Supply Chain Management Journal*, 4(1), 8–25.
- Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8), 707–725. doi:10.1002/smj.249
- Porter, L. W., Steers, R. M., Mowday, R. T., & Boulian, P. V. (1974). Organizational commitment, job satisfaction, and turnover among psychiatric technicians. *The Journal of Applied Psychology*, 59(5), 603–609. doi:10.1037/h0037335
- Porter, M. E. (1985). *Competitive advantage* (Vol. 15). New York: Free Press.
- Porter, M. E. (1998). *Competitive Advantage of Nations*. New York: Free Press.
- Porter, M. E. (2004). *Competitive Advantage*. New York: Free Press.
- Porter, M. K., & Kramer, M. R. (2006). Strategy & Society—The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review*, 84(6), 78–92. PMID:17183795
- Potter, F. (2005, January). The Informing Framework. *Strategic Finance Magazine*, 25–31.
- POWER SWOT. (2014). SWOT Analysis- POWER SWOT. Retrieved from <http://www.marketingteacher.com>
- Prahalad, C. K., & Hamel, G. (1990). *The core competence of the corporation*. Boston.
- Prahalad, C. K., & Hamel, G. (1990). The Core Competence of the Corporation. *Harvard Business Review*, 68(3), 79–91.
- Premkumar, G. P. (2000). Interorganization systems and supply chain management. *Information Systems Management*, 17(3), 56–69. doi:10.1201/1078/43192.17.3.20000601/31241.8
- Preuss, L. (2009). Ethical Sourcing Codes of Large UK-Based Corporations: Prevalence, Content, Limitations. *Journal of Business Ethics*, 88(4), 735–747. doi:10.1007/s10551-008-9978-7
- Priem, R. L., & Swink, M. (2012). A Demand-side Perspective on Supply Chain Management. *Journal of Supply Chain Management*, 48(2), 7–13. doi:10.1111/j.1745-493X.2012.03264.x
- Pruitt, D. G. (1981). *Negotiation Behavior*. New York: Academic Press.
- Pryke, S. (Ed.), (2009). *Construction Supply Chain Management* (1st ed.). Chichester: Blackwell Publishing. doi:10.1002/9781444320916
- Puccinelli, N. M., Goodstein, R. C., Grewal, D., Price, R., Raghubir, P., & Stewart, D. (2009). Customer experience management in retailing: Understanding the buying process. *Journal of Retailing*, 85(1), 15–30. doi:10.1016/j.jretai.2008.11.003
- Puertas, R., Martí, L., & García, L. (2014). Logistics performance and export competitiveness: European experience. *Empirica*, 41(3), 467–480. doi:10.1007/s10663-013-9241-z
- Pullman, M., & Wu, Z. (2012). *Food Supply Chain Management—Economic, Social, and Environmental Perspectives*.
- Purnell, N. (2014). Samsung Considers Cellphone Production in Indonesia. *Wall Street Journal*. Retrieved from <http://online.wsj.com/articles/samsung-considers-cellphone-production-in-indonesia-1408364492>
- Puschmann, T., & Alt, R. (2005). Successful use of e-procurement in supply chains. *Supply Chain Management: An International Journal*, 10(2), 122–133. doi:10.1108/13598540510589197
- Qrunfleh, S., & Tarafdar, M. (2013). Lean and agile supply chain strategies and supply chain responsiveness: The role of strategic supplier partnership and postponement. *Supply Chain Management: An International Journal*, 18(6), 571–582. doi:10.1108/SCM-01-2013-0015

Compilation of References

- Quelch, J. A., & Kenny, D. (1994). Extend profits, not product lines. *Harvard Business Review*, 72(5), 153–160.
- Quintas, P., Lefrere, P., & Jones, G. (1997). Knowledge management: A strategic agenda. *Long Range Planning*, 30(3), 385–391. doi:10.1016/S0024-6301(97)90252-1
- Rabelo, L., Helal, M., Jones, J., & Min, H.-S. (2005). Enterprise simulation: A hybrid system approach. *International Journal of Computer Integrated Manufacturing*, 18(6), 498–508. doi:10.1080/09511920400030138
- Rahimifard, S., & Clegg, A. J. (2007). Aspects of Sustainable Design and Manufacture. *International Journal of Production Research*, 45(18-19), 4013–4019. doi:10.1080/00207540701608511
- Rahman, A., Brookes, N. J., & Bennett, D. J. (2009). The precursors and impacts of BSR on AMT acquisition and implementation. *IEEE Transactions on Engineering Management*, 56(2), 285–297. doi:10.1109/TEM.2009.2016070
- Rai, A., Borah, S., & Ramaprasad, A. (1996). Critical success factors for strategic alliances in the information technology industry: An empirical study. *Decision Sciences*, 27(1), 141–155. doi:10.1111/j.1540-5915.1996.tb00848.x
- Rajagopal, S., & Chadwick, T. (1997). *Strategic supply management: An implementation toolkit*. Oxford: Butterworth-Heinemann.
- Ralston, D. A., Gustafson, D. J., Cheung, F. M., & Terpstra, R. H. (1993). Differences in Managerial Values - a Study of United-States, Hong-Kong and PRC Managers. *Journal of International Business Studies*, 24(2), 249–275. doi:10.1057/palgrave.jibs.8490232
- Ralston, D. A., Holt, D. H., Terpstra, R. H., & Kai-cheng, Y. (1997). The impact of national culture and economic ideology on managerial work values: A study of the United States, Russia, Japan, and China. *Journal of International Business Studies*, 28(1), 177–207. doi:10.1057/palgrave.jibs.8490097
- Ram, M., Smallbone, D., & Linneker, B. (2002). *Assessing the Potential of Supplier Diversity Initiatives as a Means of Promoting Diversification among Ethnic Minority Businesses in the UK*. Small Business Service.
- Ramanathan, U., & Gunasekaran, A. (2014). Supply chain collaboration: Impact of success in long-term partnerships. *International Journal of Production Economics*, 147 Part B, 252-259.
- Ramanathan, U., Bentley, Y., & Pang, G. (2014). The role of collaboration in the UK green supply chains: An exploratory study of the perspectives of suppliers, logistics and retailers. *Journal of Cleaner Production*, 70(0), 231–241. doi:10.1016/j.jclepro.2014.02.026
- Ramesh, D. (2009). Cost Cutting Becomes the Pharma Industry's Mantra. *Chemical Week*, October, 24–28.
- Ram, M., & Smallbone, D. (2003). Supplier Diversity Initiatives and the Diversification of Ethnic Minority Businesses in the UK. *Policy Studies*, 24(4), 187–204. doi:10.1080/0144287042000216117
- Rammelmeier, T., Galka, S., & Günthner, W. A. (2012). *Fehlervermeidung in der Kommissionierung* (Vol. 2012). Logistics Journal Proceedings.
- Randall, W. S., Gibson, B. J., Clifford Defee, C., & Williams, B. D. (2011). Retail supply chain management: Key priorities and practices. *The International Journal of Logistics Management*, 22(3), 390–402. doi:10.1108/09574091111181381
- Rangel, D. A., Oliveira, T. K., & Leite, M. S. A. (2014). Supply chain risk classification: Discussion and proposal. *International Journal of Production Research*, 1–20. doi:10.1080/00207543.2014.910620
- Rankina, A., Gray, A. W., Boehlje, M. D., & Alexander, C. (2011). Sustainability Strategies in US Agribusiness: Understanding Key Drivers, Objectives, and Actions. *International Food and Agribusiness Management Review*, 14(4), 1–20. Retrieved from <http://www.ifama.org/files/14i4.pdf#page=7>

Compilation of References

- Rao Tummala, V. M., Phillips, C. L. M., & Johnson, M. (2006). Assessing supply chain management success factors: A case study. *Supply Chain Management: An International Journal*, 11(2), 179–192. doi:10.1108/13598540610652573
- Rao, P., & Holt, D. (2005). Do Green Supply Chains Lead to Competitiveness and Economic Performance? *International Journal of Operations & Production Management*, 25(9), 898–916. doi:10.1108/01443570510613956
- RAVAS. (2013). *RAVAS-6100 Hubwaage Produktblatt*. Retrieved from <http://www.ravas.com/images/stories/latest/ts-spr-ravas-spr-web-ravas-6100-de-eu-latest.pdf>
- Reach for the Skies Report (2014). Industry and Government working together to secure the future for UK Aerospace: A Strategic Vision for UK Aerospace. *ADS, Aerospace Growth Partnership, and Department for Business Innovation & Skills*.
- Reck, R. F., & Long, B. C. (1988). Purchasing: A competitive weapon. *Journal of Purchasing and Material Management*, 24(3), 2–8.
- Redman, T. C. (2013). Data Quality Management Past, Present, and Future: Towards a Management System for Data. In *Handbook of Data Quality* (pp. 15–40). Berlin, Heidelberg: Springer.
- Reefke, H., Sundaram, D., & Ahmed, M. D. (2010). Maturity Progression Model for Sustainable Supply Chains. In W. Dangelmaier, A. Blecken, R. Delius, & S. Klöpfer (Eds.), *Advanced Manufacturing and Sustainable Logistics* (Vol. 46, pp. 308-319): Springer Berlin Heidelberg. Retrieved from doi:10.1007/978-3-642-12494-5_28
- Reid, S. (1981). The decision-maker and export entry and expansion. *Journal of International Business Studies*, 12(2), 101–112. doi:10.1057/palgrave.jibs.8490581
- Reid, W. V., Chen, D., Goldfarb, L., Hackmann, H., Lee, Y. T., Mokhele, K., & Whyte, A. (2010). Earth system science for global sustainability: Grand challenges. *Science*, 330(6006), 916–917. doi:10.1126/science.1196263 PMID:21071651
- Reif, R., Günthner, W. A., Schwerdtfeger, B., & Klinker, G. (2010). Evaluation of an Augmented Reality Supported Picking System Under Practical Conditions. *Computer Graphics Forum*, 29(1), 2–12. doi:10.1111/j.1467-8659.2009.01538.x
- Reinartz, W., Dellaert, B., Krafft, M., Kumar, V., & Varadarajan, R. (2011). Retailing innovations in a globalizing retail market environment. *Journal of Retailing*, 87, 53–66. doi:10.1016/j.jretai.2011.04.009
- Reiner, G. (2005). Customer-Oriented improvement and evaluation of supply chain processes supported by simulation models. *International Journal of Production Economics*, 96(3), 381–395. doi:10.1016/j.ijpe.2004.07.004
- Rekik, Y., Sahin, E., & Dallery, Y. (2008). Analysis of the impact of the RFID technology on reducing product misplacement errors at retail stores. *International Journal of Production Economics*, 112(1), 264–278. doi:10.1016/j.ijpe.2006.08.024
- Ren, J., Yusuf, Y. Y., & Burns, N. D. (2009). A decision-support framework for agile enterprise partnering. *International Journal of Advanced Manufacturing Technology*, 41(1-2), 180–192. doi:10.1007/s00170-008-1443-3
- Reutterer, T., & Kotzab, H. W. (2000). The use of conjoint-analysis for measuring preferences in supply chain design. *Industrial Marketing Management*, 29(1), 27–35. doi:10.1016/S0019-8501(99)00109-1
- RFIC. (2014). Rutgers Food Innovation Center. Retrieved from <http://foodinnovation.rutgers.edu>
- Rice, J. B., & Caniato, F. (2003, September/October). Building a secure and resilient supply network. *Supply Chain Management Review*, 7(5), 22–30.
- Richards, K., & Jones, E. (2007). Relationship effectiveness and key account performance: Assessing interfirm fit between buying and selling organizations. *AMA Winter Educators' Conference Proceedings*, Houston. American Marketing Association.

