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SUPPLY CHAIN MANAGEMENT PRACTICES IN THAI SMEs: ANTECEDENTS AND OUTCOMES

By

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Copyright Statement

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Abstract

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Supply Chain Management Practices Model for Thai SMEs: Antecedents and Outcomes

Small and medium-sized enterprises (SMEs) contribute significantly to both local and global economic development. They are a crucial business sector for all nations' economies. In developed countries, SMEs typically account for 60 per cent of employment, and the figure is even higher in developing countries. In 2011, Thai SMEs employed 83.9 per cent of the Thai workforce. Thai SMEs, like all other firms, face the challenge of satisfying customers by offering quality products at low prices. Furthermore, it is generally argued that, in this increasingly aggressive business world, competition arises between integrated supply chains rather than at the firm level. Therefore, effective supply chain management (SCM) is a key driver of sustainable competitive advantage. However, Thai SMEs have issues in adopting supply chains in their organisations. They have doubts about whether SCM will improve firm performance. Therefore, this study aims to reveal whether SCM practices could help Thai SMEs to improve their performance, and if so which ones and how.

To fill the gap in theoretical understanding, an initiation mixed method research design was specified using 20 semi-structured interviews and quantitative questionnaires distributed to 311 subjects. An SCM practices model with antecedents and consequences was identified using previous research. The measurements were evaluated, modified and analysed using several techniques, such as thematic analysis, regression and structural equation modelling.

The study makes several notable findings. Firstly, the SMEs were found to implement SCM to reduce costs and improve productivity rather than to satisfy the customer. Secondly, the IT system and top management support were two key factors in helping SMEs to successfully apply SCM. Thirdly, the major barriers to SCM were employees' lack of understanding and improper organisational design. Fourthly, firm size had no significant relationship to the level of firm performance. Finally, the firm's performance and SCM practices were positively correlated.

This work contributes to academia by expanding research into SCM practices in SMEs, of which there is a dearth in the literature (Quayle, 2003, Meehan and Muir, 2008), especially in the context of developing countries (Katunzi and Zheng, 2010). For practitioners, regarding SMEs in Thailand and other developing countries, this study confirms that SCM practice assists SMEs to gain higher performance. Furthermore, for policy makers, enhancing SCM practices in SMEs by developing SCM enablers such as IT systems and standard performance measurement and metrics, could help SMEs to achieve higher performance.

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Author's declaration

At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

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List of Abbreviations

AFTA	-	ASEAN Free Trade Area
AMOS	-	Analysis of Moment Structures
ANOVA	-	Analysis of Variance
ASEAN	-	The Association of South East Asian Nations
ASQC	-	American Society for Quality Control
AVA	-	Average Variance Extracted
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
CLM	-	Council of Logistics Management
CPFR	-	Collaborative Planning Forecasting and Replenishment
CR	-	Composite Reliability
CSCMP	-	The Council of Supply Chain Management Professionals
df	-	Degrees of Freedom
ECR	-	Efficient Consumer Response
EDI	-	Electronic Data Interchange
EFA	-	Exploratory Factor Analysis
EU	-	European Union
EXSCMD	-	External Supply Chain Management Driver
EXSCMI	-	External Supply Chain Management Impediment
FMCG	-	Fast Moving Consumer Goods
FP	-	Firm Performance
FTI	-	The Federation of Thai Industries
GDP	-	Gross Domestic Product
GFI	-	Goodness-of-Fit Index
GSCF	-	Global Supply Chain Forum
HR	-	Human Resources
INSCMD	-	Internal Supply Chain Management Driver
INSCMI	-	Internal Supply Chain Management Impediment
INTSCMF	-	Intangible Supply Chain Management Facilitator
ISIC	-	International Standard of Industrial Classification of All Economic Activities

List of Abbreviations (Continued)

IT	-	Information Technology
JIT	-	Just-in-Time
JKW	-	Jöreskog-Keesling-Wiley
KM	-	Knowledge Management
KMO	-	Kaiser-Meyer-Olkin
KPI	-	Key Performance Indicators
LEs	-	Large Enterprises
MRS	-	Market Research Society
NAPA	-	National Association of Purchasing Agents
n.e.c.	-	Not Elsewhere Classified
NFI	-	Normed Fit Index
OECD	-	Organization for Economic Co-operation and Development
OSMEP	-	The Office of the Small and Medium Enterprises Promotion
OTIF	-	On Time and In Full
RMSEA	-	Root Mean Square Error of Approximation
RNI	-	Relative Noncentrality Index
SCM	-	Supply Chain Management
SCMD	-	Supply Chain Management Drivers
SCMF	-	Supply Chain Management Facilitators
SCMI	-	Supply Chain Management Impediments
SCMP	-	Supply Chain Management Practices
SEM	-	Structural Equation Modelling
SFL	-	Standardised Factor Loadings
SMEs	-	Small and Medium-sized Enterprises
SPSS	-	Statistical Package for the Social Sciences
TANSCMF	-	Tangible Supply Chain Management Facilitator
TQM	-	Total Quality Management
UNCTAD	-	United Nations Conference on Trade and Development

O how they cling and wrangle, some who claim

For preacher and monk the honoured name!

For, quarrelling, each to his view they cling.

Such folk see only one side of a thing.

(Jainism and Buddhism. Udana 68-69)

CHAPTER 1 INTRODUCTION

1.1 Introduction

As in the above parable of Jainism and Buddhism, since the concept of supply chain management (SCM) first appeared in the 1980s, many academics and practitioners have scrutinised it (Lambert, 2008, Grant, 2012). The question "What is supply chain management?" is discussed extensively by practitioners and academics from the past to present. An extensive review of the literature and a study of SCM was conducted by Bechtel and Jayaram (1997). However, it is generally agreed that SCM is considered everybody's job and involves all functions in the firm and those of its partners (Lambert, 2008). Furthermore, SCM is not only a practice but also an essential philosophy of modern business management (Christopher, 2010). Therefore, its study has risen to prominence (Mentzer et al., 2007).

This chapter presents an overview of the thesis. First, the research background, based on the need for small and medium-sized enterprises (SMEs) to implement SCM, is examined. Then, the research objectives and justifications are explained. The research methodology used in the study is also described. Finally, the structure of this thesis is illustrated.

1.2 Research background

SMEs are the core business format in all countries (Stokes and Wilson, 2006, Tan et al., 2006). SMEs are a key to drive economic growth both national and international levels (OECD, 2009). Thai SMEs create jobs, contribute to Thailand's economic growth and enhance the country's rural development (Office of Small and Medium Enterprises Promotion, 2009, Thailand Business News, 2010). Good strategies are therefore crucial so as to nurture SMEs' survival in the current complex and competitive business environment.

The supply chain network encompasses all organisations and activities associated with the flow and transformation of products, from raw materials, through various stages, to the consumer. Along with this material flow, effective information also flows both up and down the supply chain network (Harrison and Hoek, 2011). SCM is thus the integration and management of supply chain organisations and activities. Its ultimate goal is to enhance customer value and satisfaction, and profitability for the supply chain member organisations (Mentzer et al., 2001b).

It is also recognised that competition is rapidly shifting from a firm versus firm perspective to a supply chain versus supply chain perspective (Christopher, 2011). Currently, customers require better, faster, cheaper and more product lines as well as higher service levels from firms (Chow et al., 2008). SCM is thus not only a maximising value creation process through collaboration and integration for organisations (Handfield and Nichols, 2002), but also a key to building sustainable competitive advantage and enhances firm performance (Chin et al., 2004, Arend and Wisner, 2005, Li et al., 2006, Koh et al., 2007, Petrovic-Lazarevic et al., 2007, Bayraktar et al., 2009).

The relationship between SCM practices and the performance of SMEs is an important issue for practitioners (Tan et al., 2006). The supporting and hindering factors in the implementation of SCM between large enterprises (LEs) and SMEs also remain in question (Arend and Wisner, 2005). Whether SMEs can reproduce LEs' successful SCM execution is yet to be investigated.

According to statistical data from the National Statistical Office, in 2012 the number of Thai SMEs establishments was 99.8 per cent or around 2.2 million organisations (NSO, 2012). Furthermore, it was found that more than 80 per cent of establishments employed by SMEs. This indication suggested that SMEs contribute an essential role to Thai's economy and wellbeing (Chittithaworn et al., 2011). The largest concentration of SMEs, in terms of numbers, can be found in the retail trade, followed by manufacturing and accommodation, food and beverage service activities. The motivation to study SCM practices in Thai SMEs can be identified as following:

1. Although government solutions to revive SMEs after the global financial crisis in 2008 were implemented they also confronted challenges arising from a more integrated and liberalised world, for example from Association of South East Asian Nations (ASEAN) Economic Cooperation, which will be implemented within year 2015. Despite these governmental programmes Thai SMEs have many remaining challenges, which could further hinder their supply chain resilience and

competitiveness (Office of Small and Medium Enterprises Promotion, 2011).

2. The previous studies involved with the conditions of successful SCM focused on large company rather than SMEs. This study will provides an enhanced understanding for business owners in addressing the SCM related factors which significantly affect the firm performance from implementing SCM in their organisation. Additionally, this study enhances knowledge of SMEs practices in developing country such as Thailand.
3. Having identified some of the supply chain challenges facing SMEs in Thailand, the research could define some supply chain strategies that the government and its agencies responsible for SMEs, and SMEs themselves may adopt. The government should play a leading role in educating SMEs on the SCM standard practices. Such an understanding of SCM practices should be delivered through an establishment standard for the success and sustainability of SMEs in Thailand.

1.3 Research objectives and justification

The report, “Improving the competitiveness of SMEs through enhancing productive capacity”, conducted by UNCTAD, showed that SMEs represented 99 per cent of all companies registered in the selected countries and accounted for 50 per cent of manufacturing output (United Nations Conference on Trade and Development, 2005). Similarly, Thai SMEs have been shown to represent a significant component of the Thai economy (Office of Small and Medium

Enterprises Promotion, 2011). The Department of Industrial Promotion of the Ministry of Industry began taking interest in SCM in the year 2000. It successfully conducted free training programmes for SMEs on SCM on a wide scale for several years. However, few Thai SMEs indicated any intention to invest in SCM.

Tan et al. (2006) studied the case of SMEs in the United Kingdom. Their research emphasised fundamental factors that led to the effective management of the global supply chain. This case study discussed ideas such as the key motives, enablers and inhibitors of SCM but could not conclude that SCM benefits SMEs. Although several studies have been conducted on the relationship between SCM practices and their benefits or performance outcomes (McMullan, 1996, Lai et al., 2002, Macpherson and Wilson, 2003, Quayle, 2003, Wisner, 2003, Barclay, 2005, Li et al., 2006, Koh et al., 2007, Kim et al., 2008, Lee and Klassen, 2008, Meehan and Muir, 2008, Thakkar et al., 2008b, Towers and Burnes, 2008, Katunzi and Zheng, 2010, Chong and Chan, 2011, Cook et al., 2011, Diaz et al., 2011, Hong et al., 2012, Huo, 2012), none of them has proposed a model of SCM best practices. Therefore, it is in the interests of both academics and practitioners to search for the SCM practices that are most suitable for SMEs.

The main objective of this study was to assist Thai SMEs improve their competence by suggesting a SCM practices model. The aim was thus to develop a SCM practices model for this purpose. The specific research objectives were:

1. to identify the main factors that affect the implementation of SCM practices;
2. to identify important SCM practices that create value and improve firm performance;
3. to construct a SCM practices model for the context of Thai SMEs;
4. to explore and confirm whether the SCM practices model is suitable for Thai SMEs.

1.4 Research methods

Yin (2009) explained the relationship between the form of the research question and the research method. The initial question in this research was "What are the SCM practices suitable for SMEs?". The research objectives were as listed in the previous section. Survey research was deemed suitable for this exploratory type of question. To achieve the research objectives, mixed methods, that is a combination of qualitative and quantitative approaches, were used in this study. Saunders et al. (2007) argued that there are several benefits of mixed methods research. First, different methods can be deployed for different purposes in a study. For example, in this study, interviews were deployed at an exploratory stage before the questionnaire was used to collect descriptive data. Another advantage is that it enables triangulation. For instance, here, the semi-structured interviews were a valuable way of triangulating the data collected in the questionnaires. Furthermore, the quantitative and qualitative data extracted from the mixed methods research were jointly explained.

The research process started with an exploratory study to find out what was happening in the field of SCM practices of SMEs. First, a literature review gave an understanding of the current SCM practices. A systematic review was applied. Bryman (2008: 85) defined the systematic review as *"a replicable, scientific and transparent process...that aims to minimise bias through exhaustive literature searches of published and unpublished studies and by providing an audit trail of the reviewer's decision, procedures and conclusions"*. The systematic review of the literature was conducted in order to ensure a comprehensive understanding of the subject area.

Then, qualitative techniques using semi-structured interviews were applied in order to gain an in-depth understanding of why firms had decided to implement SCM and what benefits they had gained from it. Thematic data analysis was conducted to identify themes, sub-themes and issues relating to each construct of SCM practices model. Finally, the results of the analysis of the semi-structured interviews were exploited to evaluate these scales of SCM practices model's constructs and modify them to comply with the research objectives.

Lastly, a self-completed questionnaire survey was performed. According to Saunders et al. (2007), questionnaires are suitable for an explanatory or analytical study. They provide rich details on the relationships between constructs and statistical tests such as correlation and cause-and-effect can be run on the resulting data. In this research, the quantitative work was used as a facilitator of the qualitative work. After the data had been collected, it was analysed quantitatively using multivariate data analysis with the Statistical Package for the Social Sciences (SPSS) software package and relationships among the observed variables were depicted with structural equation modelling (SEM) using the Analysis of Moment Structures (AMOS) software package. The result was an idea of the SCM best practices most suited to Thai SMEs.

Figure 1-1 provides an overview of the research process, involving a series of rational decisions. The steps of the research design are shown.

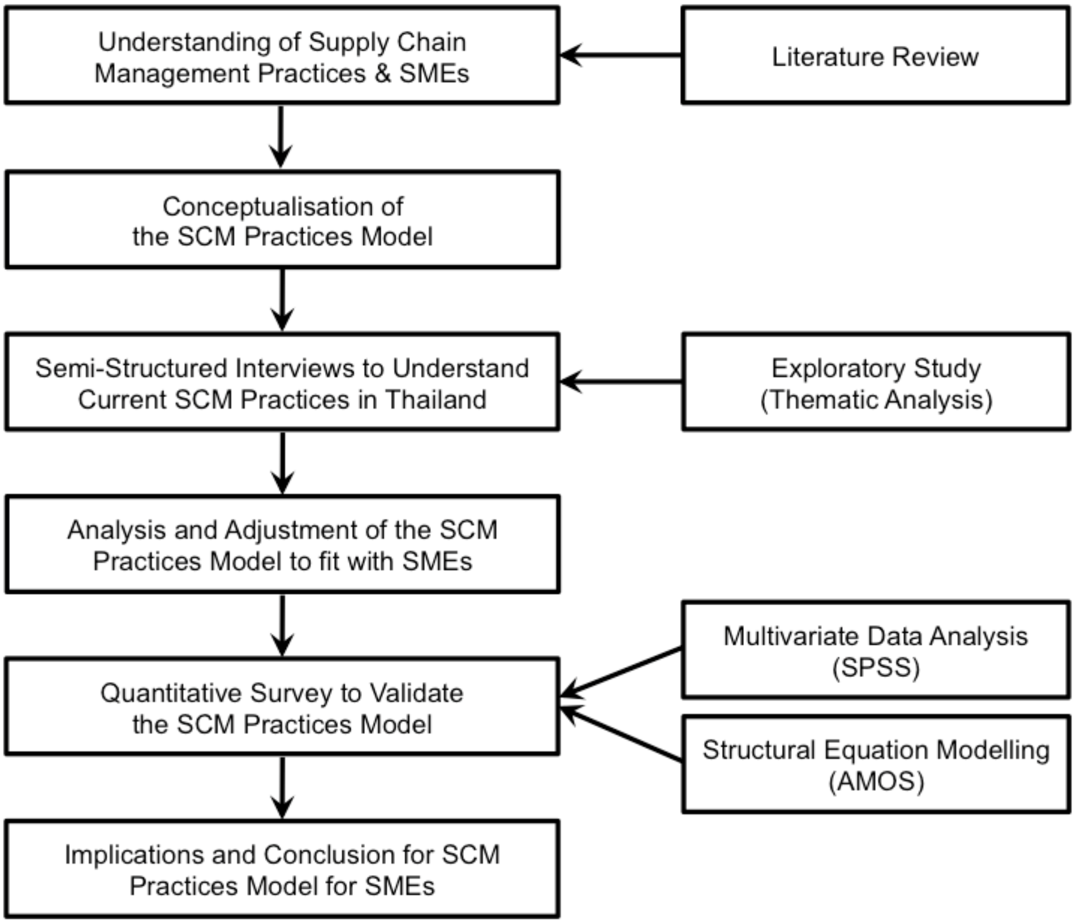


Figure 1-1 Research process in this study

1.5 Outline of the thesis

This chapter has given an idea of the research background, the objectives of the research and its justification. An overview of the research process has been provided as a guide for the reader.

The next chapter will review the literature and the factors related to the research model. It will define SCM, and its antecedents and consequences. Finally, the justifications for the research will be discussed in more detail.

Chapter 3 focuses on the conceptual SCM practices model and its framework. The model is assembled from the antecedents and consequences of SCM practices. Then the main research objectives are identified and lead to the research hypotheses.

Next, Chapter 4 illustrates the research strategy, which includes the research design and methodology. Afterwards, the preliminary qualitative data analysis is discussed. The initial scales used to measure SCM practices in Thailand are defined. The fundamental quantitative data analysis is also explained, that is, the multiple group analysis of the constructs of the SCM practices model.

Chapter 5 focuses on exploratory analysis. The thematic data analysis based on the semi-structured interviews is explained. The sub-themes are evaluated and summarised. The issues relating to each factor are discussed. Finally, measurements are developed for the self-completed questionnaire survey, ready to be evaluated in the next step.

After the quantitative data collection, in Chapter 6, the data is examined with the multivariate data analysis technique. Factor analysis and regression analysis are utilised as the tools for extracting information from the data. The results are explained and interpreted.

Chapter 7 also utilises the quantitative data to explain the components of SCM practices and the structural model. Both first-order confirmatory factor analysis and a secondary factor analysis model are evaluated and interpreted.

The last two chapters provide the findings, discussion, ideas for further research and the conclusions. Chapter 8 discusses the findings from both the semi-structured interviews and the self-completed questionnaire survey. Then, the effects of the SCM practices model for firm performance are elaborated.

Finally, in Chapter 9, the conclusions of the study are summarised. Three main areas of the research are revisited. First, the research objectives and main findings are recapped. The next section explains the contribution of this study, covering three areas: the contribution to academia, the implications for SCM practitioners and the benefits for policy makers. Future developments of this work are discussed. The thesis closes with some final thoughts about the study.

A company is its chain of continually evolving capabilities-that is,
its own capabilities plus the capabilities of everyone it does business with.
(Charles H. Fine. Clockspeed)

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

The old proverb that *'a chain is only as strong as its weakest link'* has been applied to the business world (Fine, 1998), emphasising the importance of SCM. This chapter reviews relevant literature to provide the theoretical foundation for disparate constructs that will be used to formulate the SCM practices model. Using a systematic review, the review of the literature covers the following topics: the supply chain and SCM, SCM drivers, SCM impediments, SCM facilitators, SCM practices, firm performance, and SCM in SMEs. Following this, there is a discussion of the research gap and a summary of this chapter.

2.2 Review procedures: systematic literature review

Tranfield et al. (2003) argued three stages of systematic review according to the Cochrane Collaboration's Reviewer's Handbook and the National Health Service Dissemination (2001) as planning the review, conducting the review and reporting and dissemination. In this study, to obtain the current situation and development of SCM practices in SMEs within the academic literature a systematic search was conducted in online academic databases including ProQuest, Emerald, Elsevier, ScienceDirect and EBSCO. In each case, keywords such as “supply chain management practices” and “small and medium enterprises” or “SMEs” were used to focus the search Furthermore, a search was undertaken in Google Scholar to ensure that all the relevant sources had been evaluated. If a paper could not be collected from an online database it was obtained via an inter library loan from Plymouth University Library Services. The three stages procedure of this study was described as following.

First stage, planning the review in management research intended to be more flexible and modifiable through the study. In this research, a clear definition of the scope was identified according to the SCM practices model elements. The scope of study was clearly aimed at SMEs. However, in the review process, the priori study of SCM in SMEs was extremely limited. Thus it was decided to include the SCM in large firms literature.

At the next stage, a systematic review was conducted without bias searching. Keywords were identified in accordance with the planning stage such as “supply chain management”, “SCM practices”, “drivers”, “obstacles” or “inhibitors” or “impediments”, “facilitators” or “enablers”, and “firm performance”. These terms were described in the section 2.4 to 2.8 respectively.

In the final stage, reporting and dissemination of the review was summarised as a ‘thematic analysis’. Thematic analysis was applied during the analysis of qualitative data to refer to the elicitation of key ideas in one’s data (Bryman, 2008). Thus, it was also used as a framework for defining core themes in data.

2.3 The supply chain and SCM

The study of supply chains has been of substantial importance since the mid-1980s (Cooper et al., 1997) but has recently seen increasing interest from practitioners and academic researchers. Study areas include the managing of inter-organisational operations, system integration, partnership models and the sharing of information. Ultimately, the goal of business is to meet customer needs better than one's competitors while using fewer resources. Supply chain design supports businesses to achieve this goal.

In order to implement the supply chain concept in one's firm, the number of firms involved in the supply chain and their activities and functions have to be identified in advance. This leads to the three major components of the supply chain integration concept (Jespersen and Skjøtt-Larsen, 2005), namely the network structure, business processes and management. A profusion of SCM definitions have emerged since the mid-1980s (Cooper et al., 1997, Sweeney, 2009). There are three main views:

Firstly, SCM addresses the supply process along the value chain. The entire range of activities encompasses a firm's flow of products, services, finances and information among its customers and suppliers (Scott and Westbrook, 1991, New and Payne, 1995, Larson and Rogers, 1998, Kannan and Handfield, 1998, Tan et al., 1998, Mentzer et al., 2001b, Giunipero et al., 2008).

Secondly, a number of academic researchers have defined SCM by including the end-customer's satisfaction as the key driver (Cooper et al., 1997, Lambert et al., 1998, Coyle et al., 2003, Long, 2003, Jespersen and Skjøtt-Larsen, 2005, Lambert, 2008, Jacoby, 2009, Harrison and Hoek, 2011). Therefore, the second perspective has focused on the efficiency or competitive advantage of the firm gained by improving performance. Furthermore, SCM can be interpreted as firms collaborating to leverage strategic positioning and to improve the operating efficiency of the supply chain as a whole through cooperative organisational relationships, effective business processes and a high level of information sharing.

Thirdly, SCM incorporates both the minimisation of system-wide costs and the delivery of superior customer value to the end-customer through integration, coordination and control among the members of the supply network (Keebler et al., 1999, Handfield and Nichols, 2002, Mentzer, 2004, Bowersox et al., 2013).

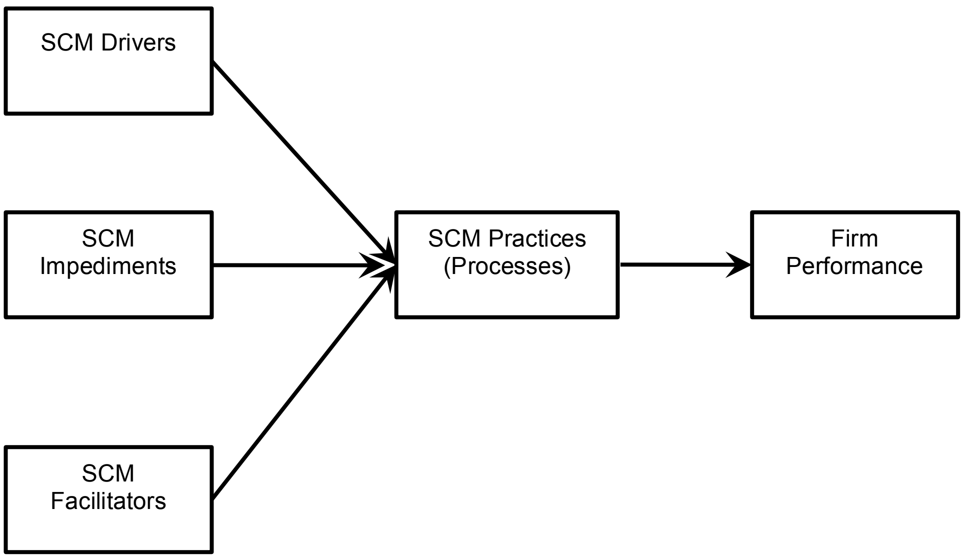
The world-leading professional organisation, The Council of Supply Chain Management Professionals (CSCMP), defines SCM as follows (CSCMP, 2003:187):

> *"Supply chain management encompasses 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 between companies in order to serve the needs of the end-customer".*

The CSCMP stresses that SCM includes the whole process of managing customer demand through the activities of the firms that belong to the supply network so as to satisfy the end-customer. The cooperation, coordination and collaboration among supply network members are the key areas of this (Wisner et al., 2008, Gattorna, 2010). Each member of a supply network is directly responsible for a process that adds value to a product. A process is a sequence of activities that transform materials and information into products or services (Harrison and Hoek, 2011).

Fawcett et al. (2009) proposed a theoretical framework for the assessment of the viability of SCM, focusing on the collaboration capability of the firm. The model evaluates four constructs that explain the viability of the SCM implementation of small businesses in the United State. These four constructs are driving forces, resisting forces, enablers of implementation success and expected performance outcomes. The findings from the research revealed that few small firms cultivated SCM as a strategic weapon even if their management found that SCM helped them to achieve higher performance. This model views SCM as collaboration capability (or network structure) only and does not include the SCM practices or business processes. Lambert (2008) proposed an "industry standard" of SCM processes based on the Global Supply Chain Forum (GSCF) framework, developed as a structure to assist academics with their research on SCM and practitioners with its implementation.

Mentzer et al. (2001a) argued that SCM relationships involved long-term strategic coordination and proposed the antecedents and consequences of SCM. The antecedents to SCM are the factors that enhance or impede the implementation of a supply chain philosophy in a firm, while the consequences of SCM are the motives behind its implementation (Mentzer et al., 2001a). From that concept the author proposes three categories of SCM antecedents, namely SCM drivers, impediments and facilitators. The author also define SCM consequences as relating to a firm's performance in order to complete the vision of SCM practices model. Figure 2-1 shows the relationship between SCM and its antecedents and consequences, as the constructs of the model proposed in this research.