Compilation of References

- Richey, R. G. Jr, Roath, A. S., Whipple, J. M., & Fawcett, S. E. (2010). Exploring a governance theory of supply chain management: Barriers and facilitators to integration. *Journal of Business Logistics*, *31*(1), 237–256. doi:10.1002/j.2158-1592.2010.tb00137.x
- Richey, R. G., Tokman, M., & Wheeler, A. R. (2006). A supply chain manager selection methodology: Empirical test and suggested application. *Journal of Business Logistics*, *27*(2), 163–190. doi:10.1002/j.2158-1592.2006.tb00221.x
- Richter, A., & Niewiem, S. (2009). Knowledge transfer across permeable boundaries: An empirical study of clients' decisions to involve management consultants. *Scandinavian Journal of Management*, *25*(3), 275–288. doi:10.1016/j.scaman.2009.05.007
- Riemann, U. (2013). Value-chain oriented identification of indicators to establish a comprehensive process improvement framework. *International Journal of Managing Value and Supply Chains*, *4*(3), 55–67. doi:10.5121/ijmvsc.2013.4306
- Rigby, D. (2011). The future of shopping. *Harvard Business Review*, December.
- Rindfleisch, A., Antia, K., Bercovitz, J., Brown, J. R., Cannon, J., Carson, S. J., & Wathne, K. H. et al. (2010). Transaction cost, opportunism, and governance: Contextual considerations and future research opportunities. *Marketing Letters*, *21*(3), 211–222. doi:10.1007/s11002-010-9104-3
- Rindfleisch, A., & Heide, J. B. (1997). Transaction cost analysis: Past, present and future applications. *Journal of Marketing*, *61*(4), 30–54. doi:10.2307/1252085
- Ring, S. P., & Van de Ven, A. (1994). Developmental process of cooperative interorganizational relationships. *Academy of Management Review*, *19*, 90–118.
- Riordan, M. H., & Williamson, O. E. (1985). Asset specificity and economic organization. *International Journal of Industrial Organization*, *3*(4), 365–378. doi:10.1016/0167-7187(85)90030-X
- Ritchie, B., & Brindley, C. (2000). The information-risk conundrum. *Marketing Intelligence & Planning*, *19*(1), 29–37. doi:10.1108/02634500110363781
- Ritchie, B., & Brindley, C. (2007). An emergent framework for supply chain risk management and performance measurement. *The Journal of the Operational Research Society*, *58*(special issue), 1398–1411. doi:10.1057/palgrave.jors.2602412
- Robb, D. J., Xie, B., & Arthanari, T. (2008). Supply chain and operations practice and performance in Chinese furniture manufacturing. *International Journal of Production Economics*, *112*(2), 683–699. doi:10.1016/j.ijpe.2007.04.011
- Roberti, M. (2005). RFID will help keep perishables fresh. Retrieved from RFID Journal website: <http://www.rfidjournal.com/articles/view?1775>
- Robinson, P. J., & Faris, C. W. (1967). *Industrial Buying and Creative Marketing*. Boston: Allyn & Bacon.
- Rockart, J. F. (1982). The changing role of the information systems executive: A critical success factors perspective. *Sloan Management Review*, *24*(1), 3–13.
- Rogani, J. F. (2007). Library consortia and digital services. *New Library World*, *108*(11/12), 504–525. doi:10.1108/03074800710838254
- Roh, J. J., Min, H., & Hong, P. (2011). A co-ordination theory approach to restructuring the supply chain: An empirical study from the focal company perspective. *International Journal of Production Research*, *49*(15), 4517–4541. doi:10.1080/00207543.2010.497506
- Roh, J., Hong, P., & Min, H. (2014). Implementation of a responsive supply chain strategy in global complexity: The case of manufacturing firms. *International Journal of Production Economics*, *147*, 198–210. doi:10.1016/j.ijpe.2013.04.013

Compilation of References

- Ronen, D. (1990). Inventory Centralization/Decentralization – The Square Root Law Revisited Again. *Journal of Business Logistics*, 11(2), 129–138.
- Rosettanet. (2012). *Overview: Clusters, segments, and PIPS*. Retrieved from <http://www.rosettanet.org>
- Ross, D. F. (1997). *Competing through supply chain management: creating market-winning strategies through supply chain partnerships*. London: Chapman & Hall.
- Rossetti, C., & Choi, Y. T. (2005). *On the dark side of strategic sourcing: experiences from the Aerospace Industry* (Vol. 19). Academy of Management Executives.
- Ross, S. A. (1973). The economic theory of agency: The principal's problem. *The American Economic Review*, 63(2), 134–139.
- Roussos, G. (2006). Enabling RFID in retail. *Computer*, 39(3), 25–30. doi:10.1109/MC.2006.88
- Rowley, J. (1999). What is Knowledge Management? *Library Management*, 20(8), 416–420. doi:10.1108/01435129910291175
- Rowley, J. (2007). The wisdom hierarchy: Representations of the DIKW hierarchy. *Journal of Information Science*, 33(2), 163–180. doi:10.1177/0165551506070706
- Royal Society. (1992). *Risk: Analysis, perception and management*. Royal Society Study Group.
- Ruamsok, K., Russell, D., & Thomnick, E. (2007). U.S. sourcing from low-cost countries: A comparative analysis of supplier performance. *The Journal of Supply Chain Management*, 43(4), 16–30. doi:10.1111/j.1745-493X.2007.00038.x
- Ruamsok, K., Russell, D., & Thomnick, E. (2009). Sourcing from low-cost countries: Identifying sourcing issues and prioritizing impacts on logistics performance. *The International Journal of Logistics Management*, 2(1), 79–96. doi:10.1108/09574090910954855
- Rumelt, R. P. (1984). Towards a strategic theory of the firm. In R. Lamb (Ed.), *Competitive strategic management*. Englewood Cliffs, NJ: Prentice-Hall.
- Rutten, R., Benneworth, P., Irawati, D., & Boekema, F. (Eds.). (2014). *The Social Dynamics of Innovation Networks*. Routledge.
- Ryan, R. M., & Deci, E. L. (2000). Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions. *Contemporary Educational Psychology*, 25(1), 54–67. doi:10.1006/ceps.1999.1020 PMID:10620381
- Ryu, S., Park, J. E., & Min, S. (2007). Factors of determining long-term orientation in interfirm relationships. *Journal of Business Research*, 60(12), 1225–1233. doi:10.1016/j.jbusres.2006.09.031
- Saaty, T. L. (1980). *The Analytic Hierarchy Process*. New York: McGraw-Hill.
- Saaty, T. L. (1996). *Decision Making with Dependence and Feedback: The Analytic Network Process*. Pittsburgh, PA: RWS Publications.
- Saaty, T. L., & Vargas, L. G. (2012). *Models, Methods, Concepts & Applications of the Analytic Hierarchy Process* (2nd ed.). New York: Springer. doi:10.1007/978-1-4614-3597-6
- Saberi, S., Shahandeh Nookabadi, A., & Reza Hejazi, S. (2012). Applying agent-based system and negotiation mechanism in improvement of inventory management and customer order fulfillment in multiechelon supply chain. *Arabian Journal for Science and Engineering*, 37(3), 851–861. doi:10.1007/s13369-012-0197-2
- Sabherwal, R., & Becerra-Fernandez, I. (2003). An empirical study of the effect of knowledge management processes at individual, group and organisational levels. *Decision Sciences*, 34(2), 225–255. doi:10.1111/1540-5915.02329

Compilation of References

- Saccani, N., & Perona, M. (2007). Shaping buyer–supplier relationships in manufacturing contexts: Design and test of a contingency model. *Journal of Purchasing and Supply Management*, 13(1), 26–41. doi:10.1016/j.pursup.2007.03.003
- Sadeghi Moghadam, M. R., Afsar, A., & Sohrabi, B. (2008). Inventory lot-sizing with supplier selection using a hybrid intelligent algorithm. *Applied Soft Computing*, 8(4), 1523–1529. doi:10.1016/j.asoc.2007.11.001
- Sadiq, S. (Ed.), (2013). *Handbook of Data Quality*. New York: Springer. doi:10.1007/978-3-642-36257-6
- Sahay, B. S. (2003). Supply chain collaboration: The key to value creation. *Work Study*, 52(2), 76–83. doi:10.1108/00438020310462872
- Sahin, E., Zied Babai, M., Dallery, Y., & Vaillant, R. (2007). Ensuring supply chain safety through time temperature integrators. *The International Journal of Logistics Management*, 18(1), 102–124. doi:10.1108/09574090710748199
- Sahin, F., & Robinson, E. P. Jr. (2005). Information sharing and coordination in make-to-order supply chains. *Journal of Operations Management*, 23(6), 579–598. doi:10.1016/j.jom.2004.08.007
- Salam, M. A. (2005, October 29-30). Achieving competitive advantage through managing supply chain excellence: The case of Thai garment industry. *Proceedings of International Conference on Computer and Industrial Management (ICIM)*, Bangkok, Thailand.
- Salinger, J. H. (2013). Economic Development Policies through Business Incubation and Co-working: A Study of San Francisco and New York City.
- Salvador, F., Rungtusanatham, M., & Forza, C. (2004, June). Supply-chain configurations for mass customization. *Production Planning and Control*, 15(4), 381–397. doi:10.1080/0953728042000238818
- Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options. *Management Information Systems Quarterly*, 27(2), 237–263.
- Sampson, R. C. (2004). The cost of misaligned governance in R&D alliances. *Journal of Law Economics and Organization*, 20(2), 484–526. doi:10.1093/jleo/ewh043
- Samsung. (2010). Samsung's annual report 2010.
- Samsung. (2011). *Samsung Electronics' Business Report Q2 2011*. Retrieved from http://www.samsung.com/us/about-samsung/investor_relations/financial_information/business_report.html
- Samsung. (2013a). *Sustainability Report 2013*. Retrieved from http://www.samsung.com/common/aboutsamsung/download/companyreports/2013_Sustainability_Report.pdf
- Samsung. (2013b). *Samsung Electronics Annual Report 2013*.
- Samsung. (2014a) *Sustainability Report 2014*. Retrieved from <http://www.samsung.com/us/aboutsamsung/sustainability/sustainabilityreports/sustainabilityreports2014.pdf>
- Samsung. (2014b). *Samsung Business Report 2014 Q1*. Retrieved from http://www.samsung.com/us/aboutsamsung/investor_relations/financial_information/business_report.html
- Samsung. (2014c). *Business Overview*. Retrieved from <http://www.samsung.com/global/business/semiconductor/aboutus/business/factsheet>
- Samsung. (2014d). *About Samsung India*. Retrieved from <http://www.samsung.com/in/aboutsamsung/samsungelectronics/india/manufacturing.html>

Compilation of References

Samsung. (2014e). *Business Overview*. Retrieved from <http://www.samsung.com/global/business/semiconductor/aboutus/business/factsheet>

Samsung. (2014f). *About Samsung*. Retrieved from <http://www.samsung.com/us/aboutsamsung/corporateprofile/history04.html>

Samuel, K. E., Goury, M. L., Gunasekaran, A., & Spalanzani, A. (2011). Knowledge management in supply chain: An empirical study from France. *The Journal of Strategic Information Systems*, 20(3), 283–306. doi:10.1016/j.jsis.2010.11.001

Sánchez-Díaz, I., Holguín-Veras, J., & Wang, X. (2014). An exploratory analysis of spatial effects on freight trip attraction. *Transportation*, (pp. 1–20).

Sandeem, M. (2013, March 11). *Louisiana facing highest sea level rise on earth*. Retrieved from <http://sustainabletransition.blogspot.com/2013/03/louisiana-facing-highest-sea-level-rise.html>

Sanders, N. R. (2007). An empirical study of the impact of e-business technologies on organizational collaboration and performance. *Journal of Operations Management*, 25(6), 1332–1347. doi:10.1016/j.jom.2007.01.008

Sanders, N. R. (2012). *Supply Chain Management: A Global Perspective*. New York: John Wiley & Sons, Inc.

Sarac, A., Absi, N., & Dauzère-Pérès, S. (2010). A literature review on the impact of RFID technologies on supply chain management. *International Journal of Production Economics*, 128(1), 77–95. doi:10.1016/j.ijpe.2010.07.039

Sari, K. (2008). On the benefits of CPFR and VMI: A comparative simulation study. *International Journal of Production Economics*, 113(2), 575–586. doi:10.1016/j.ijpe.2007.10.021

Sarkar, A., & Mohapatra, P. (2006). Evaluation of supplier capability and performance: A method for supply base reduction. *Journal of Purchasing and Supply Management*, 12(12), 148–163. doi:10.1016/j.pursup.2006.08.003

Sarkis, J. (2012). A Boundaries and Flow Perspective of Green supply Chain Management. *Supply Chain Management*, 17(2), 202–216. doi:10.1108/13598541211212924

Sarkis, J., & Dijkshoorn, J. (2007). Relationship between Solid Waste Management Performance and Environmental Practice Adoption in Welsh Small and Medium Size Enterprises (SME's). *International Journal of Production Research*, 45(21), 4989–5015. doi:10.1080/00207540600690529

Sarkis, J., & Talluri, S. (2002). A model for strategic supplier selection. *Journal of Supply Chain Management*, 38(1), 18–28. doi:10.1111/j.1745-493X.2002.tb00117.x

Sartori, S., Latrônico, F., & Campos, L. M. S. (2014). Sustainability and sustainable development: a taxonomy in the field of literature. *Ambiente & Sociedade*, 17(1), 01-22. Retrieved from http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1414-753X2014000100002&lng=en&tlng=en

Saunders, M. (1994). *Strategic purchasing and supply chain management*. London: Pitman Publishing.

Savage, N. (2012). Gaining wisdom from crowds. *Communications of the ACM*, 55(3), 13. doi:10.1145/2093548.2093553

SCC. (2012). *Supply Chain Operations Reference Model Version 11*. Pittsburgh: Supply Chain Council Inc.