Source: Author

Figure 2-1 Constructs of the SCM practices model

The following sections discuss each of the constructs of the SCM practices model.

2.4 The SCM drivers

In this section, the researcher will identify and review the SCM drivers, which are the strategic factors that help to determine an appropriate level of SCM practices. SCM drivers are regarded as separation from daily supply chain operation while they are critical to a transformation in a firm (Ayers, 2006). They are defined as the set of driving forces that affect a firm's ability to implement SCM (Fawcett et al., 2009). Ayers (2006) argued that innovation is the first driving force that comes from outside of the supply chain network to drive all of the supply chain network members to move forward to improve the supply chain's effectiveness. The next three drivers – extended product design, globalisation and flexibility imperative – form the direction, scope and format of the products and services, and the way the supply chain is configured to deliver them. Process-centred management is designed to cover the whole network process in order to create collaboration among the supply network members. Collaboration is the final driver that loops back to create innovation in the supply chain. These drivers can be both internal and external to a single company. Therefore, the researcher classifies SCM drivers into three groups based on their effects on the company.

2.4.1 External drivers of SCM

Drivers external to the supply chain network have been identified in many research studies. Economic globalisation, which leads to global SCM, is an example of the evolution of a competitive structure as large firms compete in fragmented markets (Ayers, 2006, Storey et al., 2006, Fawcett et al., 2009, Christopher, 2011). The global supply chain competition that leads to SCM will force a firm and its trading partners to collaborate as a supply chain. The information revolution and computing power is another important external supply chain network driver that forces firms to consider SCM (Murphy and Wood, 2008, Thakkar et al., 2008b, Christopher, 2011). Christopher (2011) listed more drivers such as changes in trade regulations that drive firms to cooperate with their partners and form networks of SCM. The end-customer is another driving force through their demand for higher quality products and services (Thakkar et al., 2008b, Christopher, 2011). Finally, the need to remain competitive was identified by (Chin et al., 2004) in their study on SCM practices in Hong Kong. Table 2-1 summarises these external drivers of SCM and their supporting literature.

Table 2-1 The external drivers of SCM

No.	External drivers of SCM	Literature
1.1	Global supply chain competition	Ayers (2006), Storey et al. (2006), Fawcett et al. (2009), Christopher (2011)
1.2	The information revolution drives supply chain integration	Murphy and Wood (2008), Thakkar et al. (2008b), Christopher (2011)
1.3	Trade regulations have been changed	Christopher (2011)
1.4	End-customer demand for higher quality products and services	Thakkar et al. (2008b), Christopher (2011)
1.5	To remain competitive	Chin et al. (2004)

2.4.2 Intra-supply-chain-network drivers

Intra-supply-chain-network drivers refer to those drivers that occur within the supply chain network. When the members of a supply network have shared goals such as improving product quality and process capabilities, or enhancing competitive advantage and productivity, they will look for collaboration between channel members (Tan et al., 2002, Ayers, 2006). For example, Collaborative Planning Forecasting and Replenishment (CPFR) is industry's response to the fast-moving consumer goods (FMCG) business segment. Enhancing network competitiveness through products and services improvements among the supply chain network members is the main intra supply chain network driver found in the prior literature (Tan et al., 2002, Olhager and Selldin, 2004, Ayers, 2006, Fawcett et al., 2009). Sometimes, the leading firm in a network initiates the integration effort to enhance supply chain capability, which may drive other channel members to follow, e.g. in the automotive industry (Fawcett et al., 2009). The integration can be done through real-time communication and information exchange (Murphy and Wood, 2008). The adoption of process-centred management that allows network members to focus on processes both internal to firms and intra-network, instead of within departments or functions, has been employed as a driver. Storey et al. (2006) argued that firms could become more flexible and cost efficient by outsourcing non-core activities to other network partners who operate more cost-efficiently. All in all, shifting the competition from the company to the network arena is referred to as an intra supply chain network driver (Tan et al., 2002, Fawcett et al., 2009, Christopher, 2011). Table 2-2 lists the intra SCM network drivers and their supporting literature.

Table 2-2 The intra-network drivers of SCM

No.	Intra-network drivers of SCM	Literature
2.1	Desiderate to improve product quality, process capabilities and productivity	Tan et al. (2002), Olhager and Selldin (2004), Ayers (2006), Fawcett et al. (2009)
2.2	Initiate integration efforts	Fawcett et al. (2009)
2.3	Exchange information real-time to enhance communication	Murphy and Wood (2008)
2.4	Outsource non-core activities to promote flexibility and reduce costs	Storey et al. (2006)
2.5	Competition has shifted from between companies to between networks	Tan et al. (2002), Fawcett et al. (2009), Christopher (2011)

2.4.3 Internal company drivers

Internal company drivers are an important type of drivers of the implementation of SCM practices in a firm. Improved customer satisfaction and remaining competitive are two of the top five reasons for implementing SCM in the Hong Kong manufacturing industry (Chin et al., 2004). Supply chain resources are key to creating non-imitable collaborative capability so as to increase firms' competitiveness and response times to customers, leading to enhanced competitive advantage (Tan et al., 2002, Ayers, 2006, Fawcett et al., 2009). Fawcett et al. (2009) argued that SCM can help overcome some of the limitations of scarce resources. In order to respond to highly demanding customers, firms can rely on the strengths of network partners and focus on their own core competency by implementing SCM. Research from Swedish manufacturing firms indicates that resource utilisation and cost minimisation are the main internal drivers of SCM (Olhager and Selldin, 2004). Table 2-3 lists the internal company drivers of SCM and their supporting literature.

Table 2-3 The internal company drivers of SCM

No.	Internal company drivers of SCM	Source
3.1	Improve customer satisfaction and remaining competitive	Chin et al. (2004)
3.2	Enhance cooperative efforts among functional areas e.g. logistics and material management	Tan et al. (2002), Ayers (2006), Fawcett et al. (2009)
3.3	Focus on core competency process and/or functions	Fawcett et al. (2009)
3.4	Reduce costs of operation, logistics and inventory management	Olhager and Selldin (2004)

2.5 Impediments to SCM

This section will identify and review impediments to SCM that can potentially cause SCM practices to fail. The following SCM impediments or inhibitors have been identified in the literature: employees' resistance to change, ineffective IT systems, lack of trust and sharing between supply chain network members and improper resource allocation (Goh and Pinaikul, 1998, Mentzer et al., 2000, Mentzer, 2001, Chin et al., 2004, Tan et al., 2006, Bayraktar et al., 2009). According to their relationship with the firm, the author classifies supply chain inhibitors into two categories: internal and external. Internal impediments are more related to operational efficiency or poor organisation, while external impediments are more related to collaboration among network members, such as communication infrastructure (Goh, 2002). By grouping these supply chain obstacles into two categories firms can gain a clearer understanding of how to manage and eliminate them.

2.5.1 Internal SCM impediments

Internal impediments refer to factors within the firm that prevent it from implementing SCM. Internal impediments may come from people in the organisation or the organisation itself. Employees are often resistant to change due to inertia or being happy with the current practices (Mentzer et al., 2000, Chin et al., 2004, Ellinger et al., 2006, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009), or due to inadequate SCM knowledge and the difficulty of implementing SCM (Goh and Pinaikul, 1998, Chin et al., 2004, Tan et al., 2006, Larson et al., 2007, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009). Organisational factors such as "silo" structures, a lack of management support and the inability to manage supply chain network partners are also mentioned as obstacles in many studies (Mentzer, 2001, Udomleartprasert et al., 2003, Larson et al., 2007, Fawcett et al., 2008, Fawcett et al., 2009).

Table 2-4 The internal impediments to SCM

No.	Internal SCM impediments	Source
1.1	Resistance to change from employees	Mentzer (2001), Chin et al. (2004), Tan et al. (2006), Larson et al. (2007), Fawcett et al. (2008), Bayraktar et al. (2009), Fawcett et al. (2009)
1.2	Employees' lack of understanding of SCM and/or expertise and/or inadequate skills	Goh and Pinaikul (1998), Chin et al. (2004), Tan et al. (2006), Larson et al. (2007), Fawcett et al. (2008), Bayraktar et al. (2009), Fawcett et al. (2009)

1.3	Organisational structure resembles a "silo" and does not support cross-functional processes	Mentzer (2001), Udomleartprasert et al. (2003), Larson et al. (2007), Fawcett et al. (2008), Fawcett et al. (2009)
1.4	Top management team does not support or give sufficient budget and resources for SCM implementation	Chin et al. (2004), Larson et al. (2007), Fawcett et al. (2008), Bayraktar et al. (2009), Fawcett et al. (2009)
1.5	Ineffective IT systems	Goh and Pinaikul (1998)
1.6	Deficiencies in long-term strategic vision for implementing SCM	Thakkar et al. (2008b)
1.7	Unstable internal operational processes	Chen and Paulraj (2004)
1.8	Insufficient ability to manage network partners	Udomleartprasert et al. (2003), Bayraktar et al. (2009)

Goh and Pinaikul (1998) studied logistics management practices and development in Thailand. Inefficient logistics information systems were found to be a key barrier to collaboration among network partners. Thakkar et al. (2008b) explained that the lack of a long-term strategic vision for implementing SCM is a barrier to SCM implementation. Other researchers have pointed out that an unstable internal process can also act as an obstacle to SCM (Chen and Paulraj, 2004). Studies of SCM implementation in SMEs have found that a lack of cooperation in the supply chain and a lack of ability to manage customers are additional impediments (Udomleartprasert et al., 2003, Bayraktar et al., 2009). Table 2-4 lists the internal impediments to SCM and their supporting literature.

2.5.2 External impediments to SCM

External SCM impediments include a lack of trust, or betrayal leading to poor collaboration among network members (Mentzer et al., 2000, Mentzer, 2001, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009), an unwillingness to cooperate because of the time and mutual understanding required, and the risk of a misalignment of supply chain processes (Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Thakkar et al., 2008b). Another impediment is a lack of shared vision or aims among the partners (Udomleartprasert et al., 2003). Inadequate information sharing among supply chain network members, or confidential data such as about costs and pricing, often leads members to fail to work together as partners (Mentzer et al., 2000, Mentzer, 2001, Tan et al., 2006). Mentzer (2001), Goh (2002) and Thakkar et al. (2008b) all argued that restrictive laws and regulations could hinder network members from working together. Some research papers have also indicated that obstacles are caused by the incompatible information systems of network members, or by some members resisting change or failing to support SCM implementation (Udomleartprasert et al., 2003, Chin et al., 2004, Larson et al., 2007, Fawcett et al., 2008, Fawcett et al., 2009). Several studies have argued that the uncertainty of firms' processes can lead to quality problems for the whole network, as the strength of a supply chain is defined by its weakest link (Mentzer, 2001, Chen and Paulraj, 2004). The last obstacle found in the literature is the network members' resistance to change or failure to support SCM implementation (Chin et al., 2004, Larson et al., 2007, Fawcett et al., 2008, Fawcett et al., 2009). Table 2-5 lists the external SCM impediments and their supporting literature.

Table 2-5 The external impediments to SCM

No.	External SCM impediments	Source
2.1	Lack of trust or betrayal among network members	Mentzer et al. (2000), Mentzer (2001), Fawcett et al. (2008), Bayraktar et al. (2009), Fawcett et al. (2009)
2.2	Collaboration among the members of the supply network requires time and mutual understanding	Mentzer (2001), Tan et al. (2006), Fawcett et al. (2008), Thakkar et al. (2008b)
2.3	Disparate visions, strategies and objectives regarding SCM	Udomleartprasert et al. (2003)
2.4	Communication problems such as the reluctance of members to disclose important supply chain information	Mentzer et al. (2000), Mentzer (2001), Tan et al. (2006)
2.5	Laws and regulations such as the anti-trust law do not support network members' collaboration	Mentzer (2001), Goh (2002), Thakkar et al. (2008b)
2.6	Incompatible information systems and/or difficulties with systems integration	Udomleartprasert et al. (2003), Chin et al. (2004), Larson et al. (2007), Fawcett et al. (2008), Fawcett et al. (2009)
2.7	At least one of the network members has uncertain operational processes, which leads to quality problems for the network	Mentzer (2001), Chen and Paulraj (2004)
2.8	At least one of the network members resists change or does not support SCM implementation	Larson et al. (2007), Fawcett et al. (2008), Fawcett et al. (2009)

2.6 SCM facilitators

Facilitators can be ideas, tools, actors or organisations that enhance SCM implementation. Mentzer et al. (2000) use the term "enablers" to mean the same thing, including people, organisations and technology that move SCM forward. In this study, the definition of an SCM facilitator is as follows: SCM facilitators are the structural and infrastructural factors that aid the implementation of SCM practices. Structural facilitators relate to tangibles such as information systems and technology, and process technology and systems. Alternatively, facilitators that enhance the utilisation of the structural facilitators and control those facilitators are classified as infrastructural facilitators. These infrastructural facilitators include intangibles such as management, corporate culture and organisational design.

2.6.1 Tangible SCM facilitators

Tangible SCM facilitators relate to systems, structures and technology that are obviously noticeable, such as IT, workflow structure, communication structure, planning and control methods and knowledge management (Lambert, 2008). Information and communication technologies such as electronic data interchange (EDI), Internet technologies etc. are used to transfer data in a standard format among supply chain network members in order to reduce data entry operations and increase accuracy and control (Cigolini et al., 2004, Larson et al., 2005, Harland et al., 2007, Larson et al., 2007, Archer et al., 2008, Bordonaba-Juste and Cambra-Fierro, 2009). Technology advancements also reduce communication time and make managing supply chain networks more efficient (Tan et al., 2006). Thakkar et al. (2008b) argued that IT improves a firm’s ability to analyse data, reduce inventory and reduce lead-time. A process integration structure promotes trust and transparency, and reduces the duplication of work among network members (Mentzer et al., 2000, Tan et al., 2006, Lambert, 2008, Thakkar et al., 2008b). Sharing the benefits of re-engineering processes equally among supply chain network members is another facilitator of SCM (Mentzer, 2001, Chin et al., 2004). Relationship management has also been cited as a facilitator (Olhager and Selldin, 2004, Storey et al., 2006, Fawcett et al., 2009). According to Larson et al. (2007), customer relationships are the second most important SCM facilitator. Chin et al. (2004) identified five factors that assist with the progress of SCM, namely building customer-supplier relationships, implementing information and communications technology, re-engineering material flows, creating a corporate culture, and identifying performance measurement. Furthermore, planning and promotion that are focused on the end-customer's needs have been shown to enhance SCM success (Storey et al., 2006). Table 2-6 lists the tangible SCM facilitators with their supporting literature.

2.6.2 Intangible SCM facilitators

Meanwhile, intangible SCM facilitators are the behavioural and indirect supporters of the tangible facilitators that help supply networks to achieve high levels of performance. Lambert (2008) argued that intangible SCM facilitators include management methods, power and leadership, risk and reward, culture and attitude, trust and commitment. Larson et al. (2007) studied the opinions of senior members of the Council of SCM Professionals. The study identified top management support as the most important facilitator. The four archetypes of top management that have been shown to facilitate SCM implementation are the supply chain thinker, the relationship manager, the controller and the organiser for the future (Sandberg and Abrahamsson, 2010).

Table 2-6 Tangible SCM facilitators

No.	Tangible SCM facilitators	Source
1.1	Use of IT as a tool to gather, transmit and share data	Chin et al. (2004), Cigolini et al. (2004), Tan et al. (2006), Larson et al. (2007), Thakkar et al. (2008b), Fawcett et al. (2009)
1.2	Process integration structure to enhance trust, transparency, confidence, coordination and long-term business stability, and to avoid the duplication of efforts/investments	Mentzer et al. (2000), Tan et al. (2006), Lambert (2008), Thakkar et al. (2008b)
1.3	Equally share the benefits from SCM among the network members	Mentzer et al. (2000), Chin et al. (2004)
1.4	Relationship management with knowledge sharing among the members of the network	Olhager and Selldin (2004), Storey et al. (2006), Fawcett et al. (2009)
1.5	Network has developed a customer relationship management process	Larson et al. (2007)
1.6	Re-engineered processes such as logistics management to achieve cost effectiveness	Chin et al. (2004)
1.7	Creation of effective communication channels among the network	Chin et al. (2004)
1.8	Planning is aimed at the end-customer	Storey et al. (2006)

Cigolini et al. (2004) and Thakkar et al. (2008b) stated that a culture of solving operational-level problems such as inaccurate data transfer and delayed schedules caused by machine breakdowns, and an attitude oriented towards meeting sudden customer requirements, could support SCM practices. Supply chain coordination tools such as performance measurement, benchmarking tools and a vendor-rating system are used to improve supply chain competitiveness, helping firms to measure the results of SCM implementation (Chin et al., 2004, Cigolini et al., 2004). Furthermore, an organisational design that supports coordination, cooperation and collaboration will enhance supply chain integration (Mentzer et al., 2000, Cigolini et al., 2004, Storey et al., 2006, Larson et al., 2007, Lambert, 2008). Mentzer et al. (2000) also referred to openness and trust among network members as one of the enablers of SCM. Implementing quality management systems to ensure product quality and to act as a control tool among the network members was identified by Cigolini et al. (2004), and by Olhager and Selldin (2004). Table 2-7 lists the intangible SCM facilitators with their supporting literature.

Table 2-7 Intangible SCM facilitators

No.	Intangible SCM facilitators	Source
2.1	The top management team understands and supports SCM with both time and financial resources	Mentzer et al. (2000), Chin et al. (2004), Larson et al. (2007), Thakkar et al. (2008b), Sandberg and Abrahamsson (2010)
2.2	A culture to help tackle operational-level problems	Cigolini et al. (2004), Thakkar et al. (2008b)
2.3	Implementation of supply chain coordination tools	Chin et al. (2004), Cigolini et al. (2004) ,
2.4	Network designed to support coordination, cooperation and collaboration	Mentzer et al. (2000), Cigolini et al. (2004), Storey et al. (2006), Larson et al. (2007), Lambert (2008)
2.6	Openness and trust in supply chain network members' collaboration	Mentzer et al. (2000)
2.7	Implementation of a quality management system	Cigolini et al. (2004), Olhager and Selldin (2004)

2.7 SCM practices

This section will identify and review SCM practices, which are a set of effective activities carried out across the supply chain network. Cooper et al. (1997) proposed a framework of SCM consisting of business processes, management components and the structure of the supply chain. The process approach means that every activity is focused towards meeting the customer's requirements. SCM that embraces the process approach refers to the integration of processes across functions so as to produce a specific output for a particular customer or market. The GSCF developed a process-based SCM framework consisting of the following:

1. customer relationship management;
2. supplier relationship management;
3. customer services management;
4. demand management;
5. order fulfilment;
6. manufacturing flow management;
7. product development and commercialisation;
8. returns management (Cooper et al., 1997).

Li et al. (2006) defined SCM practices as a set of activities conducted in the firm to enhance SCM effectiveness. They included five dimensions: strategic supplier partnerships, customer relationships, the level of information sharing, the quality of information sharing, and postponement (Li et al., 2006). Donlon (1996) proposed maximising value in the supply chain by extending SCM practices across the supply chain network. These practices comprised supplier partnerships, outsourcing, cycle time reduction, continuous process design and IT integration among network members.

SCM practices have been implemented successfully in the grocery industry in the US and Europe using the framework of Efficient Consumer Response (ECR) (Alvarado and Kotzab, 2001). ECR is an example of a practice that adopts the SCM concept. Supplier partnerships make up the key aspect of it. Next, technologies such as information and business process re-engineering are used to create smooth process integration among network members. Managing supply chain network member relationships and sharing information among them are other SCM practices mentioned by a number of researchers (Kannan and Handfield, 1998, Tan et al., 2002, Ulusoy, 2003, Chen and Paulraj, 2004, Lee, 2004, Min and Mentzer, 2004, Li et al., 2005, Koh et al., 2007, Chow et al., 2008, Sambasivan and Jacob, 2008).

Some research questions have emerged regarding knowledge of SCM processes such as determining the significant supply chain processes and whether they are the same for all companies (Cooper et al., 1997). The author of this research proposes to study the three main processes of a firm according to the GSCF process framework. From the semi-structured interviews, three processes are recognised as significant to a firm's success. These processes are:

1. network relationship management, which includes customer and supplier relationship management;
2. manufacturing flow management;
3. product development and commercialisation.

Using the proposed methodology, the remaining processes can be investigated similarly in future research. For each process, this study will examine the supply chain flows, including material flow, information flow and resource flow (Mangan et al., 2008). The author will now summarise the literature on these three flows and recategorise it into the three main processes of SCM practices.

Material flow

The material flow encompasses both the forward movement of physical products and services from a supplier to a customer and the backward movement in the opposite direction. In order to increase supply chain effectiveness, network members jointly manage logistics and inventory in the supply chain (Min and Mentzer, 2004, Lambert, 2008) or outsource it to other members (Lee, 2004). Tan et al. (2002) proposed on-time delivery both from suppliers and to customers as important SCM practices. These three practices are categorised as network relationship management processes.

Next, the material flow in the manufacturing flow management process is identified. Network members implement the JIT / Lean approach as a tool to improve competitiveness (Tan et al., 2002, Ulusoy, 2003, Li et al., 2005, Jie et al., 2008, Lambert, 2008). In order to be competitive, supply chain network members aim to eliminate waste to achieve higher-quality products and more dependable services with minimum operating costs (Jie et al., 2008, Lambert, 2008). Lee (2004) argued that the triple-A supply chain model included the postponement strategy and flexible manufacturing capability to respond to end-customer requirements.

The material flow in the product development and commercialisation process is described in the previous literature. Lambert (2008) established guidelines on both strategic sub-processes and operational sub-processes. The efficient flow of new products across the supply chain can be achieved with the alignment of manufacturing, logistics, marketing, and other related activities. Lee (2004) recommended that supply chain members develop new products that share common parts and processes in order to respond to changes in the volume or product mix required. Table 2-8 summarises the SCM practices that are related to material flow.

Table 2-8 SCM practices: material flow

No.	SCM practice	Source
1	**Network relationship related**	
1.1	Jointly manage inventory and logistics in the supply chain	Min and Mentzer (2004), Lambert (2008)
1.2	Some network members own and/or manage one of the supply chain processes on behalf of others	Lee (2004)
1.3	On-time delivery from suppliers and to customers is a source of competitiveness	Tan et al. (2002)
2	**Manufacturing flow related**	
2.1	Apply the concepts of JIT / Lean as tools to improve competitiveness	Tan et al. (2002), Ulusoy (2003), Li et al. (2005), Jie et al. (2008), Lambert (2008)
2.2	Implement a cost reduction programme in the supply chain network	Jie et al. (2008), Lambert (2008)
2.3	Implement flexible manufacturing capability to meet end-consumer requirements	Lee (2004)
3	**Product development and commercialisation related**	
3.1	Align strategy with product, sourcing, manufacturing and distribution strategies	Lambert (2008)
3.2	Follow established material-sourcing evaluation guidelines	Lambert (2008)
3.3	Develop flexible manufacturing capability to respond to changes in volume or product mix	Lee (2004)

Information flow

The information flow embraces order transmitting and product delivery status. IT is utilised as a set of tools to create effective communication among network members (Donlon, 1996, Ulusoy, 2003, Jie et al., 2008). Ulusoy (2003) and Jie et al. (2008) mentioned the development of an agreement to share information among network members. The information should be accurate, timely, adequate and reliable (Li et al., 2006, Jie et al., 2008). These three factors, which include IT, agreement to share information, and accurate information, relate to network relationship management process-related information flow.

The information flow in the manufacturing flow management process includes information sharing among different functions based on mutual trust, and the willingness to share it (Ulusoy, 2003). This could involve joint planning, such as sales and operation planning (S&OP) meetings (Chen and Paulraj, 2004). Also, the manufacturing information that is shared should be timely and reliable in order for continuous improvements to be made (Li et al., 2005, Li et al., 2006).

For information flow in the product development and commercialisation process, Alvarado and Kotzab (2001) proposed efficient product introduction through the development and introduction of new products according to the end-customer's requirements. These requirements should be communicated to the upstream supply chain network members formally and in a timely fashion (Tan et al., 2002, Min and Mentzer, 2004, Jie et al., 2008, Lambert, 2008). Table 2-9 summarises the SCM practices that are related to information flow.

Table 2-9 SCM practices: information flow

No.	SCM Practice	Source
1	**Network relationship related**	
1.1	Utilise IT to create effective communication among network members	Donlon (1996), Ulusoy (2003), Jie et al. (2008)
1.2	Accurate, adequate and timely sharing of information among the network	Ulusoy (2003), Li et al. (2006), Jie et al. (2008)
1.3	Agreement to share information among network members	Ulusoy (2003), Jie et al. (2008)
2	**Manufacturing flow related**	
2.1	Information sharing based on mutual trust and willingness	Ulusoy (2003)
2.2	Formal exchange of manufacturing information on a regular basis i.e. at S&OP meetings	Chen and Paulraj (2004)
2.3	Accurate and timely manufacturing information sharing	Li et al. (2005), Li et al. (2006)
3	**Product development and commercialisation related**	
3.1	Efficient product introduction scheme based on the end-customer's requirements	Alvarado and Kotzab (2001)
3.2	Timely communication of future strategic needs to upstream network members	Alvarado and Kotzab (2001)
3.3	Formal sharing of end-customer's requirements and specifications with the upstream network members	Tan et al. (1998), Min and Mentzer (2004), Jie et al. (2008), Lambert (2008)

Resource flow

The resource flow consists of financial aspects such as payments, credit terms, consignment and title ownership, and non-financial ones such as people and equipment, which improve a supply chain's effectiveness. Referring to the network relationship management processes, Min and Mentzer (2004) argued that network members should have a clear vision for SCM and build long-term relationships with established guidelines. Also needed is top management support for inter-organisational relationships (Chen and Paulraj, 2004). Finally, network members should establish trust among themselves and fairly distribute the benefits obtained from SCM (Tan et al., 2002, Min and Mentzer, 2004, Li et al., 2005).

For resource flow in the manufacturing management process, Koh et al. (2007) demonstrated that a network should have a clear vision of benchmarking and performance measurement objectives so as to create continuous improvement. These visions should then be implemented across the supply chain members (Koh et al., 2007) with an allocated budget and top management support (Chen and Paulraj, 2004). In order to achieve improved firm performance from SCM implementation, quality assurance programmes for both products and processes need to be applied (Tan et al., 1998).

In the product development and commercialisation process, there is resource flow. Lambert (2008) suggested that a network should have guidelines concerning both suppliers' and customers' involvement in product development and commercialisation. These guidelines should include cross-functional procedures both internal and external to the firm. Tan et al. (2002) focused on a customer feedback programme that would provide inputs to product development. Lee (2004) explained that supply chain efficiency was determined by the conceptual design of products, processes and packaging. Table 2-10 shows the SCM practices that are related to resource flow.