Scharl, A., Kuljis, J., Thomas, P. J., & Paul, R. J. (2000). *Evolutionary web development*. New York: Springer-Verlag, Inc. doi:10.1007/978-1-4471-0517-6

Schmid, B. F., & Lindemann, M. A. (1998, January). Elements of a reference model for electronic markets. In *System Sciences, Proceedings of the Thirty-First Hawaii International Conference* (Vol. 4, pp. 193-201). IEEE. doi:10.1109/HICSS.1998.655275

Compilation of References

- Schmitt, B. (1999). Experiential Marketing. *Journal of Marketing Management*, 15(1-3), 53–67. doi:10.1362/026725799784870496
- Schoen, L. T. (2010). Teaching out of the box: 20 Research-based Principles to Guide the Transition to High Quality Online Graduate Programs. *EDUCAUSE Southeast Regional Conference*, June.
- Scholtens, B., & Dam, L. (2007). Banking on the Equator. Are Banks that Adopted the Equator Principles Different from Non-Adopters? *World Development*, 35(8), 1307–1328. doi:10.1016/j.worlddev.2006.10.013
- Schulze, B., Spiller, A., & Wocken, C. (2006). Supplier relationship quality in German pork and dairy sector: Theoretical considerations and empirical evidence. Paper Presented at the 16th Annual.
- Schurr, P. H., & Ozanne, J. L. (1985). Influence on exchange processes: Buyers' preconceptions of a seller's truth worthiness and bargaining toughness. *The Journal of Consumer Research*, 11(4), 939–953. doi:10.1086/209028
- Schwerdtfeger, B., Reif, R., Gunthner, W. A., Klinker, G., Hamacher, D., Schega, L., . . . Tumler, J. (2009). Pick-by-Vision: A first stress test. *Proceedings of the 2009 8th IEEE International Symposium on Mixed and Augmented Reality* (pp. 115–124). doi:10.1109/ISMAR.2009.5336484
- Scott, C., & Westbrook, R. (1991). New strategic tools for supply chain management. *International Journal of Physical Distribution & Logistics Management*, 21(1), 23–33. doi:10.1108/09600039110002225
- SDMI. (2014). Stephenson Disaster Management Institute. Retrieved from <http://sdmi.lsu.edu>
- Seale, C. (Ed.). (2004). *Social research methods: A reader*. London: Routledge.
- Sebastian-Coleman, L. (2012). *Measuring Data Quality for Ongoing Improvement: A Data Quality Assessment Framework*. New York: Newnes.
- Secchi, D. (2010). *Extendable Rationality: Understanding Decision Making in Organizations*. New York: Springer.
- SEI. (2014). Stephenson Entrepreneurship Institute. Retrieved from <http://www.business.lsu.edu/Stephenson-Entrepreneurship-Institute/Pages/SEI.aspx>
- Selviaridis, K., & Spring, M. (2007). Third party logistics: A literature review and research agenda. *International Journal of Logistics Management*, 18(1), 125–150.
- Şen, C. G., Şen, S., & Başlıgil, H. (2010). Pre-selection of suppliers through an integrated fuzzy analytic hierarchy process and max-min methodology. *International Journal of Production Research*, 48(6), 1603–1625. doi:10.1080/00207540802577946
- Senge, P. M. (1990). *The Fifth Discipline*. New York: Doubleday/Century.
- Serdarasan, S. (2013). A review of supply chain complexity drivers. *Computers & Industrial Engineering*, 66(3), 533–540. doi:10.1016/j.cie.2012.12.008
- Seuring, S., & Müller, M. (2008). From a literature review to a conceptual framework for sustainable supply chain management. *Journal of Cleaner Production*, 16(15), 1699–1710. doi:10.1016/j.jclepro.2008.04.020
- Shackleton, S. (2014). Impacts of Climate Change on Food Availability: Non-Timber Forest Products. In *Global Environmental Change* (pp. 695–700). Springer Netherlands. doi:10.1007/978-94-007-5784-4_117
- Shadur, M. A., & Bamber, G. J. (1994). Toward lean management? International transferability of Japanese management strategies to Australia. *The International Executive*, 36(3), 343–364. doi:10.1002/tie.5060360307

Compilation of References

- Shafieezadeh, M., & Sadegheih, A. (2014). Developing an integrated inventory management model for multi-item multi-echelon supply chain. *International Journal of Advanced Manufacturing Technology*, 72(5-8), 1099–1119. doi:10.1007/s00170-014-5684-z
- Shah, J., & Ghosh, D. (2010). Business strategy drives supply chains. *Economic Times*, 1-2.
- Shah, J. (2009). *Supply Chain Management: Text and Cases*. Delhi, India: Pearson Education.
- Shah, J., & Ghosh, D. (2011). *Decoding Supply Chain Leadership in India in Managing Supply Chains on the Silk Road: Strategy, Performance, and Risk*. London: Taylor and Francis.
- Shah, M., & Ram, M. (2006). Supplier Diversity and Minority Business Enterprise Development: Case Study Experience of Three US Multinationals. *Supply Chain Management: An International Journal*, 11(1), 75–81. doi:10.1108/13598540610642493
- Sharifi, H., Ismail, H. S., Qiu, J., & Najafi Tavani, S. (2013). Supply chain strategy and its impacts on product and market growth strategies: A case study of SMEs. *International Journal of Production Economics*, 14(1), 397–408. doi:10.1016/j.ijpe.2013.05.005
- Sharma, M. M. (2013). A Study on the Concept of Green Supply Chain Management. *Journal of Supply Chain Management Systems*, 2(1), 1–7.
- Sharp, H., Baddoo, N., Beecham, S., Hall, T., & Robinson, H. (2009). Models of motivation in software engineering. *Information and Software Technology*, 51(1), 219–233. doi:10.1016/j.infsof.2008.05.009
- Shaw, G., & Williams, A. (2009). Knowledge transfer and management in tourism organisations: An emerging research agenda. *Tourism Management*, 30(3), 325–335. doi:10.1016/j.tourman.2008.02.023
- Sheffi, Y. (2005b). Manage risk through resilience: CEOs should build a culture that copes with the unforeseen. *Chief Executive Group*. Retrieved from <http://www.arts.ac.uk/study-at-ual/library-services/e-library/>
- Sheffi, Y., & Rice Jr, J. B. (2005). A supply chain view of the resilient enterprise. *MIT Sloan Management Review*, 47(1).
- Sheffi, Y. (2005a). Building a resilient supply chain. *Harvard Business Review Supply Chain Strategy*, 1(5), 1–4.
- Sheffi, Y. (2005c). *The resilient enterprise: overcoming vulnerability for competitive advantage*. Cambridge, MA: MIT Press Books.
- Shelanski, H., & Klein, P. (1995). Empirical research in transaction cost economics: A review and assessment. *Journal of Law Economics and Organization*, 11, 335–361.
- Sher, M. M., & Kim, S. L. (2014). Supply chain coordination with quantity discount for seasonal demand. *International Journal of Supply Chain Management*, 3(3), 7–15.
- Sherman, R. J. (1998). Collaborative Planning, Forecasting & Replenishment (CPFR): Realizing the Promise of Efficient Consumer Response through Collaborative Technology. *Journal of Marketing Theory and Practice*, 6(4), 6–9. doi:10.2307/40469932?ref=no-x-route:9763fcd626c965e59e9abc17783faa9b
- Shervani, T. A., Frazier, G., & Challagalla, G. (2007). The moderating influence of firm market power on the transaction cost economics model: An empirical test in a forward channel integration context. *Strategic Management Journal*, 28(6), 635–652. doi:10.1002/smj.585
- Sheth, J. N. (1973). A model of industrial buyer behavior. *Journal of Marketing*, 37(4), 50–56. doi:10.2307/1250358

Compilation of References

- Sheth, J. N. (1996). Organizational buying behavior: Past performances and future expectations. *Journal of Business and Industrial Marketing*, 11(3/4), 7–24. doi:10.1108/08858629610125441
- Sheth, J., & Parvatiyar, A. (1992). Towards a theory of business alliance formation. *Scandinavian International Business Review*, 1(3), 71–87. doi:10.1016/0962-9262(92)90012-U
- Sheu, C., Rebecca Yen, H. J., & Chae, B. (2006). Determinants of supplier-retailer collaboration: Evidence from an international study. *International Journal of Operations & Production Management*, 26(1), 24–49. doi:10.1108/01443570610637003
- Shih, S. C., Hsu, S., Zhu, Z., & Balasubramanian, S. (2012). Knowledge sharing: A key role in the downstream supply chain. *Information & Management*, 49(2), 70–80. doi:10.1016/j.im.2012.01.001
- Shi, J., Zhang, J., & Qu, X. (2010). Optimizing distribution strategy for perishable foods using RFID and sensor technologies. *Journal of Business and Industrial Marketing*, 25(8), 596–606. doi:10.1108/08858621011088338
- Shi, Y., & Gregory, M. (1998). International manufacturing networks – to develop global competitive capabilities. *Journal of Operations Management*, 16(2), 195–214.
- Shook, C. L., Adams, G. L., Ketchen, D. J. Jr, & Craighead, C. W. (2009). Towards a “theoretical toolbox” for strategic sourcing. *Supply Chain Management: An International Journal*, 14(1), 3–10. doi:10.1108/13598540910927250
- Shoushtari, K. D. (2013). Redesigning a large supply chain management system to reduce the government administration: A socio-functional systems approach. *Systemic Practice and Action Research*, 26(2), 195–216. doi:10.1007/s11213-012-9244-x
- Shrivastava, P. (1995). The Role of Corporations in Achieving Ecological Sustainability. *Academy of Management Review*, 20(4), 936–960. doi:10.2307/258961
- SI. (2014). Student Incubator at Louisiana State University. Retrieved from <https://sites01.lsu.edu/wp/innovationpark/about-lbtc/lsu-student-incubator/>
- Siddiqui, F., Haleem, A., & Sharma, C. (2012). The impact of supply chain management practices in total quality management practices and flexible system practices context: An empirical study in oil and gas industry. *Global Journal of Flexible Systems Management*, 13(1), 11–23. doi:10.1007/s40171-012-0002-9
- Siegel, D. S., & Vitaliano, D. F. (2007). An Empirical Analysis of the Strategic Use of Corporate Social Responsibility. *Journal of Economics & Management Strategy*, 16(3), 773–792. doi:10.1111/j.1530-9134.2007.00157.x
- Sigué, S. P., & Bonsu, S. K. (2012). Influence strategies and channel member satisfaction in Cameroon. *Journal of African Business*, 13(3), 200–208. doi:10.1080/15228916.2012.727747
- Silverman, D. (1993). *Interpreting qualitative data: Methods for analysing talk, text and interaction*. London: Sage.
- Simatupang, T. M., & Sridharan, R. (2002). The collaborative supply chain. *The International Journal of Logistics Management*, 13(1), 15–30. doi:10.1108/09574090210806333
- Simatupang, T. M., & Sridharan, R. (2004). Benchmarking supply chain collaboration: An empirical study. *Benchmarking: An International Journal*, 11(5), 484–503. doi:10.1108/14635770410557717
- Simatupang, T. M., & Sridharan, R. (2005). An integrative framework for supply chain collaboration. *International Journal of Logistics Management*, 16(2), 257–274. doi:10.1108/09574090510634548
- Simatupang, T. M., & Sridharan, R. (2005a). The collaboration index: A measure for supply chain collaboration. *International Journal of Physical Distribution & Logistics Management*, 35(1), 44–62. doi:10.1108/09600030510577421

Compilation of References

- Simchi-Levi, D. (2005). *Designing and managing the supply chain*. New York: McGraw-Hill College.
- Simchi-Levi, D. A., Kaminsky, P. A., & Simchi-Levi, E. (2003). *Designing and managing the supply chain: Concepts, strategies, and case studies*. New York, NY: McGraw-Hill.
- Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2000). *Designing and Managing The Supply chain: Concept, Strategies and Case Studies*. New York: Mc Graw Hill.
- Simchi-Levi, D., Simchi-Levi, E., & Kaminsky, P. (1999). *Designing and Managing the Supply Chain: Concepts, Strategies and Case*. New York: McGraw-Hill.
- Simon, H. (1957a). *Models of Man*. New York: John Wiley and Sons.
- Simon, H. (1957b). *Administrative Behavior*. New York: Macmillan.
- Simon, H. (1978). Rationality as process of and as product of thought. *The American Economic Review*, 68(2), 1–16.
- Simon, H. A. (1971). Designing Organizations for an Information Rich World. In M. Greeberger (Ed.), *Computers, Communications, and the Public Interest* (pp. 38–52). Baltimore, MD: The Johns Hopkins Press.
- Simon, H. A. (1993). 'Altruism and Economics'. *The American Economic Review*, 83(2), 156–161.
- Simon, H. A. (1993). Altruism and Economics. *The American Economic Review*, 83(2), 156–161.
- Simon, H., Smithburg, D., & Thompson, V. (1950). *Public Administration*. New York: Knopf.
- Simonin, B. L. (2004). An empirical investigation of the process of knowledge transfer in international strategic alliances. *Journal of International Business Studies*, 35(5), 407–427. doi:10.1057/palgrave.jibs.8400091
- Singh Srani, J., & Gregory, M. (2008). A supply network configuration perspective on international supply chain development. *International Journal of Operations & Production Management*, 28(5), 386–411. doi:10.1108/01443570810867178
- Singh, J. (1996). The importance of information flow within the supply chain. *Logistics Information Management*, 9(4), 28–30. doi:10.1108/09576059610123132
- Singh, P. J., & Power, D. (2009). The nature and effectiveness of collaboration between firms, their customers and suppliers: A supply chain perspective. *Supply Chain Management: An International Journal*, 14(3), 189–200. doi:10.1108/13598540910954539
- Singh, R. K., Murty, H. R., Gupta, S. K., & Dikshit, K. (2009). An overview of sustainability assessment methodologies. *Ecological Indicators*, 9(2), 189–212. doi:10.1016/j.ecolind.2008.05.011
- Singh, U. S., & Mishra, U. S. (2014). Supply chain management through vertical coordination in vegetable industry. *International Journal of Supply Chain Management*, 3(3), 148–154.
- Singley, M. K. (1989). *The Transfer of Cognitive Skill (No. 9)*. Cambridge, MA: Harvard University Press.
- Sinkovics, R. R., & Roath, A. S. (2004). Strategic orientation, capabilities, and performance in manufacturer: 3PL relationships. *Journal of Business Logistics*, 25(2), 43–64. doi:10.1002/j.2158-1592.2004.tb00181.x
- Sinotte, M. (2004). Exploration of the field of knowledge management for the library and information profession. *Libri*, 54(3), 190–198. doi:10.1515/LIBR.2004.190
- Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource Orchestration to Create Competitive Advantage: Breadth, Depth, and Life Cycle Effects. *Journal of Management*, 37(5), 1390–1412. doi:10.1177/0149206310385695