Table 2-10 SCM practices: resource flow (inter-firm relationships, finance, human resources, equipment)

No.	SCM Practice	Source
1	**Network relationship related**	
1.1	Network members have a clear vision for SCM	Min and Mentzer (2004)
1.2	Top management support for inter-organisational relationships	Chen and Paulraj (2004)
1.3	Network members have established trust and fairly distribute the benefits obtained from SCM	Tan et al. (2002), Min and Mentzer (2004), Li (2005)
1.4	Network members build long-term relationships with established guidelines	Min and Mentzer (2004)
2	**Manufacturing flow related**	
2.1	Clear vision of benchmarking and performance measurement objectives to create continuous improvement	Koh et al. (2007)
2.2	Top management support for quality management, benchmarking and performance measurement	Chen and Paulraj (2004)
2.3	Implementation of benchmarking and performance measurement	Koh et al. (2007)
2.4	Establishment of guidelines for a standard quality policy for both product and process	Tan et al. (1998)
3	**Product development and commercialisation related**	
3.1	Creation of guidelines concerning suppliers' and customers' involvement in product development and commercialisation	Lambert (2008)
3.2	Development of a customer feedback programme that provides inputs for product development	Tan et al. (2002)
3.3	Supply chain efficiency based on the conceptual design of product, process and packaging	Lee (2004)
3.4	Establishment of procedures that are cross-functional and include inputs from network members identifying product development issues	Lambert (2008)

2.8 Firm performance

This section will identify and review SCM performance and firm performance. Total supply chain performance can be identified as the efficiency of the whole supply chain of network members, which is very difficult to measure and may not even exist (Banomyong and Supatn, 2011). Then there is internal supply chain performance, which takes into account the efficiency and effectiveness of a firm's internal processes in producing its products and services, involving the measurement of such aspects as cost, time and reliability. Li et al. (2006) classified organisational performance into short-term and long-term objectives. The short-term objectives of SCM are mostly to increase productivity and reduce inventory and cycle time, while the long-term objectives are to increase market share and profit. From the financial perspective, increasing market share and profits reflect the asset utilisation of a firm. For this study, a firm's performance will be organised into four categories as costs, time, reliability and asset utilisation.

Banomyong and Supatn (2011) identified the cost, time and reliability dimensions as supply chain performance metrics because these factors are the result of supply chain operations aimed at giving the customer satisfaction at a lower cost, as quickly as possible, and on time. Closs and Mollenkopf (2004) described the supply chain performance of each firm in terms of five key dimensions of logistics: customer services, cost management, quality, productivity and asset management. In our research, productivity and asset management are combined into asset utilisation.

The cost is the financial expense incurred in engaging in business (Chan and Qi, 2003a). The cost dimension is essential to evaluating a firm's performance. Effective SCM will reduce the costs for a firm (Lee, 2004, Petrovic-Lazarevic et al., 2007, Fawcett et al., 2008, Chong and Chan, 2011). Cost can be measured in terms of the total supply chain (Thakkar et al., 2009b), each supply chain process (Keebler and Plank, 2009, Banomyong and Supatn, 2011), or the logistical costs only (Söderberg and Bengtsson, 2010). Costs can involve inventory costs and operating costs (Beamon, 1999).

The lead-time is defined as the time that elapses from a customer's order being transmitted to being fulfilled (Chong and Chan, 2011). Supply chain performance in the time dimension is defined by the amount of time needed to finish the process (Otto and Kotzab, 2003). Banomyong and Supatn (2011) proposed the following time measurements for supply chain activities: order cycle time, procurement cycle time and delivery cycle time. Chan and Qi (2003a) argued that the shorter the lead-time, the higher is customer satisfaction, and also concluded that, along with cost, time is essential to a firm's performance.

The reliability dimension is related to the quality of products and services, the probability of delivering on time and in full, and the ability to respond to customer requests and handle unexpected challenges (Closs and Mollenkopf, 2004, Chin et al., 2004, Fawcett et al., 2009, Banomyong and Supatn, 2011). The probability of delivering on time and in full is sometimes referred to as the service level. The ability to respond to varying order quantities and delivery times is crucial in the current business environment.

Table 2-11 Firm performance measures

No.	Firm performance measure	Source
1	**Cost dimension**	
1.1	Network has a cost advantage	Chan and Qi (2003a), Chin et al. (2004) , Petrovic-Lazarevic et al. (2007), Bayraktar et al. (2009), Chong and Chan (2011)
1.2	Network implements a cost-saving programme to enhance competitive advantage	Petrovic-Lazarevic et al. (2007), Bayraktar et al. (2009)
2	**Time dimension**	
2.1	Network has shorter lead-times than competitors	Chan and Qi (2003a), Chong and Chan (2011)
2.2	Network implements a lead-time reduction programme to enhance customer satisfaction	Petrovic-Lazarevic et al. (2007), Chong and Chan (2011)
3	**Reliability dimension**	
3.1	Network delivers products to end customers with a higher service level	Bhanomyong and Supatn (2011)
3.2	Network implements a quality management programme to ensure product reliability	Fawcett et al. (2009)
3.3	Customers can rely on network's commitment	Chin et al. (2004)
3.4	Network has the ability to respond to customer requests and can handle unexpected challenges	Closs and Mollenkopf (2003), Fawcett et al. (2009)
4	**Asset utilisation dimension**	
4.1	Network has gained a large market share	Closs and Mollenkopf (2003), Petrovic-Lazarevic et al. (2007)
4.2	Network has high profit margins	Closs and Mollenkopf (2003), Petrovic-Lazarevic et al. (2007)
4.3	Network has high inventory turnover	Closs and Mollenkopf (2003), Petrovic-Lazarevic et al. (2007)
4.4	Network has high overall competitiveness	Newly developed

The asset utilisation dimension includes the market share, inventory turnover, the return on assets and the competitiveness of the supply chain (Closs and Mollenkopf, 2004, Petrovic-Lazarevic et al., 2007). Asset utilisation shows the ability of the supply chain to manage network resources (Chan and Qi, 2003a). Table 2-11 lists the firm performance measures with their supporting literature.

2.9 Small and medium-sized enterprises

SMEs make a significant contribution to the economy of every country (Stokes and Wilson, 2006, Sutanonpaiboon and Pearson, 2006, OECD, 2009, Thakkar et al., 2009a, Chaston, 2010, Singh, 2011). They not only create jobs, but are also a source of GDP growth leading to individual and societal wellbeing (Carson et al., 1995, Sarapaivanich and Kotey, 2006).

SMEs cannot disregard the SCM concept as the competition has shifted from firm-to-firm to the supply chain level. Therefore, a firm's performance will depend on its ability to integrate with other members of the supply chain. Better performance involves shorter cycle times, less inventory, higher product availability and shorter order-to-delivery lead-times (Harrison and Hoek, 2011).

SMEs should use these metrics to monitor their supply chain performance and benchmark against their competitors. In the year 2000, the Committee on Supply Chain Integration of the US National Research Council was established to help SMEs to gain competitive advantages. The committee published a report on the increasing impacts of supply chain integration and technology advancements on SMEs (National Research Council, 2000). The report concluded that SMEs have to evaluate their own situation according to the evolving business environment, and identify the improvements needed to retain competitiveness (Cambell and Sankaran, 2005).

Definitions of SMEs also differ among regions. According to a World Bank study, there are more than 60 definitions of small and medium enterprises used in the 75 countries studied (Ayyagari et al., 2007). The United Kingdom has adopted the European Commission's definitions of SMEs: a micro-sized firm employs less than 9 people, a small-sized firm less than 49, and a medium-sized enterprise 50 to 249 (European Commission, 2003). Meanwhile, the definition for SMEs used by the United States Small Business Administration classifies firms that employ less than 20 people as micro firms. Businesses with 20 to 99 employees are categorised as small-sized firms and those with 100 to 499 employees are classified as medium-sized (USITC, 2010). Making a direct statistical comparison between SMEs in different countries involves challenges. It is therefore important now to examine the definitions of SMEs in the context of Thailand.

2.9.1 Thai SMEs

According to the Institute for Small and Medium Enterprises' Development in Thailand, SMEs are divided into three major categories depending on whether they work in the production sector, the service sector or the trading sector (Office of Small and Medium Enterprises Promotion, 2009). The production sector includes agricultural processing, manufacturing and mining. The trading sector is divided into wholesale and retail. An enterprise is considered to be an

SME based on the number of full-time employees and the value of its assets (capital) excluding land, as shown in Table 2-12.

Table 2-12 The definition of SMEs by the Ministry of Industry, Thailand

Type	Small		Medium	
	Employee	Capital (Mil. Baht)	Employee	Capital (Mil. Baht)
Production	< 50	<50	51-200	51-200
Services	< 50	<50	51-200	51-200
Wholesale	< 25	<50	26-50	51-100
Retail	< 15	<50	16-30	31-60

Source: http://www.sme.go.th/Pages/Define/Define.aspx

The Thai government considers SMEs to be the backbone of industrial infrastructure (Sevilla and Soonthornthada, 2000). According to the data from the Office of Small and Medium Enterprises' Promotion, in 2011 Thai SMEs accounted for about 36.6 per cent of GDP and 83.9 per cent of the workforce. Most SMEs in Thailand, as in other developing countries, are not yet well managed (Sarapaivanich and Kotey, 2006, Punyasavatsut, 2008). The Thai government is interested in encouraging Thai SMEs to become more competitive in the global market. One of the Thai government's visions is to develop enterprise competence in business operations, as described under the 2nd SMEs' Promotion Master Plan (Office of Small and Medium Enterprises Promotion, 2011). Activities are currently being employed to increase global competitiveness, productivity and innovation competence, and create and add value. These activities are associated with the SCM practices of firms.

Most Thai SMEs have been left behind by the advancement of SCM implementation (Banomyong and Supatn, 2011), mainly because SCM requires the support of a lot of IT and collaboration between supply chain member organisations, which most Thai SMEs are reluctant to invest in. To change this unfavourable situation, Thai government organisations such as the Department of Industrial Promotion and the Ministry of Industry have launched a number of SCM training and support programmes for Thai SMEs. However, a conclusive SCM best practices model suitable for Thai SMEs has not yet been achieved.

Thus it is argued in this thesis that an SCM practices model for Thai SMEs should be developed to help them to evaluate the relationships between SCM, facilitators, impediments and practices, and firm performance.

2.10 SCM practices in SMEs

SMEs implement SCM practices including sourcing, manufacturing and distributing their products to the end-customer in order to achieve long-term regular orders (Katunzi and Zheng, 2010). Thakkar et al. (2008b) examined 77 research papers on supply chain integration, supply chain strategy and planning, and supply chain implementation. They concluded that SMEs that survive the competition have the ability to deliver more to their customers at a lower cost, in less time and with fewer defects. Some SMEs understand the benefits of SCM practices such as collaboration, leading them to focus on value-added activities, clearer strategy development and cooperation among network members to enhance competency. However, several SMEs view supply chain as an endeavour to satisfy customers through significant IT investment, and thus as a worthless effort (Thakkar et al., 2008b, Thakkar et al., 2011).

Hong and Jeong (2006) described the SCM practices of SMEs from the business growth perspective. Their study explained the external and internal contexts of different types of SMEs. SMEs were classified into four groups named efficiency, coordination, collaboration and innovation according to their high or low chain relationships and strategic focus on low costs or added value. Finally, their model recommended SCM growth paths for SMEs but did not draw conclusions regarding the results of SCM practices.

Singh (2011) noted that a well-coordinated supply chain could lead SMEs to be more competitive because SCM helps supply chain members to work together as a whole in order to be profitable in an evolving market. The study identified 6 categories containing 32 enablers of coordination in the supply chain, namely top management commitment, organisational factors, mutual understanding, flow of information, relationship and decision making, and responsiveness. It concluded that SMEs should focus on information flow and mutual understanding among supply network members in order to enhance their performance.

2.10.1 Network relationship management in SMEs

Network relationship management, which incudes customer and supplier relationship management, is classified as a process in SCM (Lambert, 2008). A case study of a leading Spanish winery, Bodegas Pirineos, by Bordonaba-Juste and Cambra-Fierro (2009), indicated that collaboration between suppliers and customers enhances supply chain competitiveness. A firm gains benefits from establishing long-lasting relationships with its strategic suppliers, based on communication, trust and collaboration, which are also beneficial to the suppliers (Bordonaba-Juste and Cambra-Fierro, 2009). Their work confirmed previous studies' findings that customer relationships have a direct impact on a firm's growth and performance (Valsamakis and Sprague, 2001, Macpherson and Wilson, 2003). The key enablers of relationship management are effective and efficient communication and information IT usage (Stone, 2003, Larson et al., 2005, Sutanonpaiboon and Pearson, 2006, Bayraktar et al., 2009, Bordonaba-Juste and Cambra-Fierro, 2009). Thus, effective communication helps firms to achieve good relationships.

2.10.2 Management of manufacturing flow in SMEs

Manufacturing efficiencies lead to cost reductions and the enhancement of supply chain competitiveness. Wilson and Roy (2009) studied lean procurement and inventory management systems of New Zealand's SMEs. In conclusion, they proposed the double freight consolidation model, which is a technique used to implement lean procurement in order to achieve cost effectiveness. To attain this manufacturing efficiency with lean implementation, Achanga et al. (2006) recommended several critical success factors, including leadership, management, finance, organisational culture, skills and expertise. These critical success factors facilitate lean implementation, which is a manufacturing flow management process in SCM practice (Lambert, 2008). Furthermore, Towers and Burnes (2008) examined the factors that improve the ability of SMEs to align their enterprise-planning systems with SCM, and found that trust and mutual collaboration can resolve conflicts among supply chain network members.

2.10.3 Product development and commercialisation in SMEs

Lambert (2008) suggested product development and commercialisation to be SCM processes. These include developing and bringing products to market jointly with customers and suppliers. Hong et al. (2012) recommended innovation technology, modularisation, and the degree of de-coupling and postponement as facilitators of SMEs' integrated product development, an SCM practice. The study also concluded that SMEs can attain higher goals when they improve their ability to integrate product and process development with suppliers. Noke and Hughes (2010) argued that SMEs that increased productivity and repositioned themselves through product development and commercialisation could improve their competitiveness and profitability.

2.10.4 Studies of SCM practices in SMEs in various countries

A number of studies of SCM have looked at the relationship between SMEs and their performance in various countries (Quayle, 2003, Koh et al., 2007, Vaaland and Heide, 2007, Thakkar et al., 2008b, Katunzi and Zheng, 2010), revealing that (1) SMEs lack proper SCM implementation such as the use of technology and systems, resulting in lost competitiveness, (2) focusing on the strategic supply chain can improve SMEs' operational efficiency leading to competitive advantage and (3) relationship management can be built by appropriately employing SCM. Some literature has concluded that SCM is not suitable for SMEs (Arend and Wisner, 2005), actually leading to reduced firm performance and return on investment. The following paragraphs look at studies of SCM practices that have been conducted in different countries:

United Kingdom

Quayle (2003) explored the awareness of SCM principles among SMEs, and potential ways for them to improve their SCM. The study revealed the UK SCM practices of 288 industrial SMEs. It concluded that effective SCM practices are those that eliminate issues related to customer requirements, such as leadership, strategy, waste reduction and procurement. Alternatively, issues related to technology, for instance research and development, innovation and e-commerce, were considered to have the lowest importance for SMEs. The research also showed the six basic elements of SCM in SMEs to be total cost management, long-term alliances, early purchase involvement, early supplier involvement, outsourcing and total business involvement.

In Merseyside, UK, a study of SCM in 288 SMEs conducted by Meehan and Muir (2008) revealed that SCM is perceived as a means to improve customer responsiveness and supply chain communication while reducing risk, product development cycle time, the duplication of inter-organisational processes and inventory. The respondents also mentioned as barriers to SCM implementation overcoming traditional practices, lack of SCM knowledge, expense, lack of time, lack of resources and the need for external support.

Tan et al. (2006) studied key motives (drivers), enablers and inhibitors of SCM collaboration in electronics firms in a case study conducted across the UK and China. They found that the key motives for collaboration were to maintain competitiveness and to utilise each other’s expertise. In their case study, SMEs in China gained European market access through the UK SMEs while the UK SMEs enjoyed lower manufacturing costs due to sourcing their supply from

Chinese SMEs. Information sharing was found to be an enabler of SCM practices. The main obstacle was the failure to understand the rationale for SCM, an unwillingness to share sensitive information and a lack of trust. These working attitudes were found to arise from cultural differences.

United States of America

A study of SCM practices among small retailers was conducted by Hamister (2012), who identified four main practices among 79 small retailers in the US: strategic supplier partnership, information sharing, information quality and integration intensity. The research findings were quite similar to those found in Li et al. (2006) study of SCM practices among US SMEs, showing that SCM practices lead to higher firm performance.

Norway

Vaaland and Heide (2007) interviewed 16 Norwegian firms and found that SMEs and large firms have significant differences in performance with regard to technical issues. This finding confirmed Quayle (2003) study. SMEs may have the advantage of flexibility but less efficient transaction systems put them in an unfavourable competitive situation. The study concluded that SMEs could survive the competition by implementing SCM practices such as network collaboration and the sharing of resources (Vaaland and Heide, 2007).

Poland

Haan et al. (2007) conducted a survey of 127 Polish SMEs to find out about their decision-making process for IT systems support. The Polish SMEs showed their awareness of the requirements of a competitive market environment but most of them were still operating in the long-established manner, and not attempting to focus on network relationship management. However, the Polish SMEs did utilise IT systems such as decision support systems and expert systems to enhance their decision-making and management, and databases to help with customer service.

Malaysia

In a study of manufacturing best practices in Malaysian SMEs (Anuar and Yusuff, 2011) SCM was considered a higher level of implementation focus than customer focus, quality and management. SCM was divided into five groups in the study: supply chain policies, supply chain functions, supplier involvement in the SCM process, company involvement in the SCM process and customer involvement in the SCM process. The study was based on a survey of 270 ISO9000-certified Malaysian manufacturing SMEs and concluded that SCM excellence can be achieved by controlling all functions, through communication and information sharing between network members, including forecasting, inventory management, information management, production scheduling, distribution and customer services. This confirmed a previous study of SCM practices in SMEs conducted by Beamon (1999).

Pakistan

Bhutta et al. (2007) conducted a survey of SCM practices among 650 Pakistani SMEs. The study analysed specific aspects of SCM such as relationship/partnership practices, sales trends and competition, among others. The results affirmed that Pakistani SMEs mostly have strong relationship management practices with both suppliers and customers. The successful

SMEs were found to have more products, more customers, and more new customers than the others.

Tanzania

Katunzi and Zheng (2010) performed a comparison of SCM practices between Tanzanian SMEs and large firms. The research looked at four major issues: the benefits of SCM, the type of information sharing, the motivation for SCM integration and other collaborative SCM activities. The study found that Tanzanian SMEs aimed to reduce costs by engaging in SCM. While they expected to minimise the competitive effect in the market, they were reluctant to share information with other supply chain network members and less eager than the large firms to employ advanced information systems. The survey concluded that Tanzanian SMEs should apply SCM to maintain their competitiveness.

Thailand

Udomleartprasert et al. (2003) studied 106 Thai manufacturing firms, including 65 SMEs and 46 large enterprises. The study found that customer pressure was the highest driver of SCM implementation, while the main obstacle was the lack of ability to manage suppliers. The study proposed a vertical chain management strategic tool to help SMEs integrate their material and capacity management with suppliers.

2.11 Summary and Justification for the Research

This chapter has discussed the existing literature associated with SMEs and the theoretical foundation of the disparate constructs of the supply chain practice model that will be used in this research, namely, SCM drivers, impediments, facilitators and practices, and firm performance.

According to the literature review, Thai SMEs have issues in adopting SCM to their businesses. Various education and training programmes have been offered by government agencies to support Thai SMEs but there has been no direct study of the SCM that would be suitable for Thai SMEs. This study will examine the current practices of both large Thai firms currently implementing SCM, in order to gain a clearer understanding of SCM practice in the LE context, and the environment of SMEs with limited resources.

It is in the interests of both academics and practitioners to search for particular practices that will help SMEs to find the right level of SCM process implementation, which will lead them to improve their performance. This research will construct a generic model of SCM best practices for Thai SMEs.

The only entity that puts money in to a supply chain is the end customer.
Until the end customer decides to buy a product,
the rest of us are shuffling his money back and forth
among supply chain members.
(Robert B. Handfield and Ernest L. Nichols Jr., Supply Chain Redesign)

CHAPTER 3 DEVELOPMENT OF A SUPPLY CHAIN MANAGEMENT PRACTICES MODEL

3.1 Introduction

This chapter develops the conceptual SCM practices model. Handfield and Nichols (2002) remarked that one of the goals of SCM is the creation of value for the supply chain network members to focus on the end-customers needs. This is the economic value-added concept in the resource-based theory.

The development of the conceptual model of SCM practices consists of two related parts. In the first part, the framework examines the antecedent relationship between SCM drivers, impediments and facilitators, and SCM practices. In the second part, the consequences of SCM practices are represented by the firm's performance. The research questions are considered in detail with reference to the research objectives and the gaps found in the literature. The research hypotheses are then postulated to represent the inter-relationships among the components within the SCM practices framework.

3.2 Resource-based theory and sustainable competitive advantage

Research in the field of SCM has no meta-theory perspective, (Burgess et al., 2006), whose study revealed that the aspects of SCM research are explained by a multitude of existing theories from other fields. For example, Halldorsson et al. (2007) argued that there are four organisational theories for the management of supply chains: (1) the principal-agent theory, (2) transaction cost analysis, (3) the network theory and (4) the resource-based view. Furthermore, in the area of partnerships or relationships between supplier and buyer, social exchange theory and transaction cost analysis are becoming the dominant perspectives (Grover and Malhotra, 2003, Kingshott, 2006, Wilding and Humphries, 2006, Fayezi et al., 2012). However, the resource-based theory has become the main tool for examining the competitive advantages of SCM (Wong and Karia, 2010, Cao and Zhang, 2011).

A key concept of resource-based theory is that it is an efficiency-based explanation of performance differences (Wernerfelt, 1984, Barney, 2001, Barney et al., 2001, Peteraf and Barney, 2003). The theory explains competitive advantage through the concept of economic value as follows:

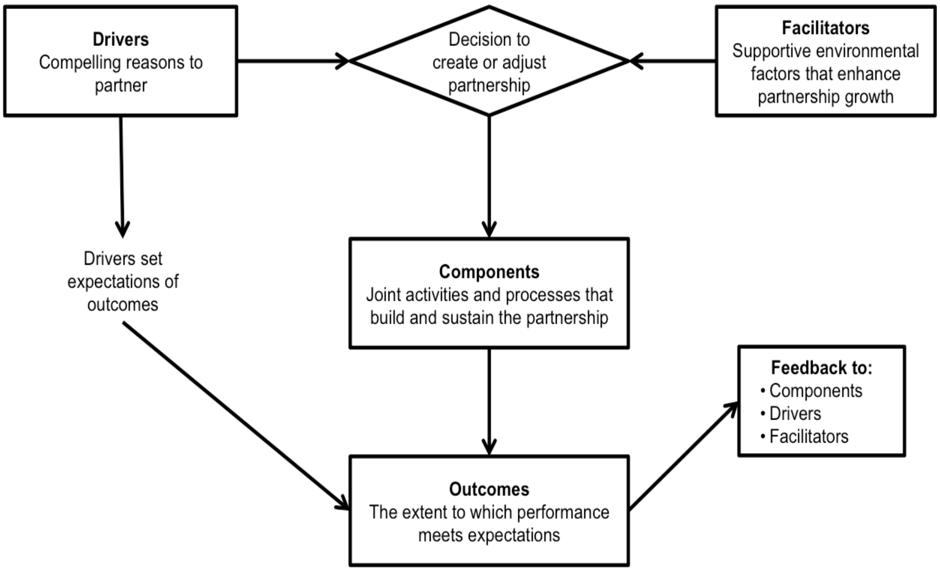
> *"The Economic Value created by an enterprise in the course of providing a good or service is the difference between the perceived benefits gained by the purchasers of the good and the economic cost to the enterprise"* (Peteraf and Barney, 2003: 314).

Handfield and Nichols (2002) noted that SCM involves not only managing costs but also adding economic value. The value system is a stream of supply chain network activities from the suppliers through the channel of distribution to the end-customer (Porter, 1985). Porter (1985) argued that the value chain of a firm may differ from that of its competitors, and so become a source of competitive advantage. A sustainable competitive advantage is generated by a firm if it controls resources that are valuable, rare, inimitable and non-substitutable (Chicksand et al., 2012). This thesis applies the resource-based theory in order to propose its conceptual model of SCM practices.

3.3 SCM practices conceptual model

The study of SCM has gradually evolved from the study of firm integration more than 50 years ago into the study of continuous processes from the end-customers through the firm and the suppliers that effectively manage flows of information, materials, money, manpower and capital equipment (Gattorna and Walters, 1996, Cooper et al., 1997, Mentzer, 2001, Min and Mentzer, 2004, Jespersen and Skjøtt-Larsen, 2005, Sweeney, 2009). This integration makes the supply chain a horizontal cross-functional operation, working both internally and externally to the firm. The conceptual model of SCM draws on collaboration among all parties. Lambert (2008) argued that SCM is relationship management (Lambert et al., 1996, Lambert et al., 2004). He also recommended the partnership model including four main components as shown in Figure 3-1.

The model begins with the drivers and facilitators of partnership, which lead to a firm's decision to implement a partnership through various activities and processes (components). These components lead to outcomes that can be measured. Finally, feedback is given which leads to the partnership components, drivers and facilitators being adjusted. Thus the partnership model is considered a tool for structuring the key relationships among business partners.



Source: Lambert (2008: 21)

Figure 3-1 Partnership model

Our SCM practices model is developed based on the partnership model. It also includes the factors that support SCM implementation, namely, SCM drivers and facilitators. Mentzer et al. (2001b) classified these factors as antecedents of SCM. However, impediments to the implementation of SCM (denoted SCM obstacles) are added to extend the partnership model to the SCM practices model. An SCM obstacle is a factor that negatively affects SCM performance (Goh and Pinaikul, 1998, Mentzer et al., 2000, Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Chen et al., 2009, Fawcett et al., 2009). Therefore, the SCM practices conceptual model with antecedents is proposed as shown in Figure 3-2.

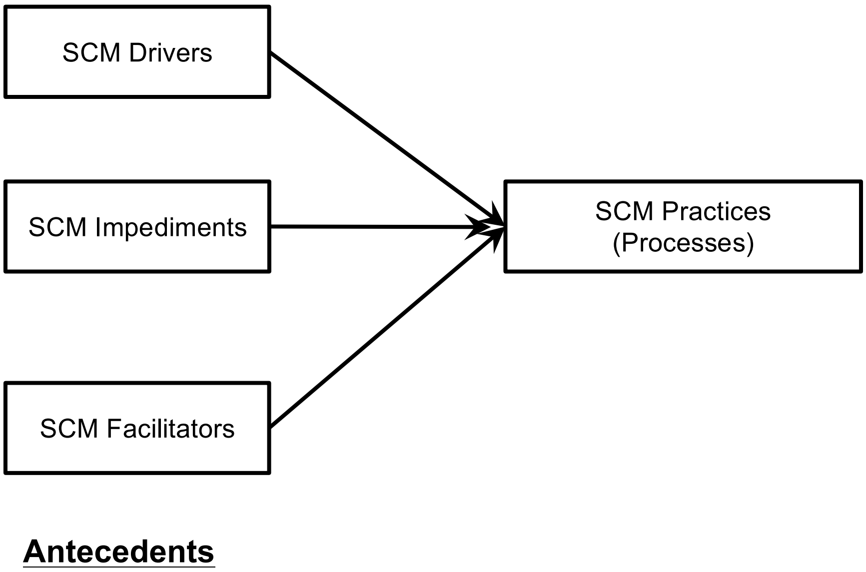


Figure 3-2 SCM practices conceptual model with antecedents

The objectives of SCM implementation are to enhance customer value and customer satisfaction, and improve profitability and competitiveness by reducing costs and adding value (Mentzer et al., 2001b, Lambert, 2008, Slone et al., 2010, Christopher, 2011). These objectives can be stated as the improvement of both efficiency and effectiveness. Therefore, the consequences of SCM should be higher firm performance. According to the literature review in section 2.8, a firm's performance can be split into four groups: cost, time, reliability and asset utilisation. Figure 3-3 illustrates the consequences of SCM practices.

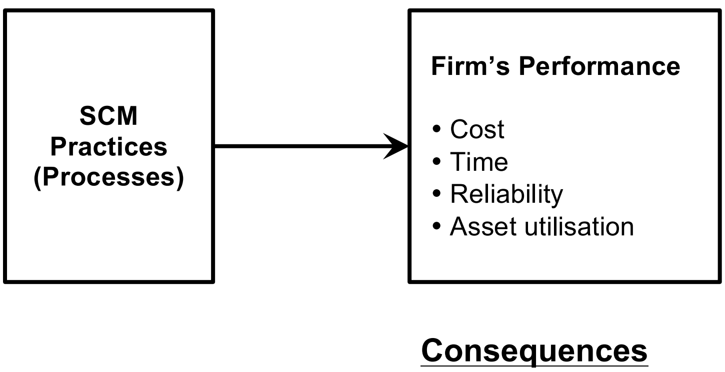


Figure 3-3 The SCM practices conceptual model with consequences

In the next section, the framework of the SCM practices model, containing both antecedents and consequences, will be further developed. The model will form the basis of the data collection and analysis in line with the research framework.

3.4 Framework of SCM practices model

In order to investigate the reasons why SMEs implement SCM, a literature review was conducted to identify key constructs. The SCM practices model is conceptualised as having five constructs or dimensions, namely SCM drivers, impediments, facilitators and practices, and firm performance. Figure 3-4 presents the research framework of SCM practices with both antecedents and consequences. The framework proposes that SCM practices are implemented according to the drivers, impediments and facilitators. Then, the SCM practices will have an impact on a firm’s performance. A detailed description of the development of the SCM practices model was provided in Chapter 2. From the literature review, for each component, a list of factors significant to the constructs were summarised and categorised.

The SCM drivers are categorised into drivers external to the supply chain network, drivers internal to the supply chain network and drivers internal to the company. The drivers are as follows:

1. Drivers external to the supply chain network;
   - 1.1. global competition to the network;
   - 1.2. trade regulation;
   - 1.3. information revolution;
   - 1.4. end-customer needs;
   - 1.5. supply chain network wants to be competitive;

SCM Driver
- global competition to the network
- trade regulation
- information revolution
- end-customer needs
- supply chain network wants to be competitive
- improvement of product quality, process capabilities and/or productivities
- process integration among network members
- real-time information exchange among network
- outsourcing to network members in order to reduce costs
- competition shifted from company base to network base
- sustainable growth and competitive advantage
- internal functions collaboration
- focus on core competency of process and/or function
- logistics cost reduction / cost reduction

SCM Impediment
- employee resistance
- organisation's "silo" structure
- employees' lack of understanding
- top management does not allocate sufficient budget and resources
- lack of long-term strategic vision to implement supply chain
- unstable processes due to machine breakdown
- lack of ability to manage network partners
- laws and regulations do not support cooperation
- time constraint of collaboration
- communication problem and/or confidential information
- lack of trust among network members
- incompatible information systems of network members
- network members have different visions, strategies and objectives regarding SCM
- quality problems of network members
- a network member does not have the SCM concept

SCM Facilitator
- information technology
- focus on end-customers
- process integration among network members
- customer database available in our network
- equal benefits-sharing framework in our network
- re-engineering process in our network
- effective communication channels
- established performance measurement within network
- quality management system implement in our network
- willingness to share knowledge
- top management understanding and support
- network culture of supporting customer requirements
- trust and openness among network members
- organisation designed to support coordination, cooperation and collaboration

SCM Practices

Network relationship management
- jointly managing inventory and logistics within the supply chain network,
- usage of IT for effective communication,
- building long-term relationships within the established guidelines and
- having a clear vision of SCM among the network members

Manufacturing flow management
- having the concept of JIT / Lean as a tool for competitiveness,
- formally exchanging manufacturing information on a regular basis,
- implementation of benchmarking and performance measurement and
- establishment of a standard quality policy for both product and process with explicit guidelines

Product development and commercialisation
- alignment of network strategy with product, sourcing, manufacturing and distribution strategy,
- formally sharing customer requirements and design information through the upstream network,
- using the concept of design in the supply chain, in product, process and packaging and
- implementing a customer feedback programme to use as an input to product development

Firm's Performance
- logistics costs
- total costs
- delivery speed
- delivery time flexibility
- product flexibility
- delivery dependability
- order fill capacity
- order flexibility
- return on assets (ROA)
- inventory turns
- customer satisfaction
- market share

<u>**Antecedents**</u>

<u>**Consequences**</u>

Figure 3-4 The research framework of SCM practices

2. Drivers internal to the supply chain network;

   2.1. improvement of product quality, process capabilities and/or productivities;

   2.2. process integration among network members;

   2.3. real-time information exchange among network;

   2.4. outsourcing to network members in order to reduce costs;

   2.5. competition shifted from company base to network base;

3. Internal company drivers;

   3.1. sustainable growth and competitive advantage;

   3.2. internal functions collaboration;

   3.3. focus on core competency of process and/or function;

   3.4. logistics cost reduction / cost reduction.

In the same way, supply chain impediments are also classified into two categories:

1. Internal SCM impediments;

   1.1. employee resistance;

   1.2. organisation's "silo" structure;

   1.3. employees' lack of understanding;

   1.4. top management does not allocate sufficient budget and resources;

   1.5. lack of long-term strategic vision to implement supply chain;

   1.6. unstable processes due to machine breakdown;

   1.7. lack of ability to manage network partners;

2. External SCM impediments;

    2.1. laws and regulations do not support cooperation;

    2.2. time constraint of collaboration;

    2.3. communication problem and/or confidential information;

    2.4. lack of trust among network members;

    2.5. incompatible information systems of network members;

    2.6. network members have different visions, strategies and objectives regarding SCM;

    2.7. quality problems of network members;

    2.8. a network member does not have the SCM concept.

The supply chain facilitators identified from the literature review are classified into two categories:

1. Tangible SCM facilitators;

    1.1. IT;

    1.2. focus on end-customers;

    1.3. process integration among network members;

    1.4. customer database available in our network;

    1.5. equal benefits-sharing framework in our network;

    1.6. re-engineering process in our network;

    1.7. effective communication channels;

    1.8. established performance measurement within network;

    1.9. quality management system implement in our network;

2. Intangible SCM facilitators;

    2.1. willingness to share knowledge;

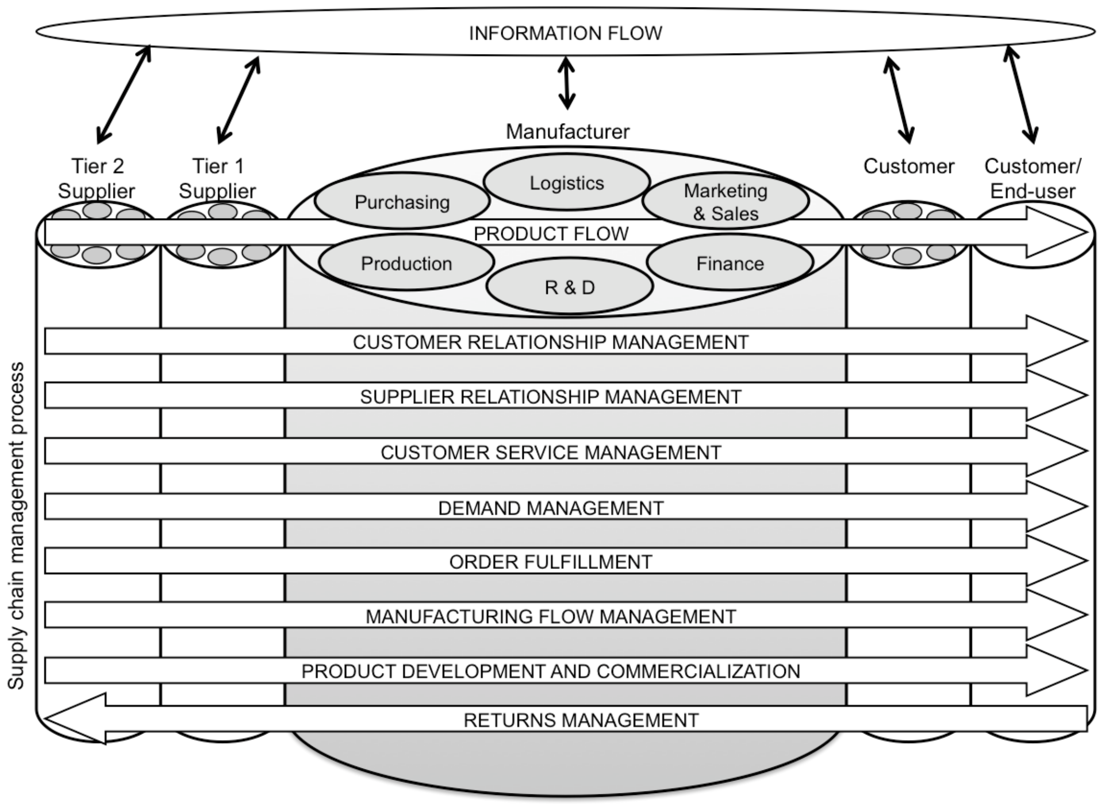
2.2. top management understanding and support;

2.3. network culture of supporting customer requirements;

2.4. trust and openness among network members;

2.5. organisation designed to support coordination, cooperation and collaboration.

Figure 3-5 shows the concept of supply chain processes (Lambert, 2008). The author focuses on the main three flows of the supply chain and the three fundamental processes of SCM according to the standard business processes identified by the GSCF (Lambert, 2008).



Source: Lambert et al. (1998: 2)

Figure 3-5 The SCM processes

Each SCM process consists of many sub-processes, which are regarded as SCM practices. The SCM practices are sorted according to three main flows in order to paint a clear picture of the links between the end-user, manufacturer and supplier as a total systems concept (Christopher, 2011). The main flows of each process are of materials flow, information flow and resources flow (i.e. inter-firm relationship, finance, human resources, and equipment) (Mangan et al., 2012).

The three majors SCM processes are studied in this research as:

Network relationship management (customer relationship management and supplier relationship management), that is, the development and maintenance of the relationships of a firm and its network members. The relationships will have an effect on firm performance. The practices include:

1. jointly managing inventory and logistics within the supply chain network;
2. usage of IT for effective communication;
3. building long-term relationships within the established guidelines;
4. having a clear vision of SCM among the network members.

Manufacturing flow management contains all movements of any physical form of product along the conversion process. The objectives of this process are to respond on time to requirements and minimise total product cost. The practices include:

1. having the concept of JIT / Lean as a tool for competitiveness;
2. formally exchanging manufacturing information on a regular basis;
3. implementation of benchmarking and performance measurement;

4. establishment of a standard quality policy for both product and process with explicit guidelines.

Product development and commercialisation is the SCM process that helps supply chain network members to work closely in order to effectively launch new products on the market. The practices can be identified as

1. alignment of network strategy with product, sourcing, manufacturing and distribution strategy;
2. formally sharing customer requirements and design information through the upstream network;
3. using the concept of design in the supply chain, in product, process and packaging;
4. implementing a customer feedback programme to use as an input to product development;

A firm's performances is measured by a set of variables that provide information on whether the network's capability has been improved according to the end-customer's requirements. From the literature review, the following set of firm performance metrics are proposed:

1. Costs;
    - 1.1. logistics costs;
    - 1.2. total costs;
2. Time;
    - 2.1. delivery speed;
    - 2.2. delivery time flexibility;

3. Reliability;
    3.1. product flexibility;
    3.2. delivery dependability;
    3.3. order fill capacity;
    3.4. order flexibility;
4. Asset utilisation;
    4.1. return on assets (ROA);
    4.2. inventory turnover;
    4.3. customer satisfaction;
    4.4. market share.

All of these constructs and their factors were validated and refined using the semi-structured interview questionnaire before large-scale data collection was carried out. The qualitative techniques used provided the insight needed to develop questions that would reveal any exceptions to our model of SCM practices.

3.5 Main research objectives

SMEs in Thailand have been struggling with new management concepts and technologies such as total quality management (TQM), knowledge management (KM) and e-commerce (Tannock et al., 2002, Sutanonpaiboon and Pearson, 2006, Supyuenyong et al., 2009). The main reason is an unwillingness to invest, which relates to concerns over the costs and benefits. Similarly, SCM is considered a new concept and represents a high investment to SMEs but can contribute considerably to firms' and networks' success. In order to fill this gap, this research focuses on understanding the factors that have an impact on SCM processes and implementation, which in turn have an impact on a firm's performance. According to the main objective of developing a suitable SCM practices model to help Thai SMEs improve their competences, the research question can be formulated as follows:

What are the SCM practices that are suitable for Thai SMEs?

The main research question is answered in three stages. This study began by reviewing the literature related to the three dimensions of factors: drivers, facilitators and impediments, which affect the implementation of SCM practices that in turn influence the firm's performance. The main research question can thus be divided into four sub-questions:

Question 1: How are SMEs' SCM practices related to their performance?

The first question is based on the finding from the literature review that how a firm's performance depends on its SCM practices has not been clearly identified, particularly for SMEs. There has been a lot of debate on whether supply chain implementation in SMEs will increase or decrease their performance (Thakkar et al., 2008b). Reasons in favour include the fact that SMEs have now become vital to the competitiveness of their networks and the buyer-supplier relationship has changed to become more coordinated through the advancement of IT. Thus, SCM will help SMEs to establish their competitive strategies. However, arguments in opposition to the implement of SCM include the difference in the capabilities of SMEs compared to large firms, and the fact that SMEs do not focus on product development and commercialisation, quality or customer service, which are the main practices of SCM, resulting in SMEs' performance being relatively lower than that of large firms. Hence, it is essential to investigate the relationship between a firm's performance and its SCM practices specifically for SMEs. This will help them to better understand the current SCM practices and their impacts so that they can select a suitable level of SCM implementation.

Question 2: What are the main reasons that drive SMEs to decide to implement SCM practices?

The second question investigates the motivational antecedents of SCM implementation in terms of expected performance or benefits. The major drivers of SCM in SMEs were drawn from the literature in section 2.3 and then confirmed and modified through semi-structured interviews. By answering this second research question, firms are able to identify the drivers of SMEs' implementation of SCM practices, which go on to improve their SCM practices. This will benefit SMEs by allowing them to compare their motivations and objectives with the benchmarking model when considering whether they should implement the respective SCM practices

Question 3: What are the main facilitators of SMEs' implementation of SCM practices?

Question 3 aims to investigate the main factors that help SMEs to implement SCM practices. Facilitators are environmental enablers of SCM practices, including ideas, tools, actors and organisations that move SCM practices forward. The answer to this question will allow SMEs to self-audit, looking back at their facilitators. As mentioned in the literature review in section 2.5, the facilitators can be both tangible and intangible.

Question 4: What are the main impediments to SMEs' implementation of SCM practices?

The fourth question studies the obstacles of SCM implementation for SMEs. From the literature review section 2.4, hindrances can be classified into two categories: internal and external to the firm. Internal impediments include poor utilisation of organisation, which reflects operational efficiency, while external impediments relate to collaboration requirements among network members, such as communication infrastructures. The answer to this research question will help SMEs to identify obstacles and eliminate them before implementing SCM practices so as to achieve higher firm performance.

Question 5: What is the generic model of SCM practices suitable for SMEs?

The answer to the last question will be the generic model that helps SMEs to apply SCM practices that are suitable for them. The model will establish the relationships between the SCM drivers, facilitators, impediments and practices, and firm performance. The research methodology was designed to evaluate the relationships between each factor so as to construct the model, using multiple regression and structural equation modelling.

3.6 Summary

This chapter formulates the conceptual model of SCM practices showing their relationships with both antecedents and consequences. The partnership model developed by the GSCF inspired the conceptualisation of the SCM practices model with antecedents including drivers, facilitators and impediments. The consequences relate to the firm's performance. The SCM practices are extracted from the three main SCM processes of the GSCF. They are network relationship management, which includes both customer relationship management and supplier relationship management, manufacturing flow management and product development and commercialisation.

A new SCM practices model was formulated to answer the main research question: "What are the SCM practices that are suitable for Thai SMEs?". The next chapter discusses the research strategy applied in the study.

'It is a capital mistake to theorise before one has data.
Insensibly one begins to twist facts to suit theories,
instead of theories to suit facts.'
(Arthur Conan Doyle, A Scandal in Bohemia)

CHAPTER 4 RESEARCH METHODOLOGY

4.1 Introduction

There has long been argument over whether theory guides research (deductive) or is an outcome of it (inductive) (Bryman and Bell, 2007). In the previous chapter, the SCM practices conceptual model was developed based on the literature review. This chapter explains the development of the research design and evaluates the research methods adopted for this research. Firstly, it is very useful to understand the philosophical ideas behind a piece of research prior to developing a research design (Easterby-Smith et al., 2012). After this has been done, the research design template and research choices are presented. Then, the techniques applied in this research are discussed, with attention confined to data collection and analysis. Finally, the research ethics are presented.

4.2 Research philosophy

As a scientific approach, research itself is a systematic data collection process with a clear purpose and methodical interpretation of the data (Saunders et al., 2007). Research theory begins with the nature of reality, known as ontology, and the perspective of the researcher towards the research objects, termed epistemology. The philosophy of this research reflects the principles of positivism. An ontology of internal realism was defined by Putnam (1987) as follows: "*a single reality, but asserts that it is never possible for scientists to access that reality directly, and it is only possible to gather indirect evidence of what is going on in fundamental physical processes"* (cited in Easterby-Smith et al., p.19). Furthermore, the epistemology of positivism is that the researcher prefers working with an observable social reality in a value-free way, using an existing theory to develop hypotheses (Saunders et al., 2007).

Golicis and Davis (2012) explained that research in logistics and SCM has mainly applied quantitative methods, reflecting the positivism perspective. The positivism perspective has eight features:

1. the observer must be independent;
2. human interests should be irrelevant;
3. explanations must demonstrate causality;
4. the research progresses through hypotheses and deductions;
5. concepts need to be defined so that they can be measured;
6. units of analysis should be reduced to the simplest terms;
7. generalisation occurs through statistical probability;
8. samples should be large and selected randomly (Easterby-Smith et al., 2012).

A phenomenological paradigm that employs qualitative methodologies has increasingly been used by logistics researchers (Mangan et al., 2004).

According to this paradigm, the researcher focuses on meanings rather than facts. Therefore, small samples are studied in depth. Multiple methods are used in order to establish different views of phenomena. This study employs positivism as a philosophical stance because it looks for causality and focuses on facts. In addition, the researcher is independent from the study. Furthermore, large samples are taken and the results can be generalised through statistical probability.

4.3 Research design

The research design is the general plan of research activities aimed at answering the research questions (Saunders et al., 2007, Easterby-Smith et al., 2012), comprising:

1. clear research purposes and objectives;
2. data collection method;
3. specified sources of data to be collected;
4. constraints of the research;
5. ethical issues.

The philosophical stance of this thesis is positivism. Therefore, the methods used reflect the research objectives. Easterby-Smith et al. (2012) recommended the research design template shown in Table 4-1 for positivist research.

In this study, Easterby-Smith et al.'s research design template is applied as a guideline. More than one data collection technique and more than one analysis procedure were used to answer the research question. Saunders et al. (2007)

identified 'multiple methods' research as a way of combining qualitative and quantitative techniques and procedures. Multiple methods can refer to multiple methods of the same type or mixed methods, as illustrated in Table 4-2.

Table 4-1 The research design template

Step in research design	Positivist perspective
Background	What is the theoretical problem and what studies have been conducted to date?
Rationale	What are the main variables, and how are they related to one another?
Research aims	List the main propositions or questions.
Data	Define dependent and independent variables and determine measures.
Sampling	Justify sample size and explain how it reflects the wider population.
Access	How can responses to questionnaires etc. be assured?
Ethics	Could results be used to harm any participants?
Unit of analysis	Specify whether individuals, groups, events or organisations.
Analysis	Statistical procedures for examining relationships between variables.
Process	Explain stages in the research process.
Practicalities	Who will gather data? How will it be recorded/stored? Who will analyse it?
Theory	In what way will the results add to existing theory?
Output	What is the dissemination strategy?

Source: Easterby-Smith et al. (2012)

Based on the characteristics and advantages of each research choice illustrated in Table 4-2, mixed-methods research is used in this study.

Table 4-2 Multiple methods research choices

Research choices	Characteristics	Advantages
Multi-method qualitative study	Combination of more than one qualitative data collection technique with associated non-numerical (qualitative) analysis.	Different methods can be used for different purposes in a study.
Multi-method quantitative study	Combination of more than one quantitative data collection technique with associated statistical (quantitative) analysis.	Different methods can be used for different purposes in a study.
Mixed-methods research	Both qualitative and quantitative data collection techniques and analysis procedures are used, either at the same time (in parallel) or one after the other (sequential) but are not combined.	Enables triangulation (corroboration), facilitation (aiding) or complementarity (dovetailing).
Mixed-model research	Combining qualitative and quantitative data collection techniques and analysis procedures are mixed within or across the stages of the research.	Increases confidence and credibility of results. Can uncover deviant dimensions.

Sources: Saunders et al. (2007), Bryman (2008), Easterby-Smith et al. (2012)

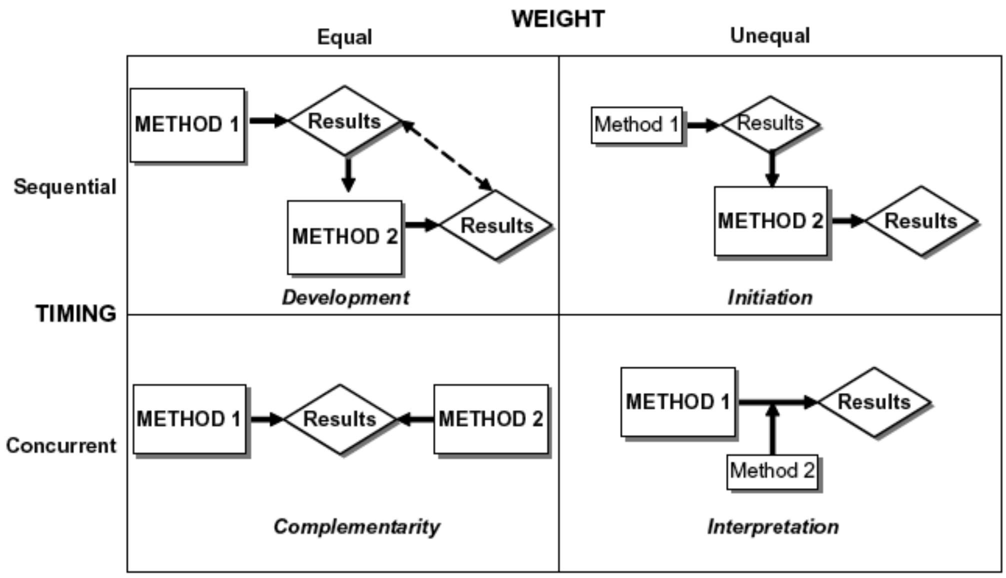
4.4 Research method

Easterby-Smith et al. (2012) showed that survey research is widely used in a variety of formats such as interviewer-administered questionnaires and self-completed questionnaires. The methods used to investigate logistics and the supply chain are normally quantitative (Gammelgaard, 2004). This research, however, employs mixed methods, integrating qualitative and quantitative research within the study. The methodology entails obtaining information directly from a group of individuals (Dane, 1990).

Golicic and Davis (2012) cited four basic research purposes of mixed-methods research as follows:

1. development, or the use of one study to inform a subsequent study;
2. initiation, or the use of a preliminary study to launch the main study;
3. complementarity, or the concurrent examination of various facets of a phenomenon through two or more studies;
4. interpretation, or the concurrent use of a second study to explain or confirm the results of the main study.

Figure 4-1 explains the weight and timing of each of these purposes of mixed-methods research.



Source: Golicic and Davis (2012: 734)

Figure 4-1 Mixed-methods research design

The initiation design was applied in this study. This research consists of two studies, an initial study using qualitative methods and a second study utilising quantitative methods. The results of the qualitative study were used to inform the quantitative study. Furthermore, the two methods have unequal weights, the qualitative being less heavily weighted. It was employed to initiate the research and is secondary to the quantitative. The quantitative method is used in the main study. The results are reported independently, but the focus of the discussion is on the quantitative. After the preliminary exploration of the phenomenon, the quantitative method is used to identify significant relationships between the model constructs. The research procedure is composed of three inter-related steps: (1) conceptual model development from the literature review, (2) factor exploration using semi-structured interviews and (3) factor confirmation using self-completed questionnaire data and statistical analysis. Figure 4-2 illustrates the research methodology applied in this study.