Compilation of References

- Sitkin, S. B., & Pablo, A. L. (1992). Reconceptualizing the determinants of risk behavior. *Academy of Management Review*, 17(1), 9–38.
- Skinner, W. (1969). Manufacturing – missing link in corporate strategy. *Harvard Business Review*, 47, 136–145.
- Skinner, W. (1996). Manufacturing strategy on the “S” curve. *Production and Operations Management*, 5(1), 3–14. doi:10.1111/j.1937-5956.1996.tb00381.x
- Skjøtt-Larsen, T., Kotzab, H., & Grieger, M. (2003). Electronic marketplaces and supply chain relationships. *Industrial Marketing Management*, 32(3), 199–210. doi:10.1016/S0019-8501(02)00263-8
- Slack, N., Chambers, S., & Johnson, R. (2007). *Operations management*. Harlow: FT/Prentice Hall.
- Slack, N., Chambers, S., & Johnston, R. (2010). *Operations Management*. New York: Pearson Education.
- Slack, N., & Lewis, M. (2011). *Operations Strategy* (3rd ed.). Harlow: Prentice Hall.
- SLIID. (2014). Soft Landings International Incubator Designation. Retrieved from https://www.nbia.org/member_services/soft_landings
- Slone, R. E. (2004). Leading a supply chain turnaround. *Harvard Business Review*, 82(10), 114–121. PMID:15559580
- Slone, R. E., Dittman, J. P., & Mentzer, J. T. (2010). *The New Supply Chain Agenda: the five steps that drive real value*. Boston, MA: Harvard Business Press.
- Smallman, C. (1996). Risk and organizational behaviour: A research model. *Disaster Prevention and Management*, 5(2), 12–26. doi:10.1108/09653569610112880
- Småros, J. (2003). Collaborative forecasting: A selection of practical approaches. *International Journal of Logistics: Research and Applications*, 6(4), 245–258. doi:10.1080/13675560310001626981
- Šmite, D., Wohlin, C., Gorschek, T., & Feldt, R. (2010). Empirical evidence in global software engineering: A systematic review. *Empirical Software Engineering*, 15(1), 91–118. doi:10.1007/s10664-009-9123-y
- Smith, B. G. (2008). Developing sustainable food supply chains. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, 363(1492), 849–861. doi:10.1098/rstb.2007.2187 PMID:17766237
- Snyder, L. V., & Shen, Z. J. M. (2007). Managing disruptions to supply chains. Proceedings of *Frontiers of engineering: reports on leading-edge engineering from the 2006 symposium*
- Soderberg, L., & Bengtsson, L. (2010). Supply chain management maturity and performance in SMEs. *Operations Management Research*, 3(1), 90–97. doi:10.1007/s12063-010-0030-6
- Söderlund, J. (2010). Knowledge entrainment and project management: The case of large-scale transformation projects. *International Journal of Project Management*, 28(2), 130–141. doi:10.1016/j.ijproman.2009.11.010
- Soni, G., & Kodali, R. (2011). A critical review of supply chain management frameworks: proposed framework. *Benchmarking: an international journal*, 20(2), 263–298.
- Soosay, C. A., Hyland, P. W., & Ferrer, M. (2008). Supply chain collaboration: Capabilities for continuous innovation. *Supply Chain Management: An International Journal*, 13(2), 160–169. doi:10.1108/13598540810860994
- Sousa, F. (2010). *Business relationships and corporate nature and scope: a critical realist analysis*. Saarbrücken, Lambert: Academic Publishing.

Compilation of References

- Sousa, C., Martínez-López, F. J., & Coelho, F. (2008). The determinants of export performance: A review of the research in the literature between 1998 and 2005. *International Journal of Management Reviews*, 10(4), 343–374. doi:10.1111/j.1468-2370.2008.00232.x
- Sousa, F. J. (2014). Boundary decisions of the firm: Make, buy, cooperate. *The IMP Journal*, 8(1), 13–21.
- Spangenberg, J. H. (2003). Sustainability Science: Science must go public for Sustainable Development. In *Frontiers 2 Conference* (pp. 12-15).
- Spangenberg, J.H., Bonniot, O. (1988). *Sustainability indicators—a compass on the road towards sustainability*. Wuppertal Paper No 81.
- Spekman, R. E., Spear, J., & Kamauff, J. (2002). Supply Chain Competency: Learning as a Key Component. *Supply Chain Management*, 7(1), 41–55. doi:10.1108/13598540210414373
- Spekman, R., Kamauff, J. W. Jr, & Myhr, N. (1998). An empirical investigation into supply chain management. *International Journal of Physical Distribution & Logistics Management*, 28(8), 630–650. doi:10.1108/09600039810247542
- Spies, K., Hesse, F., & Loesch, K. (1997). Store atmosphere, mood and purchasing behavior. *International Journal of Research in Marketing*, 14(1), 1–17. doi:10.1016/S0167-8116(96)00015-8
- Squire, B., Cousins, P. D., Lawson, B., & Brown, S. (2009). The effect of supplier manufacturing capabilities on buyer responsiveness: The role of collaboration. *International Journal of Operations & Production Management*, 29(8), 766–788. doi:10.1108/01443570910977689
- Srinivasan, M., Mukherjee, D., & Gaur, A. S. (2011). Buyer-Supplier partnership quality and supply. *European Management Journal*, 29(4), 260–271. doi:10.1016/j.emj.2011.02.004
- Sriram, T., Rao, K. V., Biswas, S., & Ahmed, B. (1996). *Applications of barcode technology in automated storage and retrieval systems*. Paper presented at the Proceedings of the 1996 IEEE IECON 22nd International Conference on Industrial Electronics, Control, and Instrumentation. doi:10.1109/IECON.1996.571035
- Srivastava, S. (2007). Green Supply Chain Management – A State of the Art Literature Review. *International Journal of Management Reviews*, 9(1), 53–80. doi:10.1111/j.1468-2370.2007.00202.x
- Stadler, H., & Kilger, C. (2002). *Supply Chain Management and Advanced Planning: Concepts, Models, Software and Case Studies*. Berlin.
- Stadtler, H. (2005). Supply chain management and advanced planning—basics, overview and challenges. *European Journal of Operational Research*, 163(3), 575–588. doi:10.1016/j.ejor.2004.03.001
- Stadtler, H., Kilger, C., & Meyr, H. (2015). *Supply Chain Management and Advanced Planning: Concepts, Models, Software, and Case Studies* (5th ed.). London, New York: Springer. doi:10.1007/978-3-642-55309-7
- Standards New Zealand. (2009). *New Zealand standards catalogue*. Wellington, New Zealand: Standards New Zealand.
- Standop, D., & Grunwals, G. (2009). How to solve product-harm crises in retailing? *International Journal of Retail & Distribution Management*, 37(1), 915–932.
- Stank, T. P., Keller, S. B., & Daugherty, P. J. (2001). Supply chain collaboration and logistical service performance. *Journal of Business Logistics*, 22(1), 29–48. doi:10.1002/j.2158-1592.2001.tb00158.x
- Staron, M. (2012). Critical role of measures in decision processes: Managerial and technical measures in the context of large software development organizations. *Information and Software Technology*, 54(8), 887-899.

Compilation of References

- Staron, M., Meding, W., & Palm, K. (2012). Release Readiness Indicator for Mature Agile and Lean Software Development Projects. *Agile Processes in Software Engineering and Extreme Programming* (pp. 93-1070).
- Staron, M., Meding, W., Karlsson, G., & Nilsson, C. (2010). Developing measurement systems: an industrial case study. *Journal of Software Maintenance and Evolution: Research and Practice*, 23(2), 89-107.
- Staron, M., & Meding, W. (2009). *Ensuring Reliability of Information Provided by Measurement Systems. Software Process and Product Measurement*. Berlin, Heidelberg: Springer.
- Staron, M., & Meding, W. (2009). Using Models to Develop Measurement Systems: A Method and Its Industrial Use. *Software Process and Product Measurement*, 5891, 212–226. doi:10.1007/978-3-642-05415-0_16
- Staron, M., & Meding, W. (2011). *Monitoring Bottlenecks in Agile and Lean Software Development Projects – A Method and Its Industrial Use. Product-Focused Software Process Improvement*. Berlin, Heidelberg: Springer.
- Staron, M., Meding, W., Hansson, J., Höglund, C., Niesel, K., & Bergmann, V. (2014). *Dashboards for continuous monitoring of quality for software product under development. System Qualities and Software Architecture (SQSA)*. Amsterdam: Elsevier Scientific Publishing.
- Staron, M., Meding, W., Karlsson, G., & Nilsson, C. (2011). Developing measurement systems: An industrial case study. *Journal of Software Maintenance and Evolution: Research and Practice*, 23(2), 89–107. doi:10.1002/smr.470
- Staron, M., Meding, W., & Nilsson, C. (2008). A Framework for Developing Measurement Systems and Its Industrial Evaluation. *Information and Software Technology*, 51(4), 721–737. doi:10.1016/j.infsof.2008.10.001
- Staron, M., Meding, W., & Söderqvist, B. (2010). A method for forecasting defect backlog in large streamline software development projects and its industrial evaluation. *Information and Software Technology*, 52(10), 1069–1079. doi:10.1016/j.infsof.2010.05.005
- Starr, M. K., & Miller, D. W. (1962). *Inventory Control: Theory and Practice*. Englewood Cliffs, NJ: Prentice Hall.
- Stavroulaki, E., & Davis, M. (2010). Aligning products with supply chain processes and strategy. *The International Journal of Logistics Management*, 21(1), 127–151. doi:10.1108/09574091011042214
- Stentoft Arlbjörn, J., & Halldorsson, A. (2002). Logistics knowledge creation: Reflections on content, context and processes. *International Journal of Physical Distribution & Logistics Management*, 32(1), 22–40. doi:10.1108/09600030210415289
- Stephens, S. (2001). Supply chain council & supply chain operations reference (SCOR) model overview. *Supply chain council*, 303.
- Sterman, J. D. (2000). *Business Dynamics, systems thinking and modeling for a complex world*. New York: McGraw-Hill.
- Stevens, J. (1989). Integrating the supply chain. *International Journal of Physical Distribution & Materials Management*, 19(8), 3–8. doi:10.1108/EUM00000000000329
- Stiner, M. C. (1991). Food procurement and transport by human and non-human predators. *Journal of Archaeological Science*, 18(4), 455–482. doi:10.1016/0305-4403(91)90038-Q
- Stock, G. N., Greis, N. P., & Kasarda, J. D. (2000). Enterprise logistics and supply chain structure: The role of fit. *Journal of Operations Management*, 18(5), 531–547. doi:10.1016/S0272-6963(00)00035-8
- Stock, J. R. (1997). Applying theories from other disciplines to logistics. *International Journal of Physical Distribution & Logistics Management*, 27(9/10), 515–539. doi:10.1108/09600039710188576