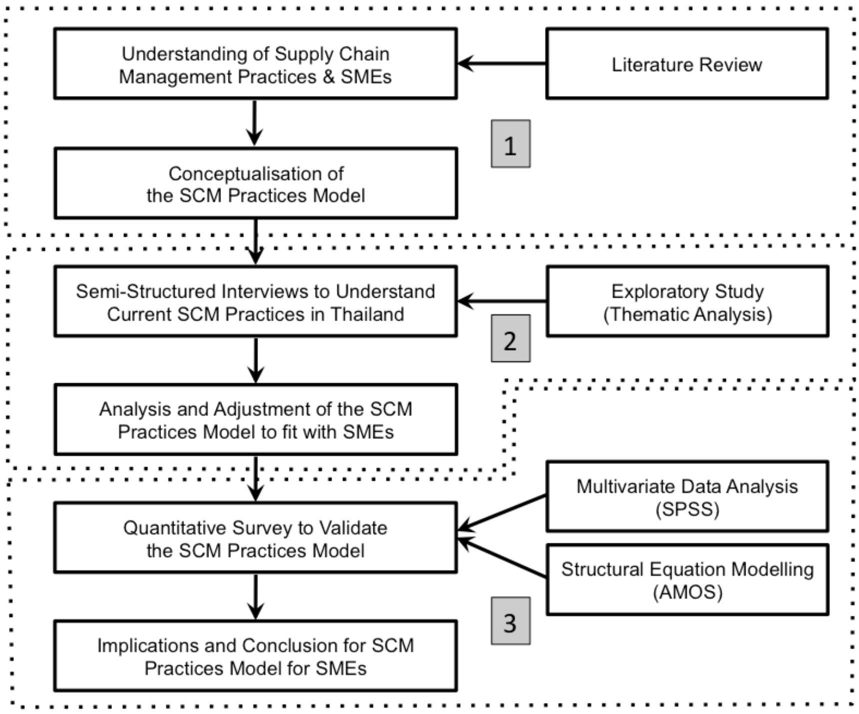


Figure 4-2 The research methodology

4.5 Research tactics: Qualitative methods

Saunders et al. (2007) distinguish the research design from research tactics. The latter concern the details of the data collection techniques and data analysis procedures used. Data collection techniques can be classified into two major methods: qualitative and quantitative. In data collection, the term qualitative is used for non-numeric data gathering techniques such as interviews while quantitative is used as a synonym for numeric data, such as that gathered in a questionnaire survey. Meanwhile, qualitative data analysis can involve categorising data while quantitative data analysis uses graphs or statistics. Both qualitative and quantitative techniques have strengths and weaknesses. In order to gain the most information possible, a combination of both qualitative and quantitative survey methods, i.e. mixed-methods research, was used in this study. According to Saunders et al. (2007), although mixed-methods research uses both qualitative and quantitative data collection techniques, the qualitative data are analysed qualitatively and the quantitative data quantitatively. In this research, the advantages of mixed-methods research are that it not only enables triangulation but also the semi-structured interviews provide exploratory-stage results. The qualitative data collection technique used in this research was semi-structured interviews with experts in SCM from various business segments. The results from the qualitative data analysis improved the focus of the SCM constructs to the appropriate context.

4.5.1 Qualitative sampling

Dane (1990) stated that sampling is the process of choosing participants for research. The whole set of entities to which the research applies is known as the population (Easterby-Smith et al., 2012). The sample is the segment of the population that is selected for study (Bryman, 2008), while the sample frame is the list of all members of the population from which the sample will be selected. Sampling techniques can be classified into two types: probability and non-probability sampling (Saunders et al., 2007).

Probability sampling designs give an equal chance to each case of being chosen from the population. Some sampling techniques offer the same chance within the segments of the design but differing probabilities across segments (Easterby-Smith et al., 2012). The probability sampling techniques are described in Table 4-3.

Table 4-3 Probability sampling techniques

Probability sampling techniques	Details	Advantages
Simple random sampling	Every sample entity has an equal chance of being part of the sample.	Easy to draw up a random list. Computer program available.
Stratified random sampling	Divide the population into homogeneous groups called strata, and then take a simple random sample within each stratum.	Small but important parts of the population are not missed.
Systematic random sampling	Generate a list in some form or other of the units in the population that the researcher is interested in.	The list is essentially organised randomly, so that bias is not introduced.
Cluster sampling	Divide the population into clusters then sample all units from within the selected cluster.	Reduces practical problems where the population units are spread very widely, such that the cost of approaching them all would be very high.
Multi-stage sampling	Combine the above techniques.	Achieves higher operational and efficiency.

Source: Easterby-Smith et al. (2012)

The non-probability sampling designs do not give an equal chance of being sampled to all members of the population (Easterby-Smith et al., 2012). Non-probability sampling provides a range of possible choices for selecting the sample based on the researcher's judgement (Saunders et al., 2007). The non-probability sampling techniques are described in Table 4-4.

Table 4-4 Non-probability sampling techniques

Non-probability sampling techniques	Details	Advantages
Convenience sampling (or haphazard sampling)	Select sample units on the basis of how easily accessible they are.	Quick and cost-effective.
Quota sampling	Divide the relevant population up into categories and then continue selecting until a sample of a specified size is achieved within each category.	Normally used for interview surveys.
Purposive sampling	Researcher has a clear idea of what sample units are needed and then approaches potential sample members to check whether they meet the eligibility criteria.	Reasonable control over sample content.
Snowball sampling	Starting with someone who meets the criteria for inclusion in the study, they are asked to name others who would also be eligible, etc.	Suitable for samples where individuals are vary and it is difficult to identify who belongs to the population.
Self-selection sampling	Allow individuals to show a desire to take part in the research.	Suitable for exploratory research.

Sources: Saunders et al. (2007), Easterby-Smith et al. (2012)

The main objectives of the qualitative semi-structured interviews were to focus the items in each construct of the SCM practices model drawn from the literature review by eliminating irrelevant items, and to confirm the main factors that affect SCM implementation. The sample frame of this part of the study was the members of The Federation of Thai Industries (FTI). Non-probability, quota sampling was used because it suited the objectives of the interviews. Of the 20 informants, ten represented SMEs and ten large firms. The large firms were included in this study as they are members of SMEs supply chain. The complete supply chain examination allowed the researcher to gain an enhanced understanding of SCM practices from both perspectives, and so develop the SCM practices model for SMEs.

4.5.2 Qualitative data collection: semi-structured interviews

Bryman (2008) explained semi-structured interviews as interview with an interview guide that contains a list of questions or reasonably particular topics. While asking questions the more specific issues can be investigated. Flexibility is the major advantage of this strategy. The literature review presented in Chapter 2 was conducted in order to evaluate the current knowledge on SCM practices. The qualitative research method allows the researcher to gain insights by discovering the attitudes, norms, beliefs, values, perceptions, opinion and views of participants (Bryman, 2008, Easterby-Smith et al., 2012). Exploratory investigations of management questions are considered to fit with qualitative research using the interview technique (Cooper and Schindler, 2011). The literature review revealed the antecedents and consequences of SCM practices, including several factors tha affect a firm’s decision to apply SCM practices. The antecedent constructs of SCM practices consist of SCM drivers, facilitators and impediments. The consequence construct is the firm’s performance. Each construct contains a number of factors based on the literature review, as described in Chapter 2. The semi-structured interviews allowed the researcher to assess the major factors of each construct. The qualitative interview topic guide is presented in Appendix A.

4.5.3 Qualitative data analysis: thematic analysis

According to Yin (2009), qualitative data analysis includes examining, categorising, tabulating, testing or otherwise recombining evidence, to draw empirically based conclusions. There are two main approaches to data analysis, based on two different types of research approach (Easterby-Smith et al., 2012). In the first approach, content analysis, constructs and ideas are defined prior to the data collection. The second approach is grounded analysis, in which the data collected are allowed to lead to the development of theory (Bryman and Bell, 2007). Generally, content analysis is a more deductive approach while grounded analysis is more inductive. Furthermore, content analysis causally links variables while grounded analysis makes more holistic associations. This research used content analysis of the qualitative data.

Content analysis processes construct quantitative indicators that assess the degree of attention or concern assigned to units such as themes, categories or issues (Weber, 1990). While content analysis focuses on the frequency of established features of a given text (Joffe and Yardley, 2003), thematic analysis puts more attention on the qualitative aspects of the data. Thematic analysis is one of the methods used for identifying, analysing and reporting the characteristics of data (Braun and Clarke, 2006). Boyatzi (1988: 4) argued that a theme is *"a pattern found in the information that at the minimum describes and organises possible observations or at the maximum interprets aspects of* *the phenomenon".* In this study, thematic analysis is applied as the qualitative data analysis method.

The theme development commenced with an exploratory factor analysis (EFA). The themes that emerged during the semi-structured interviews were grouped into sub-theme and issues. Later in the thesis, these sub-themes and issues will be highlighted in relation to the number of mentions in the interviews.

4.6 Research tactics: quantitative methods

The quantitative data collection phase began after the completion of the qualitative research. Fundamentally, quantitative research involves a deductive approach to the relationship between theory and research, which focuses on the testing of theories (Bryman and Bell, 2007). In this study, the quantitative data collection technique of a self-completion questionnaire was deployed to collect data on a large scale. Then, statistical analysis techniques were used to evaluate the quantitative data. Details of the data collection procedure, and the data analysis techniques of factor analysis and SEM, are explained in the following sub-sections.

4.6.1 Quantitative sampling

The main objective of the quantitative part of this study was to collect and analyse data on each construct of the SCM practices model in order to test the hypotheses. The sample frame for this part of the study was again the members of the FTI. The non-probability, self-selection sampling technique (see Table 4-4) was used, wherein the case individuals show a desire to take part in the research. Only firms that fit the criteria for SMEs as defined by the number of full-time employees were selected. According to the definition of SMEs given by the FTI, a small-sized business (S) typically has 50 employees or fewer, a medium-sized business (M) has 51 to 200 employees and a business that has more than 200 employees is referred to as a large-sized business (L) (Sevilla and Soonthornthada, 2000). The self-completion questionnaires are sent out to these firms. The target key informants included owner, supply chain manager, logistics manager, manufacturing manager, sales or marketing manager, IT manager and finance or accounting manager.

4.6.2 Quantitative data collection: self-completion questionnaires

In this research, the results from the semi-structured interviews were used to develop self-completion questionnaires for quantitative survey research. While, in the semi-structured interview questionnaires, each antecedent construct, namely SCM drivers, facilitators and impediments, had fourteen factors, in the newly developed self-completion questionnaires, this was reduced to seven factors. Those with lower frequencies according to the qualitative results were eliminated. One of the reasons for doing this is that, with self-completed questionnaires, the risk of 'respondent fatigue' is high if the questionnaire is too long, causing lower response rates (Bryman, 2008).

The questionnaire for this study was divided into two sections. The first focused on measuring key constructs pertaining to the SCM practices model. The second aimed to identify the respondent profile. The questions about the model constructs deployed were based on five-point Likert scales. Such scales have been used before in research on SCM practices (e.g. Arend and Wisner (2005), Li et al. (2006), Koh et al. (2007), Bayraktar et al. (2009)).

4.6.3 Quantitative questionnaire design

Based on the literature review, a research gap regarding SCM practices in Thailand was identified. The main research question in this study is "What are the SCM practices used by Thai SMEs?" As a result of the qualitative data analysis, the 98 pre-identified measures identified from the literature review were reduced to 41 items. Each question expressed just one idea as it representing to each measurement of the SCM practices model. Then, the survey questionnaire was developed to fulfil the research objectives according to the key concepts to be investigated.

As illustrated in Appendix B, the quantitative questionnaire was designed around five main constructs as identified in Chapter 3. In order to get accurate responses and avoid misunderstandings, the questionnaire was first developed in English, and then translated into Thai by a Thai Logistics and SCM lecturer with both English language skills and questionnaire development skills. The criteria considered in the questionnaire design (Mitchell and Jolley, 2010) consisted of the following:

1. questions are short and precise;
2. questions organised and grouped into sections corresponding to each factor to give a professional image and reduce likelihood of participants misunderstanding questions;
3. information about the survey provided via advance notification;
4. in each section, terms are defined and the response scale explained;

5. offers clear directions about how to respond;
6. demographic questions are at the end;
7. questionnaire responses are in a format that allows them to be input into SPSS directly.

The questionnaire consisted of two sections, SCM related measurements, and personal, company and network information. The first section was aimed at acquiring data about the constructs of the SCM practices model, namely SCM drivers, SCM facilitators, SCM impediments, SCM practices and firm performance. Each question used a 5-point rating scale (Likert scale), which is commonly used (Matell and Jacoby, 1971), anchored by 1, indicating the lowest level of perception according to questions, and scale up until the highest to level of 5. The total of 41 questions were designed to be answered within 15 to 20 minutes, as per Bryman's (2008) recommendation. He argued that making a questionnaire appear as short as possible means it is less likely to deter prospective respondents from answering. Each construct was explained before the respondent was asked to assess the importance of its factors to the implementation of SCM. The questionnaire was divided into the following sub-sections:

(1) SCM drivers are strategic factors that result in a competitive advantage. They help a firm to determine the appropriate level of SCM practice. The question for SCM drivers was ***"To what extent do you perceive the following SCM drivers influence your SCM implementation?"*** A five-point format (1= unimportant (U), 2= of little importance (LI), 3= moderately important (MI), 4= important (I), 5= very important (VI)) was used for each driver. The drivers were:

- global competition of our network;
- end-customer needs;
- process integration among network members;
- network members' collaboration;
- cost reduction;
- improvement of process capabilities and productivities;
- internal function collaboration.

(2) SCM facilitators are those elements that make SCM practices function better. They represent the environment of the supply chain network that helps SCM practice. The question asked was ***"How important do you think the following SCM facilitators are in supporting SCM implementation?"*** The same five-point format was used. The SCM facilitators included were:

- IT;
- process integration among network members;
- focus on end-customers;
- top management understanding and support;
- organisation designed to support coordination, cooperation and collaboration;
- trust and openness among network members;
- willingness to share knowledge.

(3) SCM impediments are obstacles that may cause SCM practices to fail. The question asked was ***"How important do you perceive the following SCM impediments in terms of preventing SCM implementation?"*** The same five-point format was used again. The SCM impediments investigated were:

- employees' lack of understanding;
- employees' resistance;
- organisational "silo" structure;
- quality problems from network members;
- communication problems and confidential data;
- laws and regulations not supportive;
- some network members do not understand the SCM concept.

(4) SCM practices involve the management of material, information and resource flow across a network of upstream and downstream organisations that leads to the creation of value in the form of products and/or services. The question was ***"To what degree are the following SCM practices implemented in your organisation?"*** A five-point format (1= not implemented at all (NI), 2= barely implemented (LI), 3= partially implemented (PI), 4= implemented (I), 5= fully implemented (FI)) was used for each practice. The practices included were:

1. Network relationship management:
    - Our network members jointly manage inventory and logistics in the supply chain;
    - Our network uses IT to create effective communication;
    - Our network builds long-term relationships with established guidelines;
    - Our network has a clear vision of SCM.
2. Manufacturing flow management:

- Our network uses the concept of JIT / Lean as a tool for competitiveness;
- Our network members formally exchange manufacturing information on a regular basis, e.g. at S&OP meetings;
- Our network implements benchmarking and performance measurement;
- Our network has a standard quality policy for both product and process with established guidelines.

3. Product development and commercialisation:
    - Our network has aligned network strategy with product, sourcing, manufacturing and distribution strategy;
    - Our network members formally share customer requirements and design information through the upstream network;
    - Our network uses the supply chain concept to design product, process and packaging;
    - Our network has a customer feedback programme providing inputs to product development.

(5) Firm performance is measured by a set of variables reflecting a network's capability to meet end-customer requirements. The participants were asked: ***"Please specify the performance of your firm in relation to its major competitors for the past year for each indicated measure."*** A five-point format was used (1= definitely worse than competitors (DW), 2= worse than competitors (W), 3= comparable with competitors (CC), 4= better than competitors (B), 5= definitely better than competitors (DB)) for each measure, which included the following:

- Lower logistics costs: The ability to achieve lower total cost of logistics through efficient network collaboration and efficient operations.
- Lower total costs: The competence of product from lower total unit cost.
- Reduced lead-time: The ability to reduce the lead-time between order receipt and delivery to customer.
- Faster delivery times: The ability to accommodate faster delivery times required by the customer.
- More on time and in full: The ability to meet quoted or anticipated delivery dates and quantities on a consistent basis (on time and in full).
- Higher inventory turnover: The ratio of the cost of goods sold to the average inventory during a given time period.
- Higher customer satisfaction: The perception regarding the extent to which perceived company performance matches customer expectations.
- Higher market share: The company's share of the total market.

The second part of the questionnaire aimed to gain information about the profile of the SME respondent. Data collected included type of industry, number of employees in the firm, number of years for which the company had been operating, and the job function and work experience of the respondent. Appendix B provides a copy of the self-completed questionnaire used in this study.

4.6.4 Quantitative data analysis: factor analysis and regression analysis

Factor analysis is a method used to explore and establish the correlational structure among the observed variables (Basilevsky, 1994). Then, the observed variables can be grouped or clustered into latent variables that cannot be measured directly. Field (2009) indicated that factor analysis has three main uses: (1) to understand the structure of a set of constructs; (2) to construct a questionnaire to measure a latent variable; (3) to reduce the data set to a more workable scale while maintaining as much of the original information as possible.

Regression analysis is a way of predicting an outcome (dependent) variable from one predictor (independent) variable (simple regression), or a set of independent variables (multiple regression) (Field, 2009). The objectives of regression analysis are not only to find the best prediction equation for a set of variables but also to identify and provide explanations for complex multivariate relationships (Ho, 2006).

In this study, the aim of the factor analysis was not purely exploratory. The observed variables were classified into each construct to uncover which variables were effective measures of the dimensions (i.e. SCM driver, SCM facilitator, SCM impediment, SCM practices and firm’s performance). Then, the regression method was used to produce factor scores for each latent variable. Finally, the latent variables’ factor scores from the regression were used to evaluate the relationships between the SCM model constructs.

4.6.5 Quantitative data analysis: SEM approach

SEM is a statistical technique that attempts to describe the relationships among multiple variables. It does so through several multivariate techniques such as factor analysis and multiple regression analysis but enhancing ability to assess a series of dependence relationships for variables which become both dependent and independent variables at the same time (Hair Jr. et al., 2010). Recently, SEM has been used extensively in social science and behavior research, for both theory creation and measurement (Anderson and Gerbing, 1988, Bagozzi and Yi, 1988, Baumgartner and Homburg, 1996). The advancement of user-friendly SEM computer software such as AMOS, and the ability to construct multiple layers of variables via direct or indirect paths of influence, have contributed to SEM's wide use. SEM is a combination of two approaches used to fit the model: path analysis and confirmatory factor analysis (CFA) (Cuttance and Ecob, 1987, Schumacker and Lomax, 2004).

Path analysis is a technique that is used to solve a set of simultaneous regression equations drawn up by the researcher based on prior theoretical hypotheses about casual relations among the observed variables (Schumacker and Lomax, 2004). A path model is a structural model, which defines relationships among the latent variables. The objective of path analysis is to specify the direct and indirect effects of latent variables in the model. Alternatively, the CFA is a measurement model that defines relationships between the observed and unobserved variables. The objective of CFA is thus to evaluate the model specified by the researcher.

SEM allows the researcher to evaluate complex relations among observed and latent variables (Grace, 2006, Hoyle, 1995). In the early 1970s, Jöreskog, Keesling, and Wiley proposed SEM method and it was initially called the Jöreskog-Keesling-Wiley or JKW Model (Kline, 2011). Since then, SEM has been given many different names, such as LISREL-based SEM, covariance structure analysis and latent variable modelling (Grace, 2006).

(Cuttance and Ecob, 1987) recommended two types of assumption in estimating and testing a relationship model: framework assumptions and statistical assumptions. This study applies both types. The framework assumptions are as follows:

1. linear relationships are presumed among the variables;
2. the effects of the latent exogenous variables on the latent endogenous variables are additive;
3. the relationship between those two types of variables is stochastic;
4. the observed variables are measured on an interval scale and are continuous;
5. the means, variances and covariances of the observed variables described the data.

In order to estimate and test the model, the statistical assumptions are as follows:

1. the disturbances in all equations have mean zero;
2. the disturbances are uncorrelated with the exogenous variables;
3. the errors of measurement are uncorrelated with the constructs;

4. the measurement errors and the disturbances are all mutually uncorrelated;
5. the joint distribution of the observed variables is multivariate normal (Cuttance and Ecob, 1987).

There are two categories of general SEM, namely, the measurement model and the structural model (Hoyle, 1995). The measurement model is where the latent variables are defined by their components. The structural model shows the relationships between the latent variables and the observed variables. In this study, both the measurement model and the structural model are investigated and explained.

Table 4-5 First-order CFA and second-order CFA

	First-order CFA	Second-order CFA
Description	Covariances between measured items are explained with a single latent factor layer.	The second-order latent factor that causes multiple first-order latent factors is introduced.
Empirical concerns	These covariances terms are freely estimated unless the researcher has a strong theoretical reason to hypothesise independent dimensions.	The second-order factor explicitly representing the causal constructs that impact on the first-order factors.
Theoretical concerns	All constructs share a single level of abstraction.	Constructs can be operationalised at a higher level of abstraction based on theoretical support.

Source: Hair Jr. et al. (2010)

Second-order factor analysis (second-order CFA) is a CFA technique that aims to test a model that contains two layers of latent constructs (Hair Jr. et al., 2010). The second-order factors are measured indirectly through the indicators of the first-order factors (Kline, 2011). The differences between first-order CFA (generally termed CFA) and second-order CFA and concerns regarding them are described in Table 4-5 and illustrated in Figure 4-2.

In this study, both CFA and second-order CFA of the SCM practices model are explored according to Hoyle's (2006) procedure. Hoyle (2006) recommended including the following elements in the SEM approach:

1. The model is justified by the specification estimated;
2. The model is evaluated with the index of fit;
3. Model modification or respecification;
4. Interpretation of the SEM results.

In Figure 4-3, X1-X12 are observed variables, and Y1-Y4 in the first-order model are treated as endogenous while in the second-order model they are treated as exogenous. Z1 in the second-order model is the second-order factor (treated as endogenous).

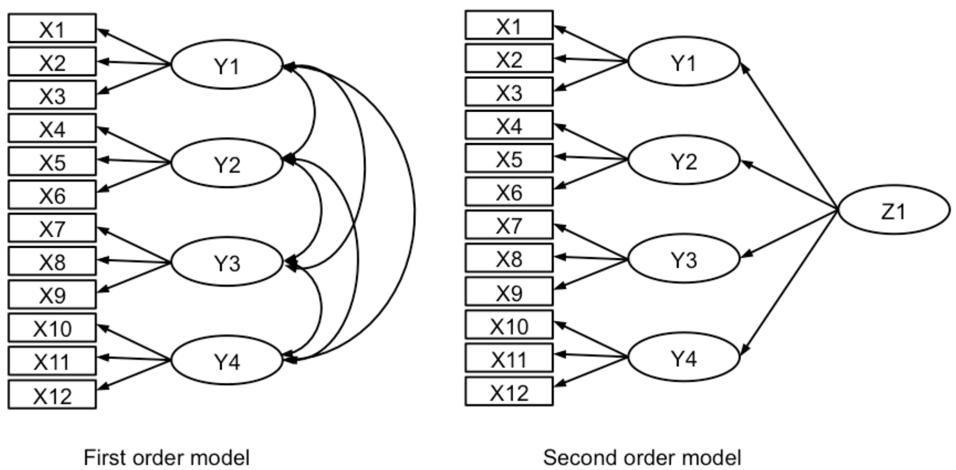


Figure 4-3 Contrasting path diagrams for a first- and second-order measurement theory

4.7 Research ethics

Ethical issues were considered at various stages of this research. First, the study was conducted according to the core principles of the Market Research Society (MRS) Code of Conduct. Accordingly, the study was carried out with informed consent, whereby the intended participants were fully informed about the nature, purpose and use of the research to be undertaken and their role within it. All of the participants were volunteers and were briefed clearly beforehand as to the purposes of the research and why their input was considered valuable. They were also informed of the type of information to be collected and how it would be used to further this research project. Next, data protection issues were identified in conducting the semi-structured interviews. The informants' names and companies were removed from the data during the analysis process. Only their business sector was reported in the summary worksheet.

4.8 Summary

This chapter has discussed the research strategy, starting with a description of the research method used. Then, the research design was described. The use of multiple methods and both qualitative and quantitative approaches to data collection and analysis were explained. As this chapter has discussed, a qualitative approach was used in this study to develop an understanding of the SCM constructs and to analyse the important factors within each one. Semi-structured interviews allowed the researcher to identify the most important factors of each SCM construct. In the quantitative part of this study, a self-completion questionnaire survey was used to gather data from firms. The survey examined the perceptions of managers towards SCM constructs. Then the cause-and-effect relationships between the factors that influence SCM practices were analysed. The next chapter presents a detailed analysis of the qualitative data gathered using the semi-structured interviews.

Qualitative data are sexy.
They are a source of well grounded, rich descriptions,
and explanations of processes in identifiable local context.
(Matthew B. Miles and A. Michael Huberman, Qualitative Data Analysis, p.1)

CHAPTER 5 EXPLORATORY STUDY RESULTS: THEMATIC ANALYSIS

5.1 Introduction

This chapter discusses the data collected from the semi-structured interviews with Thai firms in July 2011. Qualitative data usually come in the form of words rather than numbers and are important in the social sciences (Miles and Huberman, 1994). Interviews were regarded as a tool to refine and confirm the findings from the literature review in this study. Furthermore, the interviews were conducted under the conceptual framework of the SCM practices model. The interviews were undertaken with SCM experts from Thai firms, both SMEs and LEs. These interviews were used to refine the factors extracted from the literature review before developing the self-completed questionnaire. Here, the analysis of the data gathered from the interviews is presented together with the preliminary findings. Finally, implications and limitations of this exploratory study are discussed.

5.2 Objectives of the Exploratory Study

The objectives of the exploratory study of SCM practices conducted using semi-structured interviews are associated with the research objectives identified in Chapter 1:

1. to confirm the main factors that affect the implementation of SCM practices;
2. to focus the items of each construct (drawn from the literature review) by eliminating irrelevant items from the SCM practices model;
3. to enhance our understanding of each construct in the SCM practices model according to the practitioner's perspective;
4. to increase the feasibility of the data collected through the self-completed questionnaire for the SME context.

In order to achieve the abovementioned objectives, the semi-structured interviews were conducted with SCM executives of Thai companies that are members of the FTI. Easterby-Smith et al. (2012) recommended that a researcher should prepare a checklist or topic guide for such interviews. A qualitative interview topic guide was prepared and is shown in Appendix A.

The Office of Small and Medium Enterprises' Promotion (OSMEP) reports Thailand's GDP according to manufacturing sector as defined by the International Standard of Industrial Classification of All Economic Activities (ISIC) code. In 2011, the three largest industry sectors by GDP were ISIC15 - manufacture of food products and beverages, ISIC24 - manufacture of chemicals and chemical products and ISIC36 - manufacture of furniture; manufacturing n.e.c. (not elsewhere classified) (Office of Small and Medium

Enterprises Promotion, 2011). Thus, pre-exploratory interviews were held with these three industries, as explained in the next section.

5.3 Pre-exploratory Interviews

Prior to the exploratory study, three interviews were conducted with SCM experts. The main criterion for selecting the informants was their breadth of experience in the three major industry sectors. All three respondents were approached and the objectives of the pre-exploratory interviews were explained to them. One of the respondents had several years of international experience as a supply chain manager in the US. The purpose of these interviews was to discuss the SCM factors in each construct of the SCM practices model, as identified by the literature review, and to develop a structure and questions for the semi-structured interviews. Table 5-1 shows the characteristics of the pre-exploratory study respondents.

Table 5-1 Pre-exploratory study respondents

Company	Manufacturing industry sector	Informant's experience	Qualifications
A	ISIC15 - Manufacture of food products and beverages	Supply chain director	Conference speaker
B	ISIC24 - Manufacture of chemicals and chemical products	Supply chain director	Keynote speaker and international experience
C	ISIC36 - Manufacture of furniture; manufacturing n.e.c. (not elsewhere classified)	Vice president, Finance & Operations	University visiting lecturer

All three pre-exploratory interviews were undertaken after explaining the research project and SCM practices model to the interviewees. A broad overview of this study was also given. During the interviews, the interviewees were asked to provide their own views, not those of their companies. The respondents were then asked to comment in detail on each factor in each construct of the model.

5.4 Interview Structure

To achieve the research objective of developing the SCM practices model, a semi-structured interview guide was developed based on five constructs identified from the prior literature. This approach was chosen in order to allow the five constructs to be addressed in the interviews. It also helped the respondents to deliberate on any further issues that arose as a result of the questions in the interview guide. The five constructs identified from the literature review are shown in Figure 5-1.

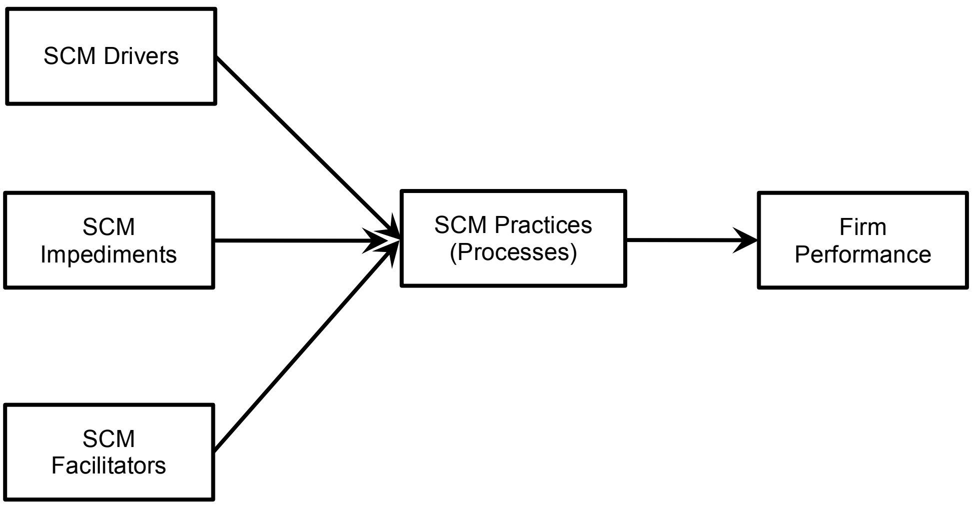


Figure 5-1 The SCM practices model

These five constructs shown in Figure 5-1 are considered the core objectives of this research. This SCM practices model's constructs can be defined in terms of themes according to the thematic analysis approach. The questions raised under each of the five constructs are briefly discussed below:

Theme 1: SCM drivers

In developing the SCM drivers construct, the questions addressed the issue of what drove the respondent's organisation to consider implementing SCM practices. The literature identifies SCM drivers as a set of driving forces that motivate a firm to implement SCM (Fawcett et al., 2009). The goals were to identify and categorise these drivers into three groups: factors external to the supply chain network, factors internal to the supply chain network and factors internal to the firm.

Theme 2: SCM impediments

SCM impediments are those things that obstruct the respondent's organisation from successfully implementing SCM. The interviewees were asked to describe the obstacles to SCM implementation in their own organisation. They were also asked to classify those impediments into factors internal and external to the firm. The literature identifies inhibitors such as employees' resistance to change, ineffective IT systems, a lack of trust and sharing between supply chain network members and improper resource allocation as negatively affecting SCM performance (Goh and Pinaikul, 1998, Mentzer et al., 2000, Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009).

Theme 3: SCM facilitators

The literature reveals that, in order to successfully implement SCM, one's organisation needs ideas, tools, actors or organisations that enhance SCM implementation. Mentzer et al. (2000) used the term "enablers" in the same way, including people, organisations and technology that move SCM forward. In our study, the author defines SCM facilitators as the structural or infrastructural factors that aid the implementation of SCM practices. The literature explains that structural facilitators are related to tangible factors such as information systems and technology, and process systems and technology. Facilitators that enhance the utilisation of structural facilitators and control those facilitators are classified as infrastructural facilitators. These include management, the corporate culture and organisational design.

Theme 4: SCM practices

The literature suggests that organisational SCM practices are activities conducted in a firm and its network to enhance SCM effectiveness (Li et al., 2006). Some research questions in this regard include identifying the significant supply chain processes and whether they are similar for all companies (Cooper et al., 1997). This research investigates the three main processes of a firm according to the GSCF process framework (Lambert, 2008). In the semi-structured interviews, these three selected processes were recognised as being significant to a firm's success. They are network relationship management, which includes customer relationship management and supplier relationship management, manufacturing flow management and product development and commercialisation.

Within each process, the interviewees were asked to explain their supply chain flows in terms of material flow, information flow and resource flow. As explained by Mangan et al. (2008), material flow encompasses the movement of physical products and services from a supplier to a customer and back; information flow embraces order transmitting and the products' delivery status; resource flow consists of financial aspects such as payments, credit terms, consignment and title ownership, and non-financial aspects such as people and equipment, which improve the supply chain's effectiveness.

Theme 5: Firm performance

Finally, the literature looks at the organisation's performance. This is the efficiency and effectiveness of a firm's internal processes in producing its products and services. Examples of measures include cost, time and reliability. Li et al. (2006) classified organisational performance into short-term and long-term targets. In the short term, SCM is mostly aimed at increasing productivity and reducing inventory and cycle time, while the long-term objective is to increase market share and profits. From the financial perspective, market share and profits reflect the asset utilisation of a firm. In the interviews, the respondents were asked to identify their firm's performance in four categories as costs, time, reliability and asset utilisation.

5.5 Data Analysis

Qualitative data analysis can be conducted in various ways, including content analysis, grounded analysis, social network analysis, discourse analysis, narrative analysis, conversation analysis and argument analysis (Easterby-Smith et al., 2012). Generally, the analytic approaches are developed on an ongoing basis during the data collection and human analysis, following the coding (Cooper and Schindler, 2011). In this study, the researcher examined the contextual framework of the phenomenon being measured. The researcher also added additional ideas and comments to the transcribed interviews. Then, interview analysis was carried out using theme and content analysis techniques.

The interview transcripts were coded in a number of steps, which can be thought of as a draft stage and a refining stage. During the draft stage, all transcripts were coded into five themes as represented by the five constructs of the model. Then, in the refining stage, the researcher categorised, re-categorised and refined emerging patterns, concepts and issues. Even though the respondents did not answer every question and there were different numbers of respondents in each category, it was decided to include all issues mentioned by the respondents. This allowed the researcher to gain a better understanding of SCM issues in the context of Thai SMEs.

5.6 Qualitative data analysis: Preliminary findings

The researcher chose the semi-structured interview methodology based on the research purpose to clarify the constructs drawn from the literature review. Twenty Thai firms were selected using non-probability, quota sampling, with a mix of SMEs and large firms. Tables 5-2 and 5-3 show the respondents' profile.

The interviewees were asked the same set of specific questions but then each was allowed to give their own opinions with the help of interviewer probes. There were five key questions asked:

1. What factors determine the SCM practices carried out in your firm?
2. What are the obstacles to SCM implementation?
3. How can SCM practices be more successful in your firm?
4. What SCM processes does your firm currently deploy?
5. What are your expectations from SCM practices?

Table 5-2 Respondents' industry sectors

No.	Industry sector	Number of firms
1	Furniture, Leather & Textile	3
2	Rubber & Plastic Products	3
3	Metal & Motor Vehicle	4
4	Chemical & Paper	4
5	Food & Beverage	4
6	Services	2

Table 5-3 Respondents' job functions

No.	Job function	Frequency
1	Top Executive	5
2	Supply Chain Management	4
3	Sales & Marketing	3
4	Financial	3
5	Logistics	2
6	Manufacturing	2
7	IT	1

During the interview, for each construct in turn, the researcher showed the interviewee a list of factors and asked them to rank them in order of importance. The detailed findings from the semi-structured interviews were summarised into a worksheet, which is presented in Appendix C. Then, the frequencies of the factors within each construct were analysed.

Within the construct of SCM drivers, cost reduction was ranked as the most important factor. It was frequently mentioned by 35% of the interviewees. The next most important factor was the improvement of process capabilities and productivities, at 24%. Following this were the global competitiveness of their network, end-customer needs and network members' collaboration at 11%, 7% and 7% respectively. The remaining factors, namely internal function collaboration, process integration among network members, internal efficiency improvement, focus on firm's core competency and outsourcing some of their tasks, were indicated to be less important. The details of the analysis of the SCM drivers construct are shown in Figure 5-2.

In a similar way, the SCM impediments construct is questioned. The most often specified is the employees' lack of understanding, at 41. After that, employees' resistance and organisational "silos" receive 12% each. Quality problems, communication problems and confidential data, laws and regulations do not support SCM, and some network members not having the SCM concept receive 6% each Figure 5-3 illustrates the findings regarding the SCM impediments.

In terms of SCM facilitators, 33% of the respondents name IT as a major factor. Top management understanding and support are next with 16% each. Process integration among network members has 13%. Organisation designed to support coordination, cooperation and collaboration was mentioned by 11%. Focus on the end-customer was specified by 9%. Trust and openness among network members and the willingness to share knowledge gained 4% each. Details are shown in Figure 5-4.

The respondents stated that their firms implemented SCM processes including customer relationship management, supplier relationship management, product development and commercialisation and manufacturing flow management.

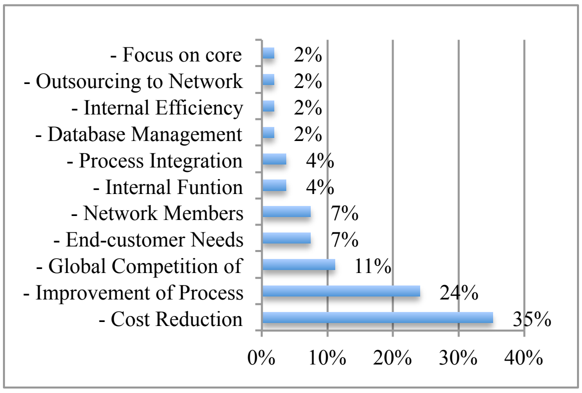


Figure 5-2 The SCM drivers identified by the respondents

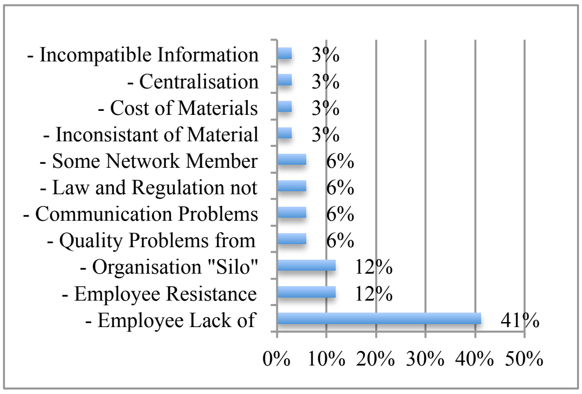


Figure 5-3 The SCM impediments identified by the respondents

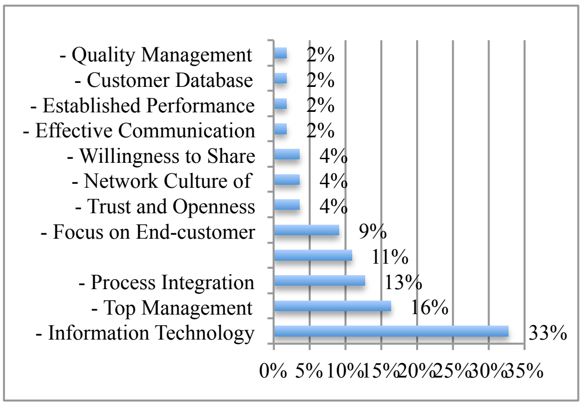


Figure 5-4 The SCM facilitators identified by the respondents

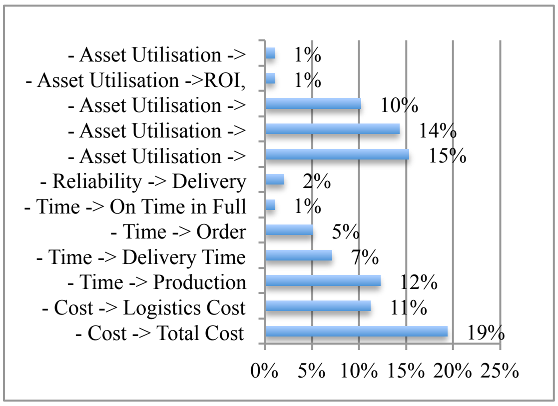


Figure 5-5 The firm performance identified by the respondents

A firm's performance is expected to increase due to SCM implementation. It can be divided into four groups: cost, time, reliability and asset utilisation. The cost aspects mentioned in the interviews were logistics costs and total cost savings, at 19% and 11% respectively. In the time dimension, the interviewees anticipated benefits such as shorter production lead-times (12%) and shorter delivery times (7%). For reliability, higher delivery dependability and more deliveries made on time and in full were each mentioned by only 1% of respondents. Finally, in the asset utilisation dimension, higher inventory turnover, higher customer satisfaction and higher market share were mentioned by 15%, 14% and 10% respectively. Figure 5-5 provides details for the factors within the firm performance construct.

The semi-structured interviews clarified and elaborated on the SCM practices construct. From the content analysis of interviewed data, it can be concluded that each factor in the SCM practices model, drawn from the literature review, is relevant.

5.7 Qualitative data analysis: thematic analysis

The findings of the exploratory study will now be discussed in line with the research themes. Each theme is presented by way of categorising emerging sub-themes according to the literature review. The process of identification of issues is analysed whilst summarising each of the sub-themes. The results of the exploratory study are then discussed along with its limitations in the following section.

Theme 1: SCM drivers

In terms of SCM drivers, the issues can be categorised into three main sub-themes:

1. **Drivers external to the supply chain network:** factors arising from outside the companies in the supply chain network;
2. **Drivers internal to the supply chain network:** factors emerging from the members of the supply chain but excluding the focal company;
3. **Internal company drivers:** factors originating within the focal company.

Each of the sub-themes is made up of a number of issues as shown in Figure 5-6.

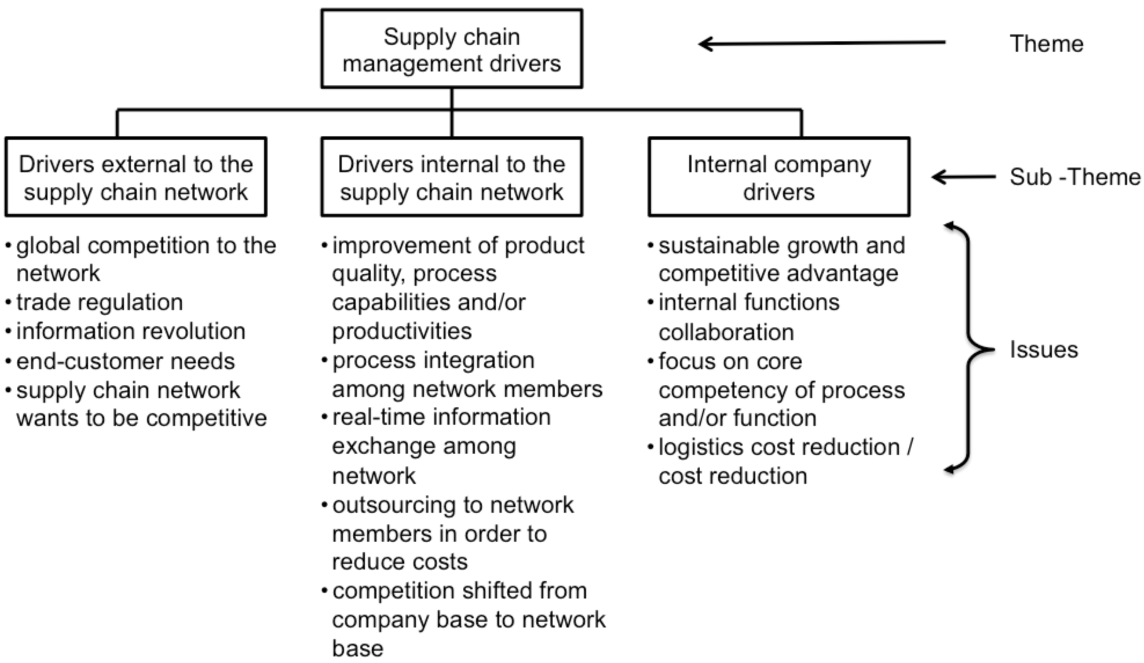


Figure 5-6 Theme 1: SCM drivers, sub-themes and issues

Drivers external to the supply chain network

The respondents identified external SCM drivers from their experiences. The literature review produced the following external SCM drivers:

1. our network has global competitors and/or international network members;
2. trade regulations were changed so our company decided to join a network;
3. the information revolution drives supply chain integration;
4. end-customer demand for higher-quality products and services;
5. to remain competitive.

Global competition to the network arose from the interviewees as one of the most important external SCM driver. The respondents from export companies agreed that SCM was important in helping them to survive amidst severe global competition. One of the respondents claimed:

> "My major market is exports to Middle East countries. Competitors from China, Malaysia and Indonesia offer lower costs. This drives me to collaborate with my suppliers to reduce costs and compete with my competitors. Collaboration not only occurs with my suppliers but also with my logistics services provider. Everybody has to work together as a single team to get costs down and win against our competitors." (Furniture manufacturer)

Another external SCM driver is the end-customer's needs. End-customers usually demand higher-quality products and services (Thakkar et al., 2008b, Christopher, 2011). The respondents from the large international firms all agreed that this driver was most relevant to SCM implementation in their firms.

One respondent explained his reasons for paying great attention to customer requirements as follows:

> "The SCM involves suppliers as well as end-customers who are the origin of all requirements. If they don't indicate any signal of requirement we shall not move. The requirements from the channel of distribution are not the real demand. All members of the supply chain have to listen to the signals from the end-customers. Let me explain more: currently the end-customer is looking for a cheaper product with faster delivery. So, one of our SCM targets is to deliver our products to the end-customer in the most efficient way, in terms of cost and time." (Chemical manufacturer)

A respondent from a sheet metal factory mentioned that one of the drivers of SCM was Thailand's agreement to be part of the ASEAN Free Trade Area (AFTA). AFTA is a trade bloc agreement made by the Association of Southeast Asian Nations (ASEAN), supporting local manufacturing in all ASEAN countries. This finding confirms the study by Christopher (2011) which found that, in the global economy, firms have choices about where they locate their assets and activities. The respondent explained the reason for his relationship with his supplier in Vietnam as follows:

> "When AFTA becomes fully effective we (Thailand) will lose some advantages to low-labour countries such as Vietnam, Laos and Cambodia. So we established relationships with our suppliers in Vietnam in order to gain benefits from lower labour costs, import tariffs and duty. This is one of our drivers, which has forced us to implement SCM." (Sheet metal manufacturer)

Drivers from within the supply chain network

The next category of SCM drivers is those from within the supply chain network. According to the literature, these drivers include the following:

1. one of our network members initiated the integration efforts;
2. our network wants to improve product quality, process capabilities and productivities;
3. our network outsources non-core activities to promote flexibility and reduce costs;
4. our network enhances communication across the network via real-time information exchange;
5. competition has shifted from between companies to between networks.

In the interviews, the representatives of SMEs stated that they had implemented SCM according to the requirements of customers or suppliers who had major control over their supply chain network. Fawcett et al. (2009) argued that this was a driver of SCM in their research about the automotive industry. The leading firm in a network initiates the integration efforts to enhance supply chain capability, which may drive other channel members to follow. The representative of an automotive SME gave a similar account:

> "We produce spare parts for Toyota. Formerly, we used to ship our products directly to Toyota but after Toyota implemented SCM we were classified as a second-tier supplier. Toyota forced us to implement SCM and to change our business processes. Now we deliver our product to Toyota's tier-one supplier using SCM concepts. We are members of their system. We implement just-in-time (JIT) methods, lean manufacturing, supplier relationship management and customer relationship management. Moreover, we have sales and operation

planning (S&OP) meetings, which we did not have before." (Automotive parts manufacturer)

Respondents also mentioned fundamental drivers coming from within the supply chain network, such as the improvement of product quality, process capability and productivity. This finding confirms the results of studies by Ayers (2006) and Tan et al. (2002). Enhancing network competitiveness through product and service improvements among supply network members is found to be a major within-network driver (Tan et al., 2002, Olhager and Selldin, 2004, Ayers, 2006, Fawcett et al., 2009). The respondent representing a hypermarket retailer, one of the most competitive sectors, identified this driver, explaining that communication among supply chain network members leads to better collaboration:

> "One of our key competitive strategies is product quality. In our fresh foods segment, we focus on our product quality. Products from our suppliers in the supply chain network are inspected against our quality standard. Good SCM guarantees food supply quality. Timely communications are made throughout our supply chain network to ensure our product quality and meet customer requirements." (Hypermarket retailer)

Outsourcing some company activities in order to reduce costs is another driver of SCM implementation (Storey et al., 2006), confirmed by our interview with a logistics service provider:

> "We learnt that our customers want to focus on their core competency. They outsource logistics activities to us not only to reduce costs but also to enable their SCM strategy. SMEs are forced to become more effective so they look for partners they can rely on. We have integrated ourselves into one of their

(the customer's) supply chain networks and it is becoming more and more efficient to work together as a network." (Logistics service provider)

Some of the respondents mentioned as their driver for implementing SCM seamlessly integrating their processes among network members. This is not cited in any of the prior literature. The food processing manufacturer's representative made the following comment:

> "Without SCM we would not have sales and marketing information. For example, in the past, we had sales forecasts based on our sales history and adjusted using our marketing campaign. We expected the most up-to-date and accurate data from our retailers but we did not get them. Then, we decided to implement SCM with an order management process. Now we have inventory visibility along the pipeline from our channel of distribution and also give information back to our suppliers. So our supply chain network members rely on a seamless integration process." (Food processing manufacturer)

However, some SCM drivers from the literature were not mentioned by our respondents, such as the competition having shifted from within-company to within-network. Our respondents, mostly SMEs, may not serve a single supply chain network. They may sell similar products to different supply chain networks. For example, the household products manufacturing firm interviewed sold its products to both Tesco and Makro. In the competition between supply chain networks, Tesco strongly competes with Makro but this household products manufacturing firm, as a member of both supply chain networks, does not perceive the competition. Thus, for the household products manufacturing firm, network competition is not a driver of the implementation of SCM.

Internal company drivers

The last sub-theme of SCM drivers is those coming from within the company. Based on the literature, the internal company drivers were identified as follows:

1. our company desires to improve its competitiveness;
2. our company enhances cooperative efforts among functional areas, e.g. logistics and material management collaboration;
3. our company focuses on core competency processes and/or functions;
4. our company aims to reduce costs of operation, logistics and inventory management.

The interviewees identified internal company drivers as major reasons for implementing SCM. Most of the respondents explained that they were motivated mostly by cost reduction. This confirms the findings of several prior works that argued for benefits of SCM adoption such as reducing costs of operation, improving inventory turnover and reducing lead-time (Chin et al., 2004, Olhager and Selldin, 2004, Murphy and Wood, 2008). Cost reductions from SCM implementation can be achieved in various ways, such as reducing non-value-adding activities and improving inter-function coordination. A supply chain director from a chemical manufacturing company shared his ideas as follows:

> "Cost reduction is viewed as the main driver but actually it is a result, an extreme aim, of our SCM implementation. The end-customer always wants quality products at a cheaper cost. Lowering costs is set as a KPI (key performance indicator) of our firm. SCM is not only a short-term, fashionable idea but our strategy for achieving higher efficiency and remaining competitive in the

highly competitive global market. We have allocated our resources, such as people, organisational infrastructure, and information and communication technologies, so as to support SCM ever since we learnt about the supply chain concept. In our case, we are one of the global sources of supply, so we are not only competing with competitors but also with other subsidiaries that are globally sourcing similar products. On top of delivery, which every source of supply has to commit to in the same way, cost is a major concern." (Chemical manufacturer)

In order to achieve cost reductions, inter-functional coordination is considered a key aspect. Poor coordination is reflected by a lack of communication, ineffective decision-making processes and deficient leadership styles, explained a representative from a tannery, adding:

"In the past, our customers wanted to know their order status but we could not give them the exactly delivery date. We realised that we were in trouble. When we tried to figure out the root cause of our lack of information problem we found that we had poor coordination not a lack of information. We had a tremendous amount of information but no alignment, which led us to ineffective decision making and we lost business as a result. Then, SCM was implemented in order to coordinate among departments. Now, we have frequent meetings where we share information based on a single, company-wide database." (Tannery)

This finding confirms several studies, such as Tan et al. (2002), Ayers (2006), and (Fawcett et al., 2009), which found that SCM was a key to creating a non-imitable collaborative capability to increase a firm's competitive level and speed up customer response times, leading to a greater competitive advantage.