Compilation of References

- Stock, J. R., Boyer, S. L., & Harmon, T. (2010). Research opportunities in supply chain management. *Journal of the Academy of Marketing Science*, 38(1), 32–41. doi:10.1007/s11747-009-0136-2
- Stoddard, J., & Fern, E. (1999). Risk-taking propensity in supplier choice: Differences by sex and decision frame in a simulated organizational buying context. *Psychology and Marketing*, 16(7), 563–582. doi:10.1002/(SICI)1520-6793(199910)16:7<563::AID-MAR2>3.0.CO;2-J
- Stoian, M. C., Rialp, A., & Rialp, J. (2011). Export performance under the microscope: A glance through Spanish lenses. *International Business Review*, 20(2), 117–135. doi:10.1016/j.ibusrev.2010.07.002
- Stonebraker, P. W., & Afifi, R. (2004). Toward a contingency theory of supply chains. *Management Decision*, 42(9), 1131–1144. doi:10.1108/00251740410565163
- Strauss, A. L., & Corbin, J. (2004). Open coding. In C. Seale (Ed.), *Social research methods: A reader* (pp. 303–306). London: Routledge.
- Stump, R. L., & Heide, J. B. (1996). Controlling supplier opportunism in industrial relationships. *JMR, Journal of Marketing Research*, 33(4), 431–441. doi:10.2307/3152214
- Sturgeon, T., Memedovic, O., VanBiesebroeck, J., & Gereffi, G. (2009). Globalisation of the automotive industry: Main features and trends. *International Journal Technological Learning, Innovation and Development*, 2(1/2), 7–24.
- Styles, C., & Ambler, T. (2000). The impact of relational variables on export performance: An empirical investigation in Australia and the UK. *Australian Journal of Management*, 25(3), 261–281. doi:10.1177/031289620002500302
- Subramani, M. R. (2003). How do suppliers benefit from IT use in supply chain relationships? Working Paper no. 02-14, Management Information Systems Research Centre.
- Subramanian, N., & Rahman, S. (2013). Supply chain complexity and strategy. In U. Ramanathan & R. Ramanathan (Eds.), *Supply chain strategies, issues and models* (pp. 1–28). London: Springer.
- Subramani, M. (2004). How do Suppliers Benefit from Information Technology Use in Supply Chain Relationships. *Management Information Systems Quarterly*, 28(1), 45–73.
- Subramani, M. (2004). How do suppliers benefit from information technology use in supply chain relationships? *Management Information Systems Quarterly*, 28(1), 45–73.
- Sultan, A., & Saurabh, D. (2013). Achieving sustainable development through value chain. *International Journal of Managing Value and Supply Chains*, 4(2), 39–46. doi:10.5121/ijmvsc.2013.4204
- Sun, S. Y., Hsu, M. H., & Hwang, W. J. (2009). The impact of alignment between supply chain strategy and environmental uncertainty on SCM performance. *Supply Chain Management: An International Journal*, 14(3), 201–212. doi:10.1108/13598540910954548
- Supply-Chain Council. (2008). Supply Chain Operations Reference-model, Version 9.0 (SCOR review). Retrieved from <http://archive.supply-chain.org/galleries/public-gallery/SCOR%209.0%20Overview%20Booklet.pdf>
- SUSTA. (2014, June 18). Expand into International Markets: Export Seminar for Food and Agriculture Companies, Southern United States Trade Association. Retrieved from <http://www.susta.org/services/ert.html>
- Sutton, M. (2006). Knowledge citizen's approach to knowledge sharing, rewards and incentive. *SA Journal of Information Management*, 8(3).
- Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*. London: Berrett-Koehler Publishers.

Compilation of References

- Sveiby, K. E. (2001). A knowledge-based theory of the firm to guide in strategy formulation. *Journal of Intellectual Capital*, 2(4), 344–358. doi:10.1108/14691930110409651
- Svensson, G. (2002). A conceptual framework of vulnerability in firms' inbound and outbound logistics flows. *International Journal of Physical Distribution & Logistics Management*, 32(2), 110–134. doi:10.1108/09600030210421723
- Svensson, G. (2002). The theoretical foundation of supply chain management: A functionalist theory of marketing. *International Journal of Physical Distribution & Logistics Management*, 32(9), 734–754. doi:10.1108/09600030210452422
- Svensson, G. (2004). Key areas, causes and contingency planning of corporate vulnerability in supply chains: A qualitative approach. *International Journal of Physical Distribution & Logistics Management*, 34(9), 728–748. doi:10.1108/09600030410567496
- Swafford, P. M., Ghosh, S., & Murthy, N. N. (2006). A framework for assessing value chain agility. *International Journal of Operations & Production Management*, 26(2), 118–140. doi:10.1108/01443570610641639
- Swami, S., & Shah, J. (2011). Channel Coordination in Green Supply Chain Management: The Case of Package Size and Shelf-Space Allocation. *Technology Operation Management*, 2(1), 50–59. doi:10.1007/s13727-012-0005-y
- Swami, S., & Shah, J. (2013). Channel Coordination in Green Supply Chain Management. *The Journal of the Operational Research Society*, 64(3), 336–351. doi:10.1057/jors.2012.44
- Swart, W., Hall, C., & Chen, H. (2012). Human performance in supply chain management. *Supply Chain Forum: An International Journal*, 13(2), 10–20.
- Sweeney, E. (2006). Managing Information Flows: the Key to Effective Supply Chain Integration. *Logistics Solutions, the Journal of the National Institute for Transport and Logistics*, 9(3), 18–21.
- Swink, M., Narasimhan, R., & Wang, C. (2007). Managing beyond the factory walls: Effects of four types of strategic integration on manufacturing plant performance. *Journal of Operations Management*, 25(1), 148–164. doi:10.1016/j.jom.2006.02.006
- Swoboda, B., Foscht, T., & Cliquet, G. (2008). International value chain processes by retailers and wholesalers- A general approach. *Journal of Retailing and Consumer Services*, 15(2), 63–77. doi:10.1016/j.jretconser.2007.05.005
- Swoboda, B., Foscht, T., & Schwarz, S. (2005, Summer). Enormously dynamic and differing strategies in retailing internationalisation: A case study of the largest food retail firms. *European Retail Digest*, 46, 55–63.
- Syson, R. (1994). Purchasing for the nineties. Retrieved from <http://www.littoralis.info/iom/assets/1994020135.pdf>
- Tai, A. P., Martin, M. V., & Heald, C. L. (2014). *Threat to future global food security from climate change and ozone air pollution*. Nature Climate Change.
- Talburt, J. R. (2011). *Entity resolution and information quality*. Amsterdam: Elsevier.
- Taljanovic, K., Salihbegovic, A., & Pandzo, A. (2012). A Fast Manual Picking of Small Parts High Volume Orders. *Journal of Communication and Computer*, 9, 1097–1103.
- Tallon, W. J. (1993). The Impact of Inventory Centralization on Aggregate Safety Stock: The Variable Supply Lead Time Case. *Journal of Business Logistics*, 14(1), 185–203.
- Talluri, S., Baker, R., & Sarkis, J. (1999). A framework for designing efficient value chain networks. *International Journal of Production Economics*, 62(1-2), 133–144. doi:10.1016/S0925-5273(98)00225-4

Compilation of References

- Tam, M., & Tummala, V. M. R. (2001). An application of the AHP in vendor selection of a telecommunications system. *Omega*, 29(2), 171–182. doi:10.1016/S0305-0483(00)00039-6
- Tang, C. (2006). Perspectives in supply chain risk management. *International Journal of Production Economics*, 103(2), 451–488. doi:10.1016/j.ijpe.2005.12.006
- Tang, C. S. (2006). Robust strategies for mitigating supply chain disruptions. *International Journal of Logistics: Research and Applications*, 9(1), 33–45. doi:10.1080/13675560500405584
- Tan, K. C. (2001). A framework of supply chain management literature. *European Journal of Purchasing and Supply Management*, 7(1), 39–48. doi:10.1016/S0969-7012(00)00020-4
- Tan, K. C., Kannan, V. R., & Handfield, R. B. (1998). Supply chain management: Supplier performance and firm performance. *The International Journal of Purchasing and Materials Management*, 34(3), 2–9.
- Tan, K. C., Kannan, V., & Handfield, R. B. (1998). Supply chain management: Supplier performance and firm performance. *International Journal of Purchasing and Materials Management*, 34(3), 2–9.
- Tarr, N. W. (2011). Food Entrepreneurs and Food Safety Regulation. *J. Food L. & Pol'y*, 7, 35.
- Tata Chemicals. (2012). Tata Chemicals takes another step towards a green supply chain strategy for soda ash. Retrieved from http://tatachemicals.com/media/releases/201207july/20120731_soda_ash.html#VEOAGPmSyNg
- Tatoglu, E. (2000). Western joint ventures in Turkey: Strategic motives and partner selection criteria. *European Business Review*, 12(3), 137–147. doi:10.1108/09555340010371809
- Taylor, T. A., & Plambeck, E. L. (2007, October). Supply chain relationships and contracts: The impact of repeated interaction on capacity investment and procurement. *Management Science*, 53(10), 1577–1593. doi:10.1287/mnsc.1070.0708
- Telegraph (2013). *Tesco's Fresh & Easy: a timeline in pictures*. Retrieved from <http://www.telegraph.co.uk/finance/newsbysector/retailandconsumer/10299870/Tescos-Fresh-and-Easy-a-timeline-in-pictures.html?frame=2537629>
- ten Hompel, M., Sadowsky, V., & Beck, M. (2011). *Kommissionierung - Materialflusssysteme 2: Planung und Berechnung der Kommissionierung in der Logistik*. Heidelberg, Germany: Springer. doi:10.1007/978-3-540-29940-0
- Tepic, M., Omta, O., Trienekens, J., & Fortuin, F. (2011). The role of structural and relational governance in creating stable innovation networks: Insights from sustainability-oriented Dutch innovation networks. *Journal of Chain and Network Science*, 11(3), 197–211. doi:10.3920/JCNS2011.x206
- Tesco, P. L. C. (n.d.). *Tesco Czech Republic*. Retrieved from <http://www.tescopl.com/index.asp?pageid=332>
- Tesco, P. L. C. (n.d.). *Tesco Hungary*. Retrieved from <http://www.tescopl.com/index.asp?pageid=340>
- Tesco, P. L. C. (n.d.). *Tesco Ireland*. Retrieved from <http://www.tescopl.com/index.asp?pageid=348>
- Tesco, P. L. C. (n.d.). *Tesco Lotus*. Retrieved from <http://www.tescopl.com/index.asp?pageid=324>
- Tesfay, Y. Y. (2014). Environmentally friendly cost efficient and effective sea transport outsourcing: The case of Statoil. *Transportation Research Part D, Transport and Environment*, 31, 135–147. doi:10.1016/j.trd.2014.05.019
- Tesfom, G., Lutz, C., & Ghauri, P. (2006). Solving export marketing problems of small and medium-sized firms from developing countries. *Journal of African Business*, 7(1-2), 57–87. doi:10.1300/J156v07n01_04
- Testa, F., & Iraldo, F. (2010). Shadows and Lights of GSCM: Determinants and Effects of These Practices Based on a Multi-national Study. *Journal of Cleaner Production*, 18(10/11), 953–962. doi:10.1016/j.jclepro.2010.03.005

Compilation of References

- The Guardian. (2011). *Tesco admits defeat and pulls out of Japan*. Retrieved from <http://www.theguardian.com/business/2011/aug/31/tesco-japan-pull-out-philip-clarke>
- The Guardian. (2013). *Tesco puts US chain Fresh n Easy into bankruptcy*. Retrieved from <http://www.theguardian.com/business/2013/oct/01/tesco-us-chain-fresh-easy-bankruptcy>
- The Guardian. (2014, October 17). *EWURA: Demand for petroleum up by 10 percent*.
- Thomas, J. J., & Cook, K. A. (2006). A visual analytics agenda. *Computer Graphics and Applications, IEEE*, 26(1), 10–13. doi:10.1109/MCG.2006.5 PMID:16463473
- Thomé, A. M. T., Scavarda, L. F., Pires, S. R. I., Ceryno, P., & Klingebiel, K. (2014). A multi-tier study on supply chain flexibility in the automotive industry. *International Journal of Production Economics*, 158, 91–105. doi:10.1016/j.ijpe.2014.07.024
- Todeva, E., & Knoke, D. (2005). Strategic alliances and models of collaboration. *Management Decision*, 43(1), 123–148. doi:10.1108/00251740510572533
- Tomaszewski, P., Berander, P., & Damm, L.-O. (2007). From Traditional to Streamline Development - Opportunities and Challenges. *Software Process Improvement and Practice*, (1): 1–20.
- Toshiba India. (2012). Environmental Position. Retrieved from <http://www.toshiba-india.com/enviroment.html>
- Toulan, O., Birkinshaw, J., & Arnold, D. (2006). The role of interorganizational fit in global account management. *International Studies of Management & Organization*, 36(4), 61–81. doi:10.2753/IMO0020-8825360403
- Towill, D. R. (1996). Industrial dynamics modelling of supply chains. *Logistics Information Management*, 9(4), 43–56. doi:10.1108/09576059610116707
- Towill, D. R., Naim, M. M., & Wikner, J. (1992). Industrial dynamics simulation models in the design of supply chains. *International Journal of Physical Distribution & Logistics Management*, 22(5), 3–13. doi:10.1108/09600039210016995
- Towill, D., & Christopher, M. (2002). The supply chain strategy conundrum: To be lean or agile or to be lean and agile? *International Journal of Logistics: Research & Applications*, 5(3), 299–309. doi:10.1080/1367556021000026736
- Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *The Academy of Management Executive*, 12(3), 17–29.
- Tregear, A. (2005). Lifestyle, growth, or community involvement? The balance of goals of UK artisan food producers. *Entrepreneurship & Regional Development*, 17(1), 1–15. doi:10.1080/0898562042000249777
- Triandis, H. C., Bontempo, R., Villareal, M. J., Asai, M., & Lucca, N. (1988). Individualism and collectivism: Cross-cultural perspectives on self-ingroup relationships. *Journal of Personality and Social Psychology*, 54(2), 323–338. doi:10.1037/0022-3514.54.2.323
- Tripathi, R., & Agarwal, S. (2014). An empirical study of marketing for guava and its sub-products by farmers in Allahabad: An approach towards agripreneurship through food processing units. *International Journal of Business and Globalisation*, 13(1), 69–75. doi:10.1504/IJBG.2014.063395
- Trkman, P., & McCormack, K. (2009). Supply chain risk in turbulent environments: A conceptual model for managing supply chain network risk. *International Journal of Production Economics*, 119(2), 247–258. doi:10.1016/j.ijpe.2009.03.002
- Trompenaars, F., & Hampden-Turner, C. (1997). *Riding the wave of culture: Understanding cultural diversity in global business*. New York: McGraw-Hill.

Compilation of References

- Tseng, M. L. (2009). A causal and effect decision making model of service quality expectation using grey–fuzzy DEMATEL approach. *Expert Systems with Applications*, 36(4), 7738–7748. doi:10.1016/j.eswa.2008.09.011
- Tudisca, S., Trapani, A. M. D., Sgroi, F., Testa, R., & Giamporcaro, G. (2014). Role of alternative food networks in Sicilian farms. *International Journal of Entrepreneurship and Small Business*, 22(1), 50–63. doi:10.1504/IJESB.2014.062130
- Tummala, R., & Schoenherr, T. (2011). Assessing and managing risks using the supply chain risk process (SCRMP). *Supply Chain Management. International Journal (Toronto, Ont.)*, 16(6), 474–483.
- Turker, D., & Altuntas, C. (2014). Sustainable supply chain management in the fast fashion industry: An analysis of corporate reports. *European Management Journal*, 32(5), 837–849. doi:10.1016/j.emj.2014.02.001
- Turner, J. R. (1993). Integrated supply chain management: What's wrong with this picture? *Industrial Engineering (American Institute of Industrial Engineers)*, 25(12), 52–55.
- Tuten, T. L., & Urban, D. J. (2001). An expanded model of business-to-business partnership formation and success. *Industrial Marketing Management*, 30(2), 149–164. doi:10.1016/S0019-8501(00)00140-1
- Tuttle, B. (2013). Tale of Two Supermarkets: Why Fresh & Easy Flopped and Fairway Flies High. *Time*. Retrieved from <http://business.time.com/2013/04/18/tale-of-two-supermarkets-why-fresh-easy-flopped-and-fairway-flies-high/>
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124–1131. doi:10.1126/science.185.4157.1124 PMID:17835457
- Tyagi, R., & Das, C. (1998). Extension of the Square Root Law for Safety Stock to Demands with Unequal Variances. *Journal of Business Logistics*, 19(2), 197–204.
- U.S. Commercial Service. (2007, September). China Franchising Industry: Access Dynamics and Emerging Markets, The JIJ Group. Retrieved from http://export.gov/china/build/groups/public/@eg_cn/documents/webcontent/eg_cn_027119.pdf
- UNEP. (2014). A guide to traceability: A practical approach to advance sustainability in global supply chains. *United Nations Environmental Report*, 1–45. Retrieved from <https://www.unglobalcompact.org/resources/791>
- United Nations Commission on Sustainable Development. (2001). Indicators of sustainable development: guidelines and methodologies. Retrieved from <http://www.un.org/esa/sustdev/natlinfo/indicators/indisd/indisd-mg2001.pdf>
- United Nations Multilateral Environmental Agreement. (2013). *Negotiator's Handbook*. Pacific Region.
- United Nations Multilateral Environmental Agreement. *Negotiator's Handbook* (2014). Retrieved from http://unfccc.int/resource/docs/publications/negotiators_handbook.pdf
- Uras, L. (2002). *An exploratory study of ownership redirection among leading luxury Italian firms* [Unpublished M.Sc. dissertation]. School of Management Studies for the Service Sector, University of Surrey, United Kingdom.
- USDS. (2014, December 24). The United States and Pacific Alliance Advance Cooperation on Entrepreneurship. Media Note. Retrieved from <http://www.state.gov/r/pa/prs/ps/2014/12/235517.htm>
- USGS. (2014, March 12). *Louisiana Coastal Wetlands: A Resource at Risk*. Retrieved from <http://pubs.usgs.gov/fs/la-wetlands>
- Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review*, 61(4), 674–698. doi:10.2307/2096399
- Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly*, 42(1), 35–67. doi:10.2307/2393808

Compilation of References

- Vahdani, B., Iranmanesh, S., Mousavi, S., & Abdollahzade, M. (2012). A locally linear neuro-fuzzy model for supplier selection in cosmetics industry. *Applied Mathematical Modelling*, 36(10), 4714–4727. doi:10.1016/j.apm.2011.12.006
- Van Hoek, R. I. (1999). From reversed logistics to green supply chains. *Supply Chain Management: An International Journal*, 4(3), 129–135.
- Van Weele, A. J., Rozemeijer, F. A., & Rietveld, G. (2010). Professionalizing purchasing in organizations: towards a purchasing development model. Retrieved from <http://www.gercorietveld.nl/wp-content/uploads/2010/10/Purchasing-Development-Model.pdf>
- Van Weele, A. J. (2009). *Purchasing and supply chain management: Analysis, strategy, planning and practice*. Cengage Learning EMEA.
- Vanany, I., Zailani, S., & Pujawan, N. (2009). Supply chain risk management: Literature review and future research. *International Journal of Information Systems and Supply Chain Management*, 2(1), 16–33. doi:10.4018/jisscm.2009010102
- Vanclay, F. (2004). Impact assessment and the Triple Bottom Line: Competing pathways to sustainability? *Sustainability and Social Science Round Table Proceedings* (pp. 27-39).
- Vandermeersch, T., Alvarenga, R. A. F., Ragaert, P., & Dewulf, J. (2014). Environmental sustainability assessment of food waste valorization options. *Resources, Conservation and Recycling*, 87, 57–64. doi:10.1016/j.resconrec.2014.03.008
- Vanpoucke, E., Boyer, K. K., & Vereecke, A. (2009). Supply chain information flow strategies: An empirical taxonomy. *International Journal of Operations & Production Management*, 29(12), 1213–1241. doi:10.1108/01443570911005974
- Vanpoucke, E., Vereecke, A., & Boyer, K. K. (2014). Triggers and patterns of integration initiatives in successful buyer-supplier relationships. *Journal of Operations Management*, 32(1–2), 15–33. doi:10.1016/j.jom.2013.11.002
- Vanpoucke, E., Vereecke, A., & Wetzels, M. (2014). Developing supplier integration capabilities for sustainable competitive advantage: A dynamic capabilities approach. *Journal of Operations Management*, 32(7–8), 446–461. doi:10.1016/j.jom.2014.09.004
- Vargo, S. L., & Lusch, R. F. (2011). It's all B2B...and beyond: Toward a systems perspective of the market. *Industrial Marketing Management*, 40(2), 181–187. doi:10.1016/j.indmarman.2010.06.026
- Vargo, S. L., Maglio, P. P., & Akaka, M. A. (2008). On value and value co-creation: A service systems and service logic perspective. *European Management Journal*, 26(3), 145–152. doi:10.1016/j.emj.2008.04.003
- Vastag, G., Kasarda, J. D., & Boone, T. (1994). Logistical support for manufacturing agility in global markets. *International Journal of Operations & Production Management*, 14(11), 73–85. doi:10.1108/01443579410068657
- VDI. (1994). *Norm 3590*. Berlin, Germany: Beuth.
- VDI. (2003). *Norm 4405*. Berlin, Germany: Beuth.
- Vecchi, A., & Brennan, L. (2009). Supply chain innovation for short-life products: A preventive assessment of RFID deployment and implementation. *International Journal of Business Innovation and Research*, 3(5), 535–554. doi:10.1504/IJBIR.2009.027176
- Venkateswaran, J., & Son, Y. J. (2005). Hybrid system dynamic–Discrete event simulation - Based architecture for hierarchical production planning. *International Journal of Production Research*, 43(20), 4397–4429. doi:10.1080/00207540500142472
- Verissimo Pereira, J. (2009). SD-DES model: A new approach for implementing an e-Supply Chain. *Journal of Modeling in Management*, 4(2), 134–148. doi:10.1108/17465660910973952

Compilation of References

- VICS. (1998). Collaborative planning forecasting and replenishment voluntary guidelines. Retrieved from http://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=632&PortalId=0&TabId=785
- VICS. (1999). Roadmap to CPFR: The case studies. Retrieved from http://www.gs1us.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=632&PortalId=0&TabId=785
- Vieira, L.M., Paiva, E.L., Finger, A.B., & Teixeira, R. (2013). Trust and supplier-buyer relationships: An empirical analysis. *Brazilian Administration Review*, 10(3-2), 263-280.
- Vilko, J., Ritala, P., & Edelmann, J. (2014). On uncertainty in supply chain risk management. *The International Journal of Logistics Management*, 25(1), 3–19. doi:10.1108/IJLM-10-2012-0126
- Villena, V. H., Revilla, E., & Choi, T. Y. (2011). The dark side of buyer–supplier relationships: A social capital perspective. *Journal of Operations Management*, 29(6), 561–576. doi:10.1016/j.jom.2010.09.001
- Villiers, J., & Barnard, E. (1993). Backpropagation neural nets with one and two hidden layers. *IEEE Transactions on Neural Networks*, 4(1), 136–141. doi:10.1109/72.182704 PMID:18267711
- Visser, J. K., & Sluiter, E. (2007). *Performance measures for a telecommunications company. Proceedings of AFRICON 2007*. doi:10.1109/AFRCON.2007.4401479
- Vitasek, K. (2013). *Supply Chain Management Terms and Glossary*. Retrieved from http://cscmp.org/sites/default/files/user_uploads/resources/downloads/glossary-2013.pdf
- Vithessonthi, C. (2008). Social interaction and knowledge sharing behaviour in multinational corporations. *Business Review (Federal Reserve Bank of Philadelphia)*, 10(2), 324–331.
- Vlachos, D., Georgiadis, P., & Iakovou, E. (2007). A system dynamics model for dynamic capacity planning of remanufacturing in closed-loop supply chains. *Computers & Operations Research*, 34(2), 367–394. doi:10.1016/j.cor.2005.03.005
- Vogel, D. (2006). *The market for virtue: The potential and limits of corporate social responsibility*. Brookings Institution Press.
- Voinea, L., & Telea, A. (2007). Visual data mining and analysis of software repositories. *Computers & Graphics*, 31(3), 410–428. doi:10.1016/j.cag.2007.01.031
- Vokurka, R., Choobineh, J., & Vadi, L. (1996). A prototype expert system for the evaluation and selection of potential suppliers. *International Journal of Operations & Production Management*, 16(12), 106–127. doi:10.1108/01443579610151788
- Von Glasersfeld, E. (1987). *The Construction of Knowledge, Contributions to Conceptual Semantics*. Salinas, CA: Intersystem Publications.
- Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). *Enabling knowledge creation: How to unlock the mystery of tacit knowledge and release the power of innovation*. Oxford: Oxford University Press. doi:10.1093/acprof:oso/9780195126167.001.0001
- Voss, G., Cable, D., & Voss, Z. (2000). Linking organizational values to relationships with external constituents: A study of nonprofit professional theatres. *Organization Science*, 11(3), 330–347. doi:10.1287/orsc.11.3.330.12497
- Vyas, R., Albright, S., Walker, D., Zachariah, A., & Lee, M. Y. (2010). Clinical training at remote sites using mobile technologies: An India-USA partnership. *Distance Education*, 31(2), 211–226. doi:10.1080/01587919.2010.498856
- Wade, D., & Recardo, R. J. (2001). *Corporate performance management: how to build a better organization through measurement-driven strategic alignment*. Boston: Butterworth-Heinemann.

Compilation of References

- Wagner, S. M., & Bode, C. (2014). Supplier relationship-specific investments and the role of safeguards for supplier innovation sharing. *Journal of Operations Management*, 32(3), 65–78. doi:10.1016/j.jom.2013.11.001
- Wagner, S. M., & Buko, C. (2005). An empirical investigation of knowledge-sharing in networks. *Journal of Supply Chain Management*, 41(4), 17–31. doi:10.1111/j.1745-493X.2005.04104003.x
- Wagner, S., & Bode, C. (2008). An empirical examination of supply chain performance along several dimensions of risks. *Journal of Business Logistics*, 29(1), 307–325. doi:10.1002/j.2158-1592.2008.tb00081.x
- Wallace, C., Sperber, W., & Mortimore, S. E. (2011). *Food safety for the 21st century: Managing HACCP and food safety throughout the global supply chain*. John Wiley & Sons.
- Waller, D. L. (2003). *Operations management: a supply chain approach*. London: International Thomson Business Press.
- Waller, M., Johnson, M. E., & Davis, T. (1999). Vendor-managed inventory in the retail supply chain. *Journal of Business Logistics*, 20, 183–204.
- Walras, L. (1893). To Johan Gustave Knut Wicksell (Letter no. 1170). In W. Jaffe (Ed.), *Correspondence of Leon Walras and related papers* (Vol. 2). Amsterdam: Royal Netherland Academy of Sciences and Letters.
- Wang, X., Petkova, B. N., & Wood, C. L. (2014). Do suppliers benefit from supply chain sustainability programs? The case of Wal-Mart. Presented at the meeting of the ANZAM Operations, *Supply Chain and Services Management conference*, Auckland.
- Wang, C., Fergusson, C., Perry, D., & Antony, J. (2008). A conceptual case-based model for knowledge sharing among supply chain members. *Business Process Management Journal*, 14(2), 147–165. doi:10.1108/14637150810864907
- Wang, H., Guo, X., Fan, Y., & Bi, J. (2014). Extended Access Control and Recommendation Methods for Enterprise Knowledge Management System. *IERI Procedia*, 10, 224–230. doi:10.1016/j.ieri.2014.09.081
- Wang, J.-W., Cheng, C.-H., & Huang, K.-C. (2009). Fuzzy hierarchical TOPSIS for supplier selection. *Applied Soft Computing*, 9(1), 377–386. doi:10.1016/j.asoc.2008.04.014
- Wang, M., Chen, Y., & Khan, M. J. (2014). Mobile Cloud Learning for Higher Education: A Case Study of Moodle in the Cloud. *International Review of Research in Open and Distance Learning*, 152(2), 254–267.
- Wang, R. Y., Storey, V. C., & Firth, C. P. (1995). A framework for analysis of data quality research. *Knowledge and Data Engineering. IEEE Transactions*, 7(4), 623–640.
- Wan, J., Zhang, H., Wan, D., & Huang, D. (2010). Research on knowledge creation in software requirement development. *Journal of Software Engineering and Applications*, 3(05), 487–494. doi:10.4236/jsea.2010.35055
- Wanke, P. F. (2009). Consolidation Effects and Inventory Portfolios. *Transportation Research Part E, Logistics and Transportation Review*, 45(1), 107–124. doi:10.1016/j.tre.2008.03.003
- Wanke, P. F., & Saliby, E. (2009). Consolidation effects: Whether and how inventories should be pooled. *Transportation Research Part E, Logistics and Transportation Review*, 45(5), 678–692. doi:10.1016/j.tre.2009.01.006
- Ward, P., McCreery, J., Ritzman, L., & Sharma, D. (1998). Competitive priorities in operations management. *Decision Sciences*, 29(4), 1035–1046. doi:10.1111/j.1540-5915.1998.tb00886.x
- Warhurst, A. (2002). Sustainability Indicators and Sustainability Performance Management. Report to the Project: *Mining, Minerals and Sustainable Development* (MMSD). Warwick, England: International Institute for Environment and Development (IIED). Retrieved from http://www.iied.org/mmsd/mmsd_pdfs/sustainability_indicators.pdf