Internal function coordination also leads to higher efficiency, as the representative of a beverage manufacturer commented:

> "SCM implementation helps us to reduce ineffective operations. It redefines the working processes. We apply a lean approach by creating end-customer value. This value is then translated across functions as a value stream. Our SCM is based on this value stream. Our competitive advantage is created because all relevant functions work together as a process not as functions." (Beverage manufacturer)

Overall, there appears to be a general recognition that SCM drivers are the "roots" of a firm's requirement to implement SCM (Ayers, 2006). Our study reveals these requirements for SCM, which leads to SCM design. The drivers guide firms to recognise their critical issues before implementing SCM. The author summarises seven main drivers based on the ideas of our respondents as follows:

1. global competition of our network;
2. end-customer needs;
3. process integration among network members;
4. network members' collaboration;
5. cost reduction;
6. improvement of process capabilities and productivities;
7. internal function collaboration.

These drivers are contained in the quantitative study. The developing a means-ends hierarchy of SCM drivers as shown in Figure 5-7.

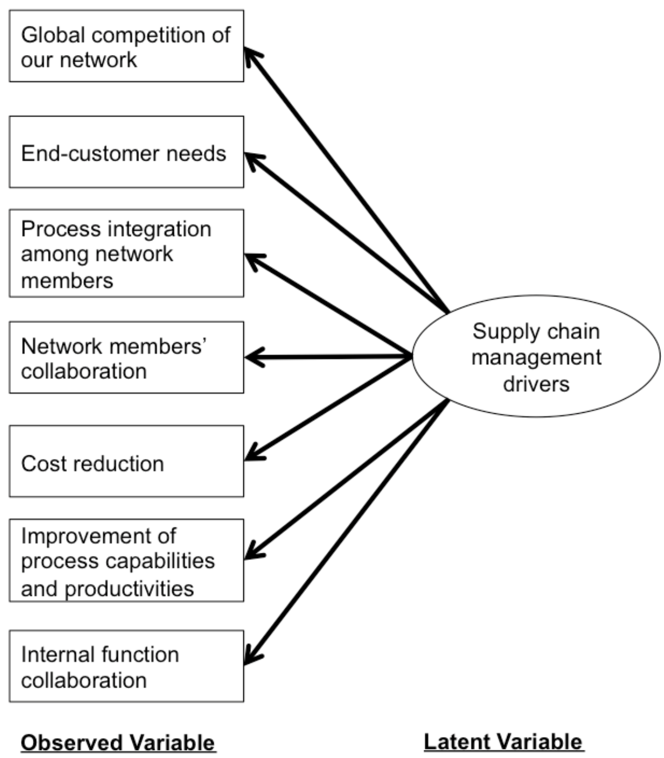


Figure 5-7 The SCM drivers construct and its variables

Theme 2: SCM impediments

SCM impediments are categorised into two main sub-themes:

1. **Within-firm supply chain impediments:** factors that arise within the firm that prevent it from successfully implementing SCM;
2. **External supply chain impediments:** factors originating outside the firm that prevent it from successfully implementing SCM.

Each of the sub-themes is made up of a number of issues, as shown in Figure 5-8

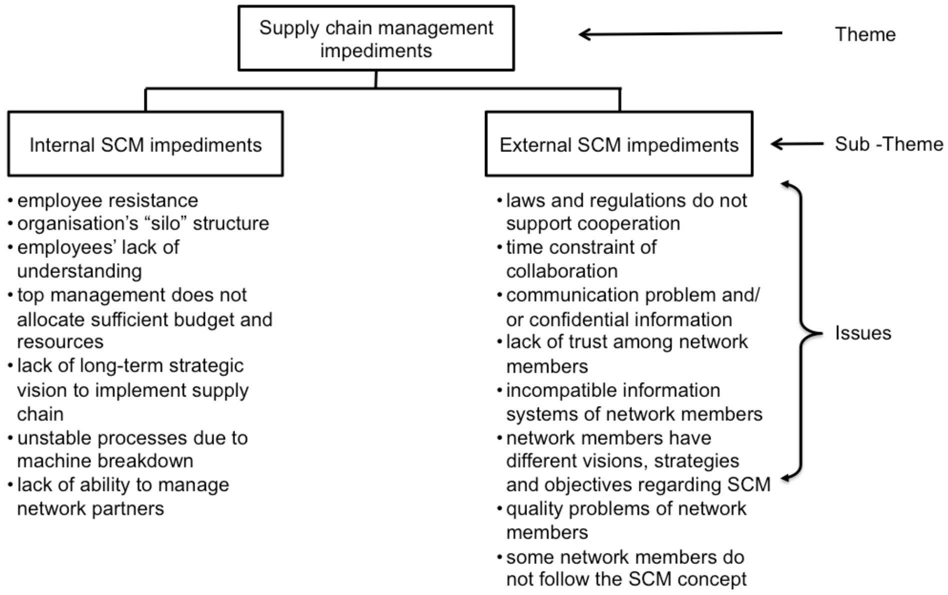


Figure 5-8 The SCM impediments, sub-themes and issues

Within-firm supply chain impediments

From the literature, the following internal SCM impediments were identified:

1. our employees have resistance to change;
2. our organisational structure looks like a "silo" and does not support cross-functional processes;
3. our company has ineffective IT systems;
4. our employees lack SCM understanding and/or expertise and/or adequate skills;
5. our top management team does not support or give sufficient budget and resources to supply chain implementation;
6. our company does not have a long-term strategic vision for implementing SCM;
7. our company has one or more uncertain processes emerging from machine breakdowns;

8. our company lacks the ability to manage network partners.

According to the interviews, employees' lack of understanding emerged as the key internal obstacle to SCM. Those companies that exported to international markets agreed that employee understanding was a crucial barrier to the implementation of SCM. The respondent from an apparel manufacturing firm stated:

> "For our employees, SCM is quite a new concept. They do not want to change the way they perform their jobs. We solve this issue by providing more training about SCM to give them more understanding. It took time to make the change but finally we achieved it." (Apparel manufacturer)

This confirms the Hong Kong manufacturing perspective reported by Chin et al. (2004). They argued that common reasons why firms did not implement SCM were that it was "too difficult to implement" and that the "present system works". This leads employees to resist changing their current practices because some would gain additional work while others might get less work or lose their jobs. Goh and Pinaikul (1998) also mentioned employee resistance as an obstacle to implementing SCM. The interviewee from the paper industry commented as follows:

> "Our employees resisted change when we redesigned the work processes. Moreover, we introduced new KPIs based on the new processes. This resistance impacted upon the supply chain project implementation. We educated our employees about the benefits of SCM. Our employees accepted our SCM system after several training sessions and meetings. Moreover, the top management also played an important role in driving the change." (Paper manufacturer)

An organisational “silo” structure has also been identified as an internal obstacle of SCM. Lambert and Cooper (2000) argued that, in major firms, the individual functions should be integrated in order to achieve optimised product flows and information flows that lead to successful SCM. The respondent from the food processing industry referred to the problem of “silos” in their organisation as follows:

> “In our operation we had strong functional targets. Each department had their own objectives and aims to be achieved. When we started to implement SCM in our firm, the first thing we realised was that this was the main obstacle. Operations and sales had different functional targets. So we eliminated functional objectives by setting up corporate meetings at which we developed our process targets. These led us to focus on the end-customers instead of functional aims. Finally, we eliminated the “silo” structure by setting up cross-functional teams.” (Food processing manufacturer)

Mentzer et al. (2000) defined the “silo” functional problem as the failure to understand how collaboration with others would increase overall performance because of an inability to see the overall picture of the entire supply chain.

Supply chain impediments external to the firm

The literature review identified the following external SCM impediments:

1. laws and regulations do not support our network members working together (e.g. anti-trust laws);
2. collaboration among our supply network members requires time and mutual understanding;

3. our network has communication problems such as a reluctance to disclose important supply chain information among network members;
4. our network members lack trust or betray each other;
5. our network has incompatible information systems and/or has difficulties achieving systems integration;
6. our network members have different visions, strategies and objectives regarding SCM;
7. at least one of our network members has uncertain operational processes that lead to quality problems for our network;
8. at least one of our network members resists change or does not follow the SCM concept.

The respondents were asked to talk about external SCM impediments from their own perspective. The respondent from the beverage distribution company argued that communication problems such as a reluctance to disclose important supply chain information among network members was their main external impediment:

> "We do not get timely information from the manufacturer because they keep their marketing plans secret. Sometimes they change their plans according to a competitor's marketing campaign. Our SCM implementation is obstructed because of a lack of timely communication of information from the manufacturer. To solve this, we set up regular partnership meetings between the manufacturing firm and ourselves. Resulting from those partnership meetings, we share monthly sales and operations planning on a formal basis." (Beverage distributor)

Bayraktar et al. (2009) argued that inhibitors are factors that prevent SCM implementation from achieving operational performance. They identified insufficient vendor support as one of these obstacles. Poor integration with suppliers' and customers' systems is also a barrier to achieving supply chain operational performance. Mentzer et al. (2000) interviewed 20 SCM executives from leading companies across a range of industries. They found supply chain impediments to include not only a failure to communicate but also, and most seriously, the betrayal of a partner. They gave as an example of betrayal revealing concepts developed for one partner to a competitor of that partner. In our interview with an executive from the tannery, he mentioned betrayal as follows:

> "In the past, we asked suppliers to supply raw hide as we had a requirement from a customer. Sometimes we would bid for an order, then we informed our suppliers about the customer's specifications but our suppliers shared these requirements with our competitors, causing us to face severe competition. Based on that experience, we stopped trusting some of our suppliers. When we decided to implement SCM, we decided to share information with our suppliers. We were reluctant to do so. In the end, we developed a non-disclosure agreement with our network members in order to keep our information secret." (Tannery)

Uncertain operational processes of network members leading to quality problems were referred to as an SCM impediment by the supply chain manager of a household products manufacturer as follows:

> "An external obstacle to our SCM is uncertainty from our sourcing suppliers. Shortages of raw materials from our suppliers lead us to miss our production schedule. In order to solve this issue of late delivery, we conducted a meeting with our customers and informed them of the situation. Then we

arranged for replacement products, which had a similar specification and performance, for a short period. However, we are planning to eliminate this barrier in order to increase our supply chain reliability." (Household products manufacturer)

Chen and Paulraj (2004) mentioned quality problems due to the uncertain operational processes of network members as an environmental uncertainty factor. Moreover, Mentzer et al. (2000) identified ineffective replenishment in response to demand fluctuations as an obstacle of collaborative relationships that limits the network members' visibility in the SCM.

Next, laws and regulations failing to support or distorting SCM were identified by the food processing manufacturer's executive. For instance, the government encourages farmers to plant some crops by supporting the market prices of agricultural products. This distorts the cost of raw materials for the food processing manufacturer and obstructs the implementation of SCM, as explained below:

> "The government policy to support a minimum price for peanuts distorts the supply of peanuts in the market. We have long-term plans for our plant capacity. Then, the government announces price support for certain crops and the farmers change their farms and start producing crops with government-guaranteed prices. This sort of regulation hinders our SCM." (Food processing manufacturer)

Altogether, the respondents talked of a variety of SCM impediments that hinder the achievement of higher performance in SCM. The author summarise seven main hurdles based on the opinions of the interviewees as follows:

1. employees' lack of understanding

2. employees’ resistance
3. organisational “silo” structure
4. quality problems from network members
5. communication problems and confidential data
6. laws and regulations do not support SCM
7. some network members do not follow the SCM concept

These obstacles are identified in the quantitative study. An SCM impediments relationship hierarchy is developed by the researcher as shown in Figure 5-9.

Theme 3: SCM facilitators

SCM facilitators are structured into two sub-themes as follows:

1. **Tangible supply chain facilitators:** factors related to systems, structure and technology, which are obviously noticeable, such as IT, workflow structure, communication structure, planning and control methods, and knowledge management;
2. **Intangible supply chain facilitators:** factors related to behaviour, and sometimes indirectly supporting the tangible facilitators so that the supply chain network achieves high levels of performance.

Each of the sub-themes is made up of a number of issues as shown in Figure 5-10.

Figure 5-9 The SCM impediments construct and its variables

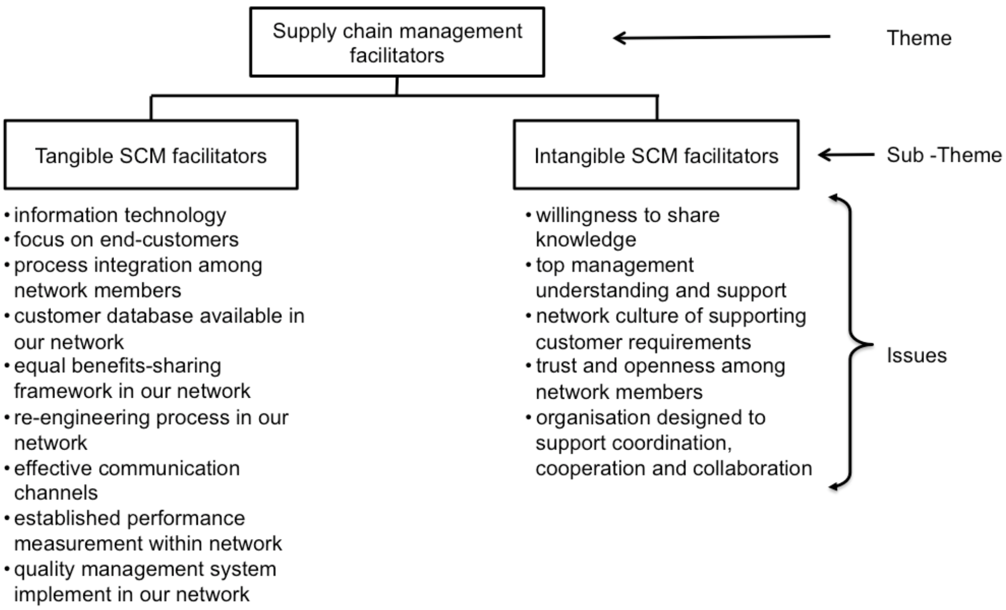


Figure 5-10 Theme 3: SCM facilitators, sub-themes and issues

Tangible supply chain facilitators

Based on the literature review, the author identified the following tangible SCM facilitators:

1. our network utilises IT as a tool to gather, transmit and share data;
2. there is relationship management with knowledge sharing among the members of our network;
3. the planning and control of our network is aimed at the end-customers;
4. our network has a process integration structure that helps us to improve trust, transparency, confidence, coordination and long-term business stability, and avoid duplicating efforts/investments;
5. our network has developed a customer relationship management process;
6. our network has equally shared the benefits of SCM among the network members;
7. our network has re-engineered processes such as logistics management to reduce inventory and achieve cost effectiveness;
8. our network has effective communication channels both among the network and cross-functional teams within our company.

The respondents identified IT as the most important tangible facilitator of SCM practices. Several prior works have acknowledged IT as a tool that can be used to gather, transmit and share data so as to establish an information flow among supply chain network members (Chin et al., 2004, Cigolini et al., 2004, Tan et al., 2006, Larson et al., 2007, Thakkar et al., 2008b, Fawcett et al., 2009). For example, the executive from a stationery products manufacturing company described its usage of IT as follows:

"We have invested in information systems to enhance the cooperation both within our firm and among our supply chain network partners. We acknowledge that the better we share data the better is our planning and our returns in cost savings. We gather daily sales data from our retail partners through their point of sale machines. These help us to achieve almost real-time production planning and better inventory management than in the past few years. You can imagine how many stock keeping units we have in our company. IT and SCM have helped us to dramatically decrease inventory and increase turnover." (Stationery products manufacturer)

Next, effective process integration helps supply chain network members to avoid duplicating efforts or investment. It also constructs long-term business stability by improving trust and transparency (Mentzer et al., 2000, Tan et al., 2006, Lambert, 2008, Thakkar et al., 2008b). Furthermore, effective information systems connectivity for sharing information is highly important to SCM, according to the hypermarket representative. He also commented that effective information systems yield better results by creating seamless process integration among supply chain network members:

"As well as IT, data integration is crucial. We share not only stock on-hand level with our suppliers, but also promotion plans and in-store activities. Our buyer usually has meetings with the suppliers' sales department in order to achieve better planning and effective SCM practices. For example, we conduct co-promotions with the product's owner to eliminate duplicate promotion campaigns and reduce consumer confusion over promotion campaigns." (Hypermarket)

In the interviews, the respondents agreed that they put effort into integration, mostly in planning and control processes focusing on the end-customers rather than their immediate customer. Therefore, the definition of a customer in the supply chain is the end-customer. Lambert (2008) argued that SCM is made up of processes that consist of activities from many functions, both intra-firm and inter-firm. Workflow structure, communication structure and knowledge management are put together to enable effective SCM processes. The supply chain director from a chemical manufacturing company informed us about their planning and control processes that focused on end-users as follows:

> "Normally, we focus on relationship management in our supply chain network. We aim at being an innovative company, then we listen to our end-customers' requirements. Our products are modified to suit local specifications and regulations. Some countries have special requirements in law for some chemicals to be avoided. So, we work with our suppliers in our supply chain to launch products as needed." (Chemical manufacturer)

The author selected the top three SCM facilitators to research in our quantitative study. These were IT, process integration among the supply chain network members and the focus on the end-customer.

Intangible supply chain facilitators

The intangible SCM facilitators extracted from the literature review were as follows:

1. top management team understands and supports SCM with both time and financial resources;

2. our network has a culture to help tackle operational-level problems such as inaccurate data transfer and delayed schedules caused by machine breakdowns, and an attitude aimed at meeting sudden customer requirements;
3. our network has common interests, openness and trust in working together;
4. our network has been designed to support coordination, cooperation and collaboration;
5. our network has performance management metrics, benchmarking and vendor rating systems;
6. our network has a quality management system and certificates to ensure product quality, acting as control tools among network members.

The semi-structured interviews revealed support from top management to be the most significant facilitator. This support could involve any required resource such as time, money or any other form of help (Mentzer et al., 2000, Chin et al., 2004, Larson et al., 2007, Thakkar et al., 2008b, Sandberg and Abrahamsson, 2010). The respondent from the paper industry commented as follows:

> "Not only does IT significantly facilitate the SCM of our company but so does top management support. They initiate SCM projects within the firm and then with our network partners. We have an allocated budget for training our employees in SCM. Also, we have established a SCM department to coordinate, collaborate and cooperate with our partners as well as within our company. Sometimes we have conflicts between two functions that have different KPIs; our top management gives us clear directions to solve the issues. I strongly agree

that top management support is the key to achieving successful SCM implementation." (Paper manufacturer)

The next intangible SCM facilitator is an organisation designed to support coordination, cooperation and collaboration. Larson et al. (2007) argued that in conventional supply chain activities, interaction between partners occurs mainly during the buying-selling process, but to achieve higher performance for the entire chain, several departments of both firms should interact regularly. The author examined this argument in our interview with the hypermarket retailer. The business development executive of the hypermarket agreed that the organisation was designed to facilitate a good working environment with its suppliers, as the following shows:

> "We have regular meetings and planning conversations between our suppliers and the staff in our buying department. Our logistics staffs also have meetings with our suppliers' transportation function. We redesigned our organisation to match our suppliers' functions. In the past, our suppliers usually had contact with more than one department in our company. Then, we implemented a single contact point – a representative who coordinates with the suppliers. This has reduced our response time when we have problems with our supply chain network. Furthermore, it has resulted in higher end-customer satisfaction." (Hypermarket retailer)

The fundamental aspects of working together are trust and openness. Mentzer et al. (2000) defined them as basic human qualities that are essential throughout an organisation, both at the management level and in functional areas. Trust and openness allow network members to understand their common interests so that they can work together effectively. The owner of the tannery gave the following opinion about the trust and openness in his firm:

> "In our industry, local suppliers who provide raw hide to us may have difficulties storing a large quantity of the raw materials as they have a short lifetime. So, we purchase these materials and convert them to a work-in-process that has a longer shelf life. We do this as an investment in raw materials and also to help our local suppliers to compete with overseas suppliers. There is trust and openness between us and the local suppliers. This has built strong bonding in our supply chain." (Tannery)

The last point of note made by the respondents concerned their willingness to share knowledge among the network members. A willingness to share and educate network members can help them to understand each other and be more successful. The supply chain is only as strong as its weakest link. The executive from an automotive manufacturing firm identified this as an important supply chain enabler for their business:

> "It is not only our practice to share our knowledge in manufacturing and SCM systems but also our philosophy. We organise manufacturing and logistics for our suppliers. We prepare training, consulting and operational procedures for them to follow. We share our principles and want to guide our suppliers. We believe that our supply chain is only as strong as our weakest members. So, we allocate resources to improve the entire chain's performance. This willingness is the major facilitator of our supply chain implementation." (Automotive manufacturer)

The researcher summarise the following seven main enablers based on the opinions of the respondents:

1. IT;
2. process integration among network members;
3. focus on end-customers;
4. top management understanding and support;
5. organisation designed to support coordination, cooperation and collaboration;
6. trust and openness among network members;
7. willingness to share knowledge.

These enablers are included in the questionnaire for quantitative study. A hierarchy of SCM facilitator relationships was developed by the researcher as shown in Figure 5-11.

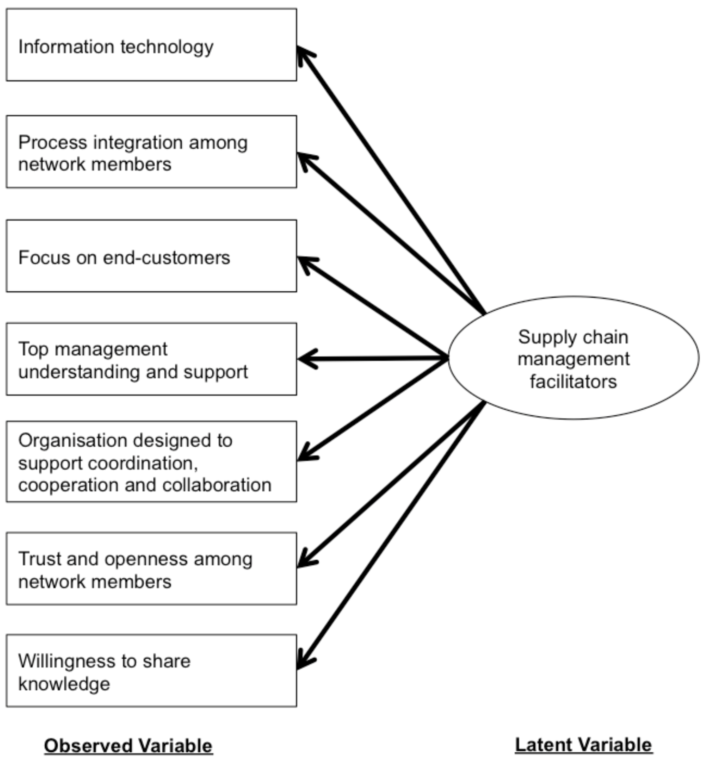


Figure 5-11 The SCM facilitators construct and its variables

Theme 4: SCM practices

SCM practices are defined as a set of activities undertaken across the supply chain network. Lambert (2008) expressed the idea that “corporate success requires a change from managing individual functions to integrating activities into SCM processes”. Despite the wealth of suggestions for SCM business processes there was no “industry standard”. Thus, he recommended standard processes that give managers from firms across the supply chain a common understanding of the supply chain. Based on this, the GSCF developed a process-based SCM framework consisting of:

1. customer relationship management;
2. supplier relationship management;
3. customer services management;
4. demand management;
5. order fulfilment;
6. manufacturing flow management;
7. product development and commercialisation;
8. returns management (Cooper et al., 1997).

These eight processes are cross-functional and to be implemented inter-organisationally across key members of the supply chain (Lambert, 2008). In our interviews, the researcher showed the respondents these eight processes and asked them to identify which were the major supply chain practices in their opinion. The researcher then selected three main processes based on the consensus of the interviewees to assess further and set them as the three sub-themes in this research. They are as follows:

1. network relationship management, including customer and supplier relationship management;
2. manufacturing flow management;
3. product development and commercialisation.

In each process, the researcher examined the supply chain flows including material flow, information flow and resource flow (Mangan et al., 2008). Material flow includes the movement of physical products and services from the suppliers, along the supply chain network to the customers, and back. Information flow embraces order transmitting and product delivery status. Resource flow consists of financial aspects such as payments, credit terms, consignment and title ownership, and non-financial aspects such as people and equipment, which enhance a supply chain's effectiveness.

Network relationship management

The literature (Tan et al., 2002, Ulusoy, 2003, Chen and Paulraj, 2004, Lee, 2004, Min and Mentzer, 2004, Li et al., 2005, Koh et al., 2007, Lambert, 2008) identified the following network relationship management practices:

1. network has agreement that on-time delivery is a source of competitiveness;
2. network members jointly manage inventory and logistics in the supply chain;
3. one of network members owns and/or manages one of the supply chain processes on behalf of the others;
4. network has agreement on information sharing among network members;

5. network uses IT to achieve effective communication;
6. network members share information about forecasting, planning, order fulfilment, scheduling and inventory;
7. network has a clear vision for SCM;
8. network has top management support for inter-organisational relationships;
9. network creates trust among the network members by fairly distributing the benefits gained from SCM;
10. network builds long-term relationships with established guidelines.

The author asked the interviewed executives to rank the above practices from 1 to 10, 10 being the most important and 1 the least, according to their own opinion. Then, the total score was summed up for each network relationship management practice across the 20 respondents. These scores are shown in Table 5-4 below.

Table 5-4 The importance rank order summary: network relationship management

Network relationship management practices	Score
Joint inventory management	173
Clear vision of SCM	171
IT coordination	161
Long-term relationships enabled	157
On-time delivery	98
Top management support for inter-org. relationships	95
Manage SCM processes for others	75
Use IT to communicate	73
Fair distribution of benefits	51
Information sharing	46

The respondent from the hypermarket identified the practice of jointly managing inventory as crucial to managing their retail business:

> "Our business implements a vendor-managed inventory (VMI) programme with the main suppliers. This programme enables our vendors to track demand for their products and they can then decide to replenish their stock with the permission of our buyer teams. We get more effective shelving and planograms and better inventory turnover." (Hypermarket retailer)

Min and Mentzer (2004) also argued that jointly managed logistics and inventory in the supply chain was a factor in the practice of cooperation in SCM.

The next most important network relationship management practice according to the interviewees was a clear vision for SCM. This enables network members to have common goals for SCM. It also encourages them to get actively involved in standardising supply chain practices and operations, and clearly define roles and responsibilities. An executive from the tannery commented as follows:

> "We had a meeting with all the suppliers to explain our operations and supply chain practices to them so they could understand what we were looking for in the future. The meeting was called 'partnering for growth'. At the meeting, we asked our suppliers to explain their operating processes, such as delivery and reverse logistics, and we informed them of our requirements. After that, we established an agreement for future services. Now, if we have any arguments over the operating processes we refer to the agreement that we set at that meeting." (Tannery)

In addition to a clear vision for SCM, information sharing creates effective communication. Li et al. (2005) studied SCM practices among the members of the Society of Manufacturing Engineers and the attendees at the Council of Logistics Management (CLM) conference in New Orleans, 2000. They found information sharing to consist of the following:

1. share business units' proprietary information with trading partners;
2. inform trading partners in advance of changing needs;
3. trading partners share proprietary information;
4. trading partners keep fully informed about issues that affect business;
5. trading partners share their business knowledge regarding core business processes;
6. trading partners exchange information that helps establish business planning;
7. trading partners keep each other informed about events or changes that may affect the others' partners.