Compilation of References

- Wastell, D. G., White, P., & Kawalek, P. (1994). A methodology for business process re-design: Experiences and issues. *The Journal of Strategic Information Systems*, 3(1), 23–40. doi:10.1016/0963-8687(94)90004-3
- Waters, D. (2007). *Supply chain risk management: Vulnerability and resilience in logistics*. London: Kogan Page Limited.
- Waters, D. (2009). *Supply Chain Management: An Introduction to Logistics* (2nd ed.). Basingstoke: Palgrave Macmillan.
- Wathne, K. H., & Heide, J. B. (2000). Opportunism in Interfirm Relationships: Forms, Outcomes, and Solutions. *Journal of Marketing*, 64(4), 36–51. doi:10.1509/jmkg.64.4.36.18070
- Wathne, K. H., & Heide, J. B. (2004). Relationship governance in a supply chain network. *Journal of Marketing*, 68(1), 73–89. doi:10.1509/jmkg.68.1.73.24037
- Watson, A., Stanworth, J., Healeas, S., Purdy, D., & Stanworth, C. (2005). Retail franchising: An intellectual perspective. *Journal of Retailing and Consumer Services*, 12(1), 25–34. doi:10.1016/j.jretconser.2004.02.001
- Watson, E. (2005). Nestle switches to vendor managed inventory with Tesco. *Food Manufacture*, 80(8), 20. Retrieved from <http://www.foodmanufacture.co.uk/Supply-Chain/Nestle-switches-to-vendor-managed-inventory-with-Tesco>
- Watson, R. T., Akselsen, S., & Pitt, L. F. (1998). Attractors: Building mountains in the flat landscape of the World Wide Web. *California Management Review*, 40(2), 36–56. doi:10.2307/41165932
- Watson, R. T., Boudreau, M. C., & Chen, A. J. (2010). Information Systems and Environmentally Sustainable Development: Energy Informatics and New Directions for the IS Community. *Management Information Systems Quarterly*, 34(1), 23–38.
- WCED (World Commission on Environment and Development). (1987). *Our common future*. Oxford: Oxford University Press.
- Webber, R. A. (1969). Convergence or Divergence. *The Columbia Journal of World Business*, 4(3), 75–83.
- Webster, F. E. Jr. (1979). *Industrial Marketing Management*. New York: John Wiley & Sons.
- Webster, F. E. Jr. (1992). The changing role of marketing in the corporation. *Journal of Marketing*, 56(4), 1–17. doi:10.2307/1251983
- Webster, F. E. Jr., & Wind, Y. (1972). A general model for understanding organizational buying behavior. *Journal of Marketing*, 36(2), 12–19. doi:10.2307/1250972
- Weeks, R. R., & Marks, W. J. (1969). The marketing concept in historical perspective. *Business & Society*, 9(2), 24–32. doi:10.1177/000765036900900203
- Weele, A. J. (2000). *Purchasing and supply chain management: analysis, planning and practice*. London: Business Press.
- Weigelt, C., & Miller, D. J. (2013). Implications of internal organization structure for firm boundaries. *Strategic Management Journal*, 34(12), 1411–1434. doi:10.1002/smj.2074
- Weill, P., & Vitale, M. R. (2001). *Place to Space, migrating to ebusiness models*. Boston, MA: Harvard Business School Publishing Corporation.
- Welch, J. A., & Ranganathan Nayak, P. (1992). Strategic sourcing: A progressive approach to the make-or-buy decision. *The Academy of Management Executive*, 6(1), 23–31. doi:10.5465/AME.1992.4274302
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. doi:10.1002/smj.4250050207

Compilation of References

- Wever, M., Wognum, P. M., Trienekens, J. H., & Omta, S. W. F. (2012). Supply chain-wide consequences of transaction risks and other contractual solutions: Towards an extended transaction cost economics framework. *Journal of Supply Chain Management*, 48(1), 73–91. doi:10.1111/j.1745-493X.2011.03253.x
- Wheatley, M. (2006, December). Emerging perils. *Financial Director*, 37-39.
- Whipple, J. M., & Frankel, R. (2000). Strategic alliance success factors. *Journal of Supply Chain Management*, 36(3), 21–28. doi:10.1111/j.1745-493X.2000.tb00248.x
- White, A. E. D. M., Daniel, E. M., & Mohdzain, M. (2005). The role of emergent information technologies and systems in enabling supply chain agility. *International Journal of Information Management*, 25(5), 396–410. doi:10.1016/j.ijinfomgt.2005.06.009
- Whitfield, G., & Landeros, R. (2006). Supplier Diversity Effectiveness: Does Organizational Culture Really Matter? *Journal of Supply Chain Management*, 42(4), 16–28. doi:10.1111/j.1745-493X.2006.00019.x
- Whitworth, E., & Biddle, R. (2007). The social nature of agile teams. *Proceedings of Agile conference* (pp. 26-36). IEEE.
- Wiengarten, F., Humphreys, P., Cao, G., Fynes, B., & McKittrick, A. (2010). Collaborative supply chain practices and performance: Exploring the key role of information quality. *Supply Chain Management: An International Journal*, 15(6), 463–473. doi:10.1108/13598541011080446
- Wiengarten, F., Humphreys, P., McKittrick, A., & Fynes, B. (2013). Investigating the impact of e-business applications on supply chain collaboration in the German automotive industry. *International Journal of Operations & Production Management*, 33(1), 25–48. doi:10.1108/01443571311288039
- Wiig, K. M. (1997). Knowledge management: Where did it come and where will it do? *Expert Systems with Applications*, 13(1), 1–14. doi:10.1016/S0957-4174(97)00018-3
- Wiig, K. M., de Hoog, R., & van der Spek, R. (1997). Supporting knowledge management: A selection of methods and techniques. *Expert Systems with Applications*, 13(1), 15–27. doi:10.1016/S0957-4174(97)00019-5
- Wikström, P. (2010). Sustainability and organizational activities—three approaches. *Sustainable Development*, 18(2), 99–107. doi:10.1002/sd.449
- Wilcox King, A., & Zeithaml, C. P. (2003). Measuring organizational knowledge: A conceptual and methodological framework. *Strategic Management Journal*, 24(8), 763–772. doi:10.1002/smj.333
- Wilding, R., & Humphries, A. S. (2006). Understanding collaborative supply chain relationships through the application of the Williamson organisational failure framework. *International Journal of Physical Distribution & Logistics Management*, 36(4), 309–329. doi:10.1108/09600030610672064
- Wild, R., & Griggs, K. (2008). A model of information technology opportunities for facilitating the practice of knowledge management. *Vine*, 38(4), 490–506. doi:10.1108/03055720810917732
- Willem Ziggers, G., & Trienekens, J. (1999). Quality assurance in food and agribusiness supply chains: Developing successful partnerships. *International Journal of Production Economics*, 60, 271–279. doi:10.1016/S0925-5273(98)00138-8
- Williamson, O. E. (1988, March 7). Markets and hierarchies: analysis and antitrust implications, *This Weeks Citation Classic*, CC/No. 10. Retrieved from <http://garfield.library.upenn.edu/classics1988/A1988M191900001.pdf>
- Williamson, O. E. (2007, March 1). Transaction cost economics: An introduction (Discussion paper 2007-3). *The Open Access Open Assessment E-Journal*, . Retrieved from <http://www.economics-ejournal.org/economics/discussionpapers/2007-3>

Compilation of References

- Williamson, O. (1979). Transaction-cost economics: The governance of contractual relations. *The Journal of Law & Economics*, 22(2), 233–261. doi:10.1086/466942
- Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and anti-trust implications*. New York: The Free Press.
- Williamson, O. E. (1975). *Markets and hierarchies: Analysis and anti-trust Implications: a study in the economics of internal organization*. New York: Free Press.
- Williamson, O. E. (1976). Franchise bidding for natural monopolies-in general and with respect to CATV. *The Bell Journal of Economics*, 7(1), 73–104. doi:10.2307/3003191
- Williamson, O. E. (1981). The Economics of Organization: The Transaction Cost Approach. *American Journal of Sociology*, 87(3), 548–577. doi:10.1086/227496
- Williamson, O. E. (1983). Credible commitments: Using hostages to support exchange. *The American Economic Review*, 73(4), 519–540.
- Williamson, O. E. (1985). *The economic institutions of capitalism*. New York: Free Press.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: Free Press.
- Williamson, O. E. (1985). *The economic institutions of capitalism: firms, markets, relational contracting*. New York: The Free Press.
- Williamson, O. E. (1991). Comparative economic organization: The analysis of discrete structural alternatives. *Administrative Science Quarterly*, 36(2), 269–296. doi:10.2307/2393356
- Williamson, O. E. (1998). Transaction cost economics: How it works; where it is headed? *De Economist*, 146(1), 23–58. doi:10.1023/A:1003263908567
- Williamson, O. E. (2002). The Theory of the Firm as Governance Structure: From Choice to Contract. *The Journal of Economic Perspectives*, 16(3), 171–195. doi:10.1257/089533002760278776
- Williamson, O. E. (2008). Outsourcing: Transaction cost economics and supply chain management. *The Journal of Supply Chain Management*, 44(2), 5–16. doi:10.1111/j.1745-493X.2008.00051.x
- Williamson, O. E. (2010). Transaction cost economics: The natural progression. *Journal of Retailing*, 86(3), 215–226. doi:10.1016/j.jretai.2010.07.005
- Williamson, O. E. (2010). Transaction cost economics: The natural progression. *The American Economic Review*, 100(3), 673–690. doi:10.1257/aer.100.3.673
- Wills, S., & Barham, K. (1994). Being an international manager. *European Management Journal*, 12(1), 49–58. doi:10.1016/0263-2373(94)90046-9
- Wilson, M. M. J. (2006). *Supply chains behaving badly: A dynamic model of inter-organisational supply chain exchange behaviour under rational, relational and chaotic paradigms*. (Doctoral thesis, Lincoln University, Lincoln, New Zealand). Retrieved from <http://researcharchive.lincoln.ac.nz/dspace/handle/10182/310>
- Wiltsey Stirman, S., Kimberly, J., Cook, N., Calloway, A., Castro, F., & Charns, M. (2012). The sustainability of new programs and innovations: A review of the empirical literature and recommendations for future research. *Implementation Science; IS*, 7(17), 1–19. doi:10.1186/1748-5908-7-17 PMID:22417162
- Wittgenstein, L. (1995). *Philosophical Investigations (orig. 1953)*. Oxford: Blackwell.

Compilation of References

- Wittstruck, D., & Teuteberg, F. (2012). Understanding the success factors of sustainable supply chain management: Empirical evidence from the electronics and electronics industry. *Corporate Social Responsibility and Environmental Management*, 19(3), 141–158. doi:10.1002/csr.261
- Woertz, E. (2013). *Oil for Food: The Global Food Crisis and the Middle East*. Oxford University Press. doi:10.1093/acprof:oso/9780199659487.001.0001
- Wolf, J. (2011). Sustainable supply chain management integration: A qualitative analysis of the German manufacturing industry. *Journal of Business Ethics*, 102(2), 221–235. doi:10.1007/s10551-011-0806-0
- Wölfle, M., & Günthner, W. A. (2011). Wearable RFID in order picking systems. *7th European Workshop on Smart Objects: Systems, Technologies and Applications* (pp. 1-6).
- Womack, J. P., & Jones, D. T. (1996). *Lean thinking*. New York, NY: Simon Schuster.
- Womack, J. P., & Jones, D. T. (2005). *Lean Solutions: How Companies and Customers Can Create Wealth Together*. New York: Simon and Schuster.
- Wong, W. P., & Wong, P. S. (2011). Supply chain management, knowledge management capability, and their linkages towards firm performance. *Business Process Management Journal*, 17(6), 940–964. doi:10.1108/14637151111182701
- Woods, T. (2013). Mis-Picks Cost Businesses Nearly £242,000 per year (Press Release). *Honeywell*. Retrieved from http://www.intermec.co.uk/about_us/newsroom/press_releases/DC3-1-2013.aspx
- Woods, T. A. (2014). Innovation in Agri-Food Clusters: Theory and Case Studies. *American Journal of Agricultural Economics*, 2014, 96(2), 610–611. doi:10.1093/ajae/aat082
- World Commission on Environment and Development. (1987). *Our common future – The Brundtland Report*. Oxford: Oxford University Press.
- World Economic Forum. (2008). *Global risks 2008*. Geneva: World Economic Forum.
- Worthington, I., Ram, M., Boyal, H., & Shah, M. (2008). Researching the Drivers of Socially Responsible Purchasing: A Cross-National Study of Supplier Diversity Initiatives. *Journal of Business Ethics*, 79(3), 319–331. doi:10.1007/s10551-007-9400-x
- Wu, D. J. (2001). Software agents for knowledge management: Coordination in multi-agent supply chains and auctions. *Expert Systems with Applications*, 20(1), 51–64. doi:10.1016/S0957-4174(00)00048-8
- Wu, D., & Olson, D. L. (2008). Supply chain risk, simulation, and vendor selection. *International Journal of Production Economics*, 114(2), 646–655. doi:10.1016/j.ijpe.2008.02.013
- Wu, F., Zsidisin, G., & Ross, A. (2007). Antecedents and outcomes of e-procurement adoption: An integrative model. *Engineering Management. IEEE Transactions*, 54(3), 576–587.
- Wu, I. L., & Chuang, C. H. (2009). Analyzing contextual antecedents for the stage-based diffusion of electronic supply chain management. *Electronic Commerce Research and Applications*, 8(6), 302–314. doi:10.1016/j.elerap.2009.04.013
- Wu, Z., & Pagell, M. (2011). Balancing priorities: Decision-making in sustainable supply chain management. *Journal of Operations Management*, 29(6), 577–590. doi:10.1016/j.jom.2010.10.001
- Wycherley, I. (1999). Greening supply chains: The case of The Body Shop International. *Business Strategy and the Environment*, 8(2), 120–127. doi:10.1002/(SICI)1099-0836(199903/04)8:2<120::AID-BSE188>3.0.CO;2-X

Compilation of References

- Wycisk, C., McKelvey, B., & Hulsmann, M. (2008). Smart parts, supply networks as complex adaptive systems: Analysis and implications. *International Journal of Physical Distribution & Logistics Management*, 38(2), 108–125. doi:10.1108/09600030810861198
- Xerox. (2013). Retrieved from http://www.xerox.com/downloads/usa/en/e/Environment_Sustainability_Commitment.pdf
- Xiao, T., & Yang, D. (2008). Price and service competition of supply chains with risk-averse retailers under demand uncertainty. *International Journal of Production Economics*, 114(1), 187–200. doi:10.1016/j.ijpe.2008.01.006
- Xie, E., Peng, M., & Zhao, W. (2013). Uncertainties, resources, and supplier selection in an emerging economy. *Asia Pacific Journal of Management*, 30(4), 1219–1242. doi:10.1007/s10490-012-9321-9
- Xu, B., Wang, N., & Li, C. (2011). A cloud computing infrastructure on heterogeneous computing resources. *Journal of Computers*, 6(8), 1789–1796. doi:10.4304/jcp.6.8.1789-1796
- Xu, L., Xiang, W., Zhao, H., & Li, J. (2012). Supply chain partner relationships classification: An empirical study on Leg model. *Advanced Materials Research*, 468-471, 2341–2347. doi:10.4028/www.scientific.net/AMR.468-471.2341
- Yale University. (2014). Environmental Performance Index. Retrieved from www.epi.yale.edu/epi
- Yang, F., Wu, D., Liang, L., Bi, G., & Wu, D. D. (2011). Supply chain DEA: Production possibility set and performance evaluation model. *Annals of Operations Research*, 185(1), 195–211. doi:10.1007/s10479-008-0511-2
- Yang, H., Lin, Z. J., & Lin, Y. L. (2010). A multilevel framework of firm boundaries: Firm characteristics, dyadic differences, and network attributes. *Strategic Management Journal*, 31(3), 237–261. doi:10.1002/smj.815
- Yates, J. F., & Stone, E. (1992). The risk construct. In J. F. Yates (Ed.), *Risk-taking behavior* (pp. 1–25). Chichester, England: Wiley.
- Ye, C., Cronin, J. J. Jr, & Pelozo, J. (2014). The Role of Corporate Social Responsibility in Consumer Evaluation of Nutrition Information Disclosure by Retail Restaurants. *Journal of Business Ethics*, 130(2), 1–14.
- Yeung, R. M., & Morris, J. (2001). Food safety risk: Consumer perception and purchase behaviour. *British Food Journal*, 103(3), 170–187. doi:10.1108/00070700110386728
- Yin, R. (1981). The case study crisis: Some answers. *Administrative Science Quarterly*, 26(1), 58–65. doi:10.2307/2392599
- Yin, R. (2009). *Case study research. Design and methods*. United States of America: Sage.
- Yin, R. K. (2009). *Case study research: Design and methods* (4th ed.). London: Sage.
- Youn, S., Yang, M. G. M., & Jungbae Roh, J. (2012). Extending the Efficient and Responsive Supply Chains Framework to the Green Context. *Benchmarking: An International Journal*, 19(4/5), 463–480. doi:10.1108/14635771211257954
- Youn, S., Yang, M. G., & Roh, J. J. (2012). Extending the efficient and responsive supply chains framework to the green context. *Benchmarking: An International Journal*, 19(4–5), 463–480.
- Yu, C., & Wong, T. (2014). A supplier pre-selection model for multiple products with synergy effect. *International Journal of Production Research*, 52(17), 5206–5222. doi:10.1080/00207543.2014.900199
- Yu, H., Zeng, A. Z., & Zhao, L. (2009). Single or dual sourcing: Decision-making in the presence of supply chain disruption risks. *Omega*, 37(4), 788–800. doi:10.1016/j.omega.2008.05.006
- Yu, L. C., & Hui, H. Y. (2008). An Empirical Study on Logistics Services Provider Intention to Adopt Green Innovations. *Journal of Technology. Management and Innovation*, 3(1), 17–26.

Compilation of References

- Yu, M., & Nagurney, A. (2013). Competitive food supply chain networks with application to fresh produce. *European Journal of Operational Research*, 224(2), 273–282. doi:10.1016/j.ejor.2012.07.033
- Yusuff, R. D., Yee, K. P., & Hashmi, M. S. J. (2001). A preliminary study on the potential use of the analytical hierarchical process (AHP) to predict advanced manufacturing technology (AMT) implementation. *Robotics and Computer-integrated Manufacturing*, 17(5), 421–427. doi:10.1016/S0736-5845(01)00016-3
- Yusuf, Y. Y., Adeleye, E. O., & Sivayoganathan, K. (2003). Volume flexibility: The agile manufacturing conundrum. *Management Decision*, 41(7), 613–624. doi:10.1108/00251740310495540
- Yu, X., & Jing, S. (2004). A decision model for supplier selection considering trust. *The China Business Review*, 3(6), 15–20.
- Zacharia, Z. G., Sanders, N. R., & Fugate, B. S. (2014). Evolving functional perspectives within supply chain management. *Journal of Supply Chain Management*, 50(1), 73–88. doi:10.1111/jscm.12022
- Zaheer, A., & Venkatraman, N. (1995). Relational governance as an interorganizational strategy: An empirical test of the role of trust in economic exchange. *Strategic Management Journal*, 16(5), 373–392. doi:10.1002/smj.4250160504
- Zaheer, S. (1995). Overcoming the Liability of Foreignness. *Academy of Management Journal*, 38(2), 341–363. doi:10.2307/256683
- Zahra, S. A., Korri, J. S., & Yu, J. F. (2001). Cognitive and international entrepreneurship: Implications for research on international opportunity recognition and exploitation. *International Business Review*, 14(2), 112–146.
- Zajac, E. J., & Olsen, C. P. (1993). From transaction costs to transactional value analysis: Implications for the study of interorganizational strategies. *Journal of Management Studies*, 30(1), 131–145. doi:10.1111/j.1467-6486.1993.tb00298.x
- Zbilgin, M. F. (2009). *Career choice in management and entrepreneurship: a research companion*. London: Edward Elgar Publishing.
- Zenger, T. D., Lazzarini, S. G., & Poppo, L. (2002). Informal and formal organization in new institutional economics. *Advances in Strategic Management*, 19, 277–306. doi:10.1016/S0742-3322(02)19009-7
- Zhang, A., Luo, H., & Huang, G. Q. (2013). A bi-objective model for supply chain design of dispersed manufacturing in China. *International Journal of Production Economics*, 146(1), 48–58. doi:10.1016/j.ijpe.2012.12.008
- Zhang, D. A. (2006). Network economic model for supply chain versus supply chain competing. *Omega: The International Journal of Management Science*, 34(3), 283–295. doi:10.1016/j.omega.2004.11.001
- Zhang, Y., & Huxham, C. (2009). Identity construction and trust building in developing international collaborations. *The Journal of Applied Behavioral Science*, 45(2), 186–211. doi:10.1177/0021886309333327
- Zhao, J., Pablo, P., & Qi, Z. (2012). Enterprise knowledge management model based on China's practice and case study. *Computers in Human Behavior*, 28(2), 324–330. doi:10.1016/j.chb.2011.10.001
- Zhao, X., Huo, B., Sun, L., & Zhao, X. (2013). The impact of supply chain risk on supply chain integration and company performance: A global investigation. *Supply Chain Management: An International Journal*, 18(2), 115–131. doi:10.1108/13598541311318773
- Zhengyi, Y., & Ronghua, J. (2005). Artificial neural network and its application in the performance evaluation enterprise knowledge management research. *Guangxi Social Sciences*, 126(12), 58–61.
- Zhou, H., & Benton, W. Jr. (2007). Supply chain practice and information sharing. *Journal of Operations Management*, 25(6), 1348–1365. doi:10.1016/j.jom.2007.01.009

Compilation of References

- Zhou, K. Z., & Xu, D. (2012). How foreign firms curtail local supplier opportunism in China? Detailed contracts, centralized control, and relational governance. *Journal of International Business Studies*, 43(7), 677–692. doi:10.1057/jibs.2012.7
- Zhu, Q., & Sarkis, J. (2007). The Moderating Effects of Institutional Pressures on Emergent Green Supply Chain Practices and Performance. *International Journal of Production Research*, 45(18-19), 4333–4355. doi:10.1080/00207540701440345
- Zinn, W., Levy, M., & Bowersox, D. J. (1989). Measuring the Effect of Inventory Centralization/Decentralization on Aggregate Safety Stock: The Square Root Law Revisited. *Journal of Business Logistics*, 10(1), 1–14.
- Zsidisin, G. (2003). Managerial perceptions of supply risk. *The Journal of Supply Chain Management*, 39(4), 14-26. doi:10.1111/j.1745-493X.2003.tb00146.x
- Zsidisin, G. A., & Ellram, L. M. (2003). An agency theory investigation of supply risk management. *Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, 39(3), 15-27.
- Zsidisin, G. A., & Ritchie, B. (2008). Supply chain risk management: Developments, issues and challenges. In G. A. Zsidisin & B. Ritchie (Eds.), *Supply chain risk: A handbook of assessment, management, and performance* (Vol. 124, pp. 1-12). New York: Springer.
- Zsidisin, G. A. (2003). A grounded definition of supply risk. *Journal of Purchasing and Supply Management*, 9(5-6), 217–224. doi:10.1016/j.pursup.2003.07.002
- Zsidisin, G. A., Ellram, L. M., Carter, J. R., & Caviato, J. L. (2004). An analysis of supply risk assessment techniques. *International Journal of Physical Distribution & Logistics Management*, 34(5), 397–413. doi:10.1108/09600030410545445
- Zsidisin, G. A., Melnyk, S. A., & Ragatz, G. L. (2005). An institutional theory perspective of business continuity planning for purchasing and supply management. *International Journal of Production Research*, 43(16), 3401–3420. doi:10.1080/00207540500095613
- Zsidisin, G. A., Panelli, A., & Upton, R. (2000). Purchasing organization involvement in risk assessments, contingency plans, and risk management: An exploratory study. *Supply Chain Management: An International Journal*, 4(4), 187–197. doi:10.1108/13598540010347307
- Zwietering, M. H., Ross, T., & Gorris, L. G. M. (2014). Food safety assurance systems: Microbiological testing, sampling plans, and microbiological criteria. In *Encyclopedia of Food Safety* (Vol. 4, pp. 244-253). Academic Press.

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