One of the respondents, representing the automotive manufacturer, claimed:

> "Our production system procedures are developed in Japan and implemented around the world. The procedures are introduced to our suppliers and distributors. We have an IT team dedicated to supporting our network partners. We understand that we could not compete without the information flow among the network partners." (Automotive manufacturer)

Overall, long-term relationships were identified by most of the interviewees as one of the most important practices in relationship management. Bowersox et al. (1999) found that effective supply chain members have guidelines for developing, maintaining and monitoring long-term supply chain relationships with each other. The respondent from the chemical manufacturing company told us about their long-term supply chain relationships:

> "Our top management proposed the idea of long-term partnerships with our suppliers. We have a very decisive supplier selection process. Vendors are checked every year to ensure they comply with our standard operating procedures. We have a monitoring process so as to maintain the quality of materials we supply to our end-customers. For listed vendors that prove they keep to our standards, we continue to do business with them in the long term." (Chemical manufacturer)

These top four practices those discussed, which scored more than 100 points each, are selected to be researched in the quantitative approach. These are jointly managing inventory, a clear vision of SCM, IT coordination, and the enabling of long-term relationships.

Manufacturing flow management

Lambert (2008:12) explained manufacturing flow management as *"the process that includes all activities necessary to obtain, implement, and manage manufacturing flexibility in the supply chain and to move products into, through and out of the plants".* The literature identifies the following manufacturing flow management practices:

1. network applies the concepts of JIT / Lean as tools to improve competitiveness;
2. network members implement a cost reduction programme in the supply chain;

3. network has flexible manufacturing capability to meet end-consumer requirements;
4. network members have mutual trust and are willing to share information;
5. network members formally exchange manufacturing information on a regular basis, e.g. at S&OP meetings;
6. network members sharing accurate, timely, adequate and reliable information;
7. network has a clear vision for benchmarking and performance measurement objectives to create continuous improvement;
8. network has top management support for quality management, benchmarking and performance measurement;
9. network implements benchmarking and performance measurement;
10. network has a standard quality policy for both product and process with established guidelines (Tan et al., 1998, Ulusoy, 2003, Chen and Paulraj, 2004, Lee, 2004, Min and Mentzer, 2004, Li et al., 2005, Koh et al., 2007, Lambert, 2008).

The researcher asked the interviewees to rank the above practices from 1 to 10 according to their opinion, 10 again being the most important and 1 the least. Then the total score was calculated for each manufacturing flow management practice across the 20 respondents. The scores are shown in Table 5-5 below.

Table 5-5 The importance rank order summary: manufacturing flow management

Manufacturing flow management practices	Score
JIT/Lean implementation	169
Benchmarking & performance measurement	168
S&OP implementation	165
Quality policy established	161
Implementation of cost reduction programme	98
Top management support for quality policy	94
Sharing accurate information	84
Mutual trust and sharing information	66
Flexible manufacturing capability	54
Vision for benchmarking	43

The respondent from the automotive parts supplier indicated that his network applied the concept of JIT / Lean as a tool for competitiveness, and that this was the first priority out of the manufacturing flow management processes in the firm's SCM:

> "We work with a Japanese automotive manufacturer and its tier one supplier. They helped us to implement a lean manufacturing system. We learnt to manage our product flow and processes steadily so as to deliver on time and in full for the lowest cost. The JIT approach has resulted in a lower inventory than [we had in] the past. Currently we are continuing to improve our processes with help from the automotive manufacturer that is our customer." (Automotive parts manufacturer)

Lambert (2008) defined manufacturing flow management as a SCM process that allows firms to adapt to changing demands from end-customers. It relies on external connectivity to meet consumer expectations such as specific attributes, and a certain quality, cost and availability. In order to achieve these requirements, operational execution is measured through benchmarking and performance measurement (Koh et al., 2007). The supply chain executive from the paper industry offered his ideas on this topic as follows:

> "In order to manage our product flow seamlessly across the supply chain network, we execute benchmarking of our processes so as to improve our systems. Our team works closely with both suppliers and customers to ensure that the material flow faces minimal disruption. The performance measurement metrics are set and measured for us so that we can make plans for improvements. The manufacturing flow management team also interacts extensively with other SCM process teams in our company, for instance the teams dealing with supplier and customer relationship management, to ensure effective coordination." (Paper manufacturer)

To manage manufacturing flow effectively, supply chain network members formally exchange manufacturing information on a regular basis, e.g. at S&OP meetings. Chen and Paulraj (2004) identified the following means of two-way communication and interaction with suppliers:

1. sharing sensitive information (financial, production, design, research and/or competition);
2. frequently exchanging information in a timely manner;
3. keeping each other informed about events or changes that may affect the other party;
4. frequent face-to-face planning and/or communication;
5. exchanging performance feedback.

These actions reduce suppliers' product problems. One of our respondents informed us about how the company frequently exchanged manufacturing information:

> "We have frequent meetings with suppliers, not only among our purchasing and their sales departments but also including our logistics and production departments. Regular meetings help us to avoid communication breakdowns. We find that the more closely we work with suppliers, the higher performance we get from them. Our suppliers are always informed about our campaigns and marketing programmes in advance. In that way, we have a very good flow of materials through to the end-customers." (Beverage manufacturer)

Another key practice identified by the interviewees was that of the network having a standard quality policy for both product and process, with established guidelines. Tan et al. (1998) conducted research examining the relationship between SCM practices, supplier performance and company performance among members of the American Society for Quality Control (ASQC). They confirmed that selected purchasing practices and customer relationship practices are highly related to the perceived financial and market success of firms. In the survey, both product and process criteria for suppliers were widely practiced by the firms with higher performance. The supply chain manager of a household products manufacturer confirmed this as follows:

> "Most of our suppliers have the ISO9000 certificate, which ensures us of the quality of materials that they deliver to us. We have confidence in our suppliers' quality management system and we also provide technical support to minimise disruptions to the process. If we have a quality problem, it is solved through the standard procedure that we have set up. Therefore, our products flow very smoothly because we do not have to check the quality of the materials. We only conduct product and process auditing as scheduled." (Household goods manufacturer)

The four practices that the respondents scored the highest were chosen to be investigated in the quantitative approach. These were applying JIT / lean concepts to the supply chain network, implementing performance measurement and benchmarking, frequently exchanging manufacturing information, and implementing quality management for both product and process.

Product development and commercialisation

Lambert (2008:12) explained the product development and commercialisation process as *"the supply chain management process that provides the structure for developing and bringing to market products jointly with customers and suppliers".* The literature identifies the following product development and commercialisation practices:

1. network has aligned network strategy with product, sourcing, manufacturing and distribution strategies;
2. network members have material-sourcing evaluation guidelines to be used in the product development and commercialisation process;
3. network has flexible manufacturing capability to respond to changes in volume or product mix;
4. network has an efficient product introduction scheme based on the end-customer's requirements;
5. network members communicate future strategic needs to their upstream network on a timely basis;
6. network members formally share end-customer requirements and specifications with the upstream network;

7. network has clear guidelines concerning suppliers' and customers' involvement in product development and commercialization;
8. network has a customer feedback programme that provides inputs into product development;
9. network assumes supply chain efficiency when designing a concept for product, process or packaging;
10. network has consistent procedures that are cross-functional and also include inputs from appropriate network members to identify product development and commercialisation issues and constraints (Tan et al., 1998, Alvarado and Kotzab, 2001, Tan et al., 2002, Ulusoy, 2003, Lee, 2004, Lambert, 2008).

The interviewees ranked the above practices from 1 (least important) to 10 (most important), according to their own opinion. The total scores for each product development and commercialisation practice across the 20 respondents shown in Table 5-6.

The respondents reported the most important practice to be "our network has a customer feedback programme that provides inputs into product development". Tan et al. (2002), whose research was based on the senior managers of manufacturing firms from the National Association of Purchasing Agents (NAPA), also revealed that product development and commercialisation involves determining customers' future needs and contacting end-users to get feedback. The respondent from the household goods manufacturing company expressed her ideas about the use of feedback from customers as an input to product design as follows:

"Innovation is our key concept when doing business. We spend more than 15 per cent of our sales on our research and development programmes. Based on our six different business units and forty core technology platforms, we encourage our employees to create networks that offer a tremendous number of potential interactions with and solutions for our customers. We link innovation and basic research to customer needs. We carefully connect our innovation with the customer through coordination and meetings. We explore the end-customer's needs and current problems so as to deliver a better solution or improve the quality of living." (Household goods manufacturer)

Table 5-6 The importance rank order summary: product development and commercialisation

Product development and commercialisation practices	Score
Customer feedback as input to design	161
Design for supply chain concept	150
Customer requirement sharing	149
Material strategy alignment	145
Clear guidelines	105
Efficient product introduction scheme	103
Flexible manufacturing capability	81
Communicate with upstream network	75
Sourcing guidelines	72
Cross-functional procedure	59

Feedback from the customer is not only utilised as a source of product development but also in the design of manufacturing processes, products and/or packaging in order to enhance supply chain efficiency. Lee (2004) demonstrated that, in "the tripple-A supply chain", sustainable competitive advantage requires three supply chain practices:

1. agility: quick responses to short-term changes in demand or supply;
2. adaptability: an adjustable supply chain designed to accommodate market shifts;
3. alignment: distributing benefits among supply chain members to improve the whole chain's performance.

Lee mentioned that different supply chains should be used for different product lines in order to optimise the capabilities in each area. For instance, low-volume and high-customisation products are suitable for suppliers located near to the market. Standard high-volume products should be manufactured in low-cost countries. This was confirmed by the executive from the stationery products manufacturer, which obtains its products from different sources according to the customer requirements. Moreover, he revealed that his firm's products and packaging were designed to reduce logistics costs. The following excerpt from his interview explains:

> "We have several sources of supplies. China is our main source because it has the lowest cost of products. However, some of the products that need to be customised according to customer needs, we order from local suppliers. We have different supply chains for each group of customers, i.e. for the house brand product, the lowest cost is the key. For high-quality products, the customer determines the design and reliability. When we order the house brand from China, we design the packaging to fit the container's dimensions so as to reduce freight costs." (Stationery products manufacturer)

Formally sharing customer requirements and specifications with suppliers in order to create an efficient supply chain is the next SCM practice identified. Tan et al. (1998) agreed that notifying suppliers of a new product design and sharing confidential information were two of the main SCM practices. The owner of the tannery expressed his ideas about product development and commercialisation practices in SCM as follows:

> "Our customers give exact specifications about the thickness and appearance of the leather they want in their products. We control the quality of the hide, which directly impacts on the quality of the finished goods. In order to get that quality, we talk to our suppliers and help them to analyse the quality of cattle skin. Working closely with suppliers in the supply chain network allows us to meet our customers' requirements." (Tannery)

The fourth most important product development and commercialisation practice according to our respondents is "alignment of network strategy with product, sourcing, manufacturing and distribution strategy". Lambert (2008) explained that there are two elements to the product development and commercialisation process, strategic and operational. The strategic part establishes a structure for developing products and moving them to the market using a constructed template. The operational part consists of implementing the strategic part. The most important aspect of both parts is the alignment of the cross-functional product development strategies with the supply chain's network strategy. Our interviewee from the automotive manufacturer shared his idea of material strategy alignment as follows:

> "In our industry, we have planning for new product models and minor changes in advance. When we have a model change, if some of the raw materials are no longer required then our suppliers are informed. We work closely with our suppliers to ensure that the cost of our raw materials is kept as

low as possible. We regularly review our corporate, marketing, manufacturing and sourcing strategies." (Automotive manufacturer)

These top four product development and commercialisation practices identified by the respondents were taken to investigate in the quantitative approach, namely, taking customer feedback as an input to product design, using supply chain concept to design product, process and packaging, sharing customer requirements, and material strategy alignment among supply chain network members. Figure 5-12 illustrates all of the SCM practices.

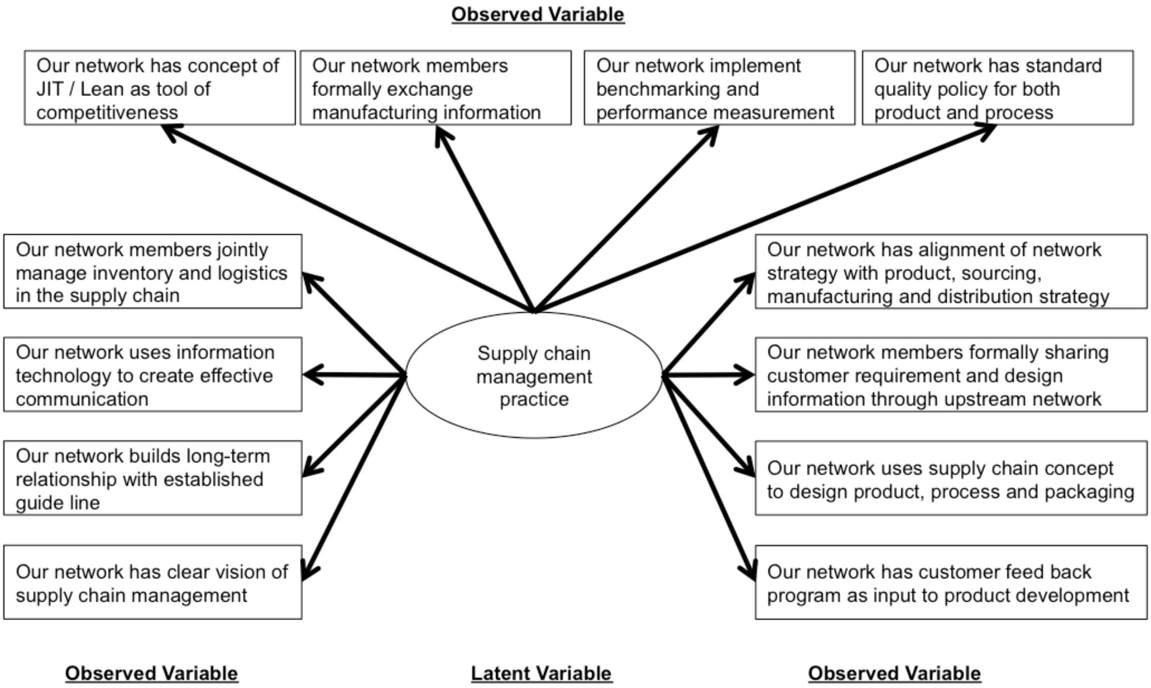


Figure 5-12 The SCM practices construct and its variables

Theme 5: Firm performance

Performance measurement is a set of metrics used to evaluate both the efficiency and effectiveness of business activities (Neely et al., 1995). Firm performance is measured by evaluating how well an organisation accomplishes its objectives (Chong and Chan, 2011). Total supply chain performance can be identified as the efficiency of performance over all of the network members of the supply chain, which is very difficult to measure and may not even exist (Banomyong and Supatn, 2011). Instead, the internal supply chain performance is measured, which takes into account the efficiency and effectiveness of firms' internal processes in producing their products and services, and involves aspects such as cost, time and reliability. Li et al. (2006) classified organisational performance into short-term and long-term objectives. In the short term, SCM objectives are productivity improvement, inventory reduction and the shortening of the cycle time. The long-term objectives are market share growth and higher profit margins. From the firm's financial perspective, growth in market share and profits reflect the firm's asset utilisation. In this study, firm performance is organised into four categories as cost, time, reliability, and asset utilisation.

The cost dimension

Cost is the financial expenses incurred when doing business (Chan and Qi, 2003a). Neely et al. (1995) conducted survey research to evaluate the use of performance measurement by UK SMEs. A main result was that the managers of SMEs are greatly interested in the unit cost. The cost dimension is thus an essential tool for measuring firm performance. Effective SCM reduces costs for a firm (Lee, 2004, Petrovic-Lazarevic et al., 2007, Fawcett et al., 2008, Chong and Chan, 2011). Cost can be measured in terms of the total supply chain (Thakkar et al., 2009b), each supply chain process (Keebler and Plank, 2009, Banomyong and Supatn, 2011) or logistics costs alone (Söderberg and Bengtsson, 2010).

In the questionings, the respondents identified total costs and logistics costs as part of firm performance measurement. One revealed:

> "In order to evaluate our performance we measure the cost of the product for every order we complete. Then we compare the cost per square foot of each type of product. When the cost per square foot is greater than our standard cost, we investigate the causes of this. In our management meetings, we also discuss the root causes of higher costs, whether direct or indirect. Another area where we look to make cost savings is the logistics costs. We hold raw materials for more than 90 days, which means one target for us could be to reduce inventory. Transportation costs are not a problem for us now." (Tannery)

In the interviews, 90% of the respondents said that both total and logistics costs were crucial to their firm's ability to compete with their rivals. Thus, the researcher proposes to investigate "the ability to achieve a lower total cost of logistics through efficient network collaboration and efficient operations" and "the competence of product from lower total unit cost" as our measurements of the cost dimension in our quantitative questionnaire survey.

Time dimension

Lead-time is described as the time that elapses from the transmitting of a customer's order to order fulfilment (Chong and Chan, 2011). Supply chain performance here is defined by how much time is needed to finish the process (Otto and Kotzab, 2003). Banomyong and Supatn (2011) proposed time measures such as order cycle time, procurement cycle time and delivery cycle time for supply chain activities. Chan and Qi (2003b) argued that the shorter the lead-time, the higher is customer satisfaction, and also concluded that, in addition to cost, time is also essential for measuring firm performance. Neely et al. (1995) argued that the time dimension of performance is a contributing factor to a firm's competitive advantage and the cornerstone of evaluating production performance.

In our interviews, the researcher asked the respondents for their opinions about the time dimension of performance measurement, specifically, whether they measured the lead-times of their products and/or implemented lead-time reduction programmes to enhance customer satisfaction. Fifty-five per cent of our interviewees confirmed that they focused on production lead-time, thirty-five per cent mentioned delivery time as a factor for determining the firm's performance, twenty-five per cent had some kind of programme to evaluate order fulfilment in their organisation, and only 10% measured the concept of on-time-and-in-full in their performance metrics. The executive from the beverage manufacturing company talked about his company's time-related performance metrics as follows:

> "As well as cost measurement as a key performance indicator of our company, we also appraise our performance in terms of our ability to deliver our products to our customers at the time they require and in exactly the amount they want. We have a 100% delivery target but it is quite hard to achieve. Sometimes there are problems with seasonal raw materials that we cannot control. Anyway, we have now improved our production lead-time performance compared to the past few years through SCM implementation." (Beverage manufacturer)

Thus, the author investigated "the ability to reduce the lead-time between order receipt and customer delivery" and "the ability to accommodate faster delivery times for the customer" as the time dimension in our quantitative survey.

Reliability dimension

The next factor in measuring the performance of the firm is reliability. This relates to the quality of products and services that a customer can depend on from the firm. It refers to an ability to respond to customer requests and handle unexpected challenges (Closs and Mollenkopf, 2004, Chin et al., 2004, Fawcett et al., 2009, Banomyong and Supatn, 2011). The probability of delivering on time and in full is sometimes referred to as the service level. Furthermore, the ability to respond to various customers' order quantities and delivery times is crucial in the current business environment. In our research, the researcher asked the respondents about four areas of reliability:

1. network delivers products to the end-customers with a high service level;
2. network implements a quality management programme to ensure product reliability;
3. customers can rely on our commitment;
4. network has the ability to respond to customer requests and can handle unexpected challenges.

The supply chain executive from the food processing manufacturer responded to our questions about the reliability dimension of performance measurement as follows:

> "We measure the reliability of our products and processes regularly. For example, we use line fill rate, item fill rate and order fill rate to measure our delivery reliability. We also implement other dimensions of reliability, such as transportation reliability to measure our transportation team's performance, and

inventory accuracy and order accuracy to measure our warehouse and order processing teams' performance." (Food processing manufacturer)

Banomyong and Supatn (2011) proposed SCM performance metrics with a reliability dimension to measure supply chain activities such as customer service and support. They measured delivery on time and in full, demand forecasting and planning to forecast accuracy. Thus, the author quotes "the ability to meet quoted or anticipated delivery dates and quantities on a consistent basis (on time and in full)" as a reliability dimension in the quantitative survey.

Asset utilisation dimension

The asset utilisation dimension includes market share, inventory turnover, return on assets, and the competitiveness of the supply chain (Closs and Mollenkopf, 2004, Petrovic-Lazarevic et al., 2007). Asset utilisation shows the ability of the supply chain to manage network resources (Chan and Qi, 2003a). In our interview with an executive from a sheet metal manufacturer, he explained his firm's performance measurement based on asset utilisation as follows:

> "Our business has a very high use of direct materials; about 90% of our costs come from raw materials. So we focus on inventory turnover. We usually benchmark our performance against the industry standard. Our return on investment figures, such as ROE and ROA, are used to guide our business. However, our market share information is not so accurate because we lack third-party data but we still estimate our market size and market share for planning purposes." (Sheet metal manufacturer)

These three aspects of asset utilisation to measure performance were included in the quantitative survey: “the ratio of the cost of goods sold to the average inventory during a given time period”, “the perception regarding the extent to which perceived company performance matches customer expectations” and “the company’s share of the total market”. Figure 5-13 shows the firm performance construct.

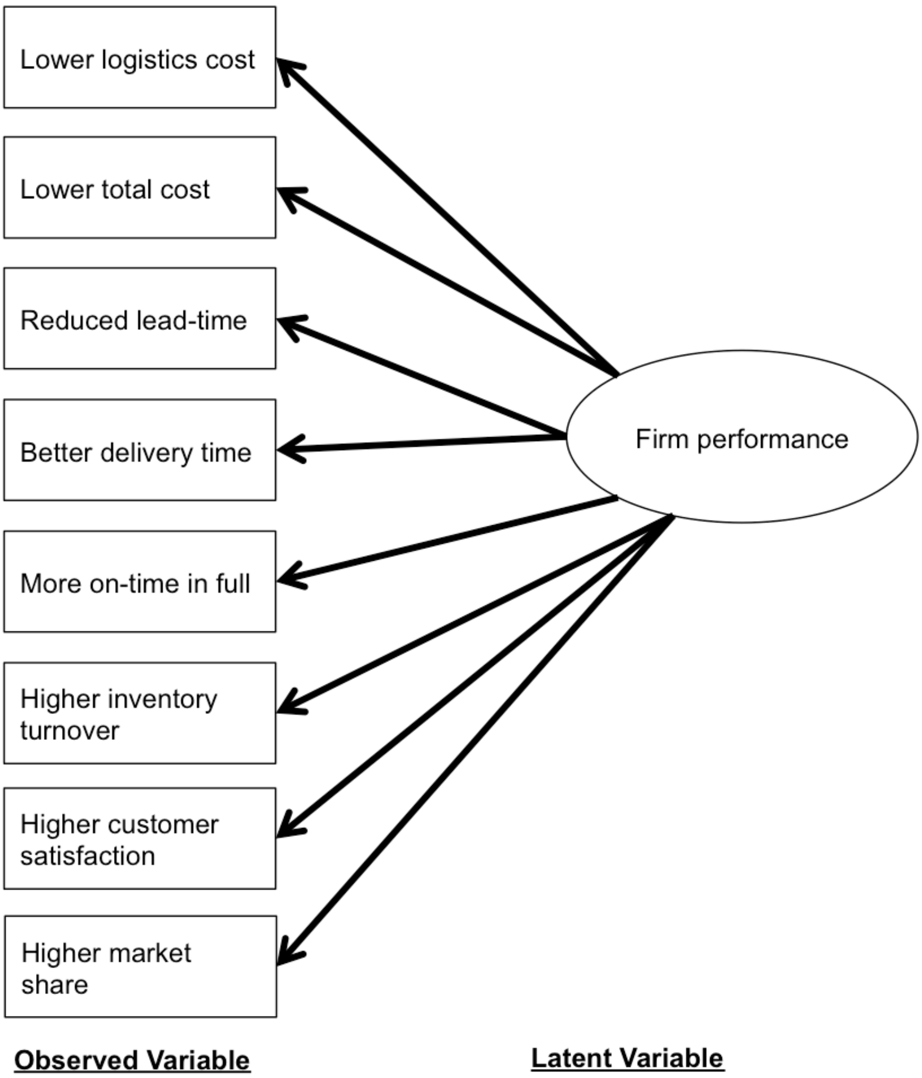


Figure 5-13 The firm performance construct and its variables

5.8 Implications and limitations of the exploratory study

In this section, the author discusses the implications and limitations of the exploratory study. The research questions that were identified prior to conducting the semi-structured interviews were as follows:

1. What determines the SCM practices of your firm?
2. What are the obstacles to SCM implementation?
3. How can SCM practices become more successful in your firm?
4. What SCM processes are you currently deploying in your firm?
5. What are your expectations from the SCM practices?

5.8.1 Implications of an exploratory study

By completing the exploratory study, the researcher gained knowledge about the antecedents and results of SCM implementation. Next, the researcher wanted to quantify and identify the relationships between these factors by deploying the quantitative research method via a questionnaire. Based on the results of the qualitative analysis, the author proposes the following concise details regarding the constructs:

SCM drivers

Based on the question "What determines the SCM practices of your firm?" 14 factors were identified from the literature as representative of SCM drivers. After the interviews, seven factors were selected based on the opinions of the interviewees.

According to the interviews, the rationales behind implementing SCM practices mainly come from internal drivers such as “cost reduction”, “efficiency” and “internal function collaboration”. Generally, cost focus is one of the two basic types of competitive advantage (Porter, 1985). A cost advantage can be achieved in several ways but internal function collaboration and efficiency are sources of it. The respondents regarded SCM as a tool to help them achieve a cost advantage.

Looking outside the four walls of the firm, “global competition” and “end-customer needs” also push firms to seek collaboration tools to help them reduce costs and remain competitive. Then, the supply chain network members can work together seamlessly. The respondents agreed that “process integration among their supply chain’s network members” and “the network members’ collaboration” would enable them to survive severe competition. Finally, the researcher summarises the key factors that lead firms to implement SCM as follows:

1. global competition of the supply chain network;
2. end-customer needs;
3. process integration among network members;
4. network members’ collaboration;
5. cost reduction;
6. improvement of process capabilities and productivities;
7. internal function collaboration.

The level of importance of these factors will be identified based on the results of the quantitative survey.

SCM facilitators

"How can SCM practices become more successful in your firm?" produced 14 facilitators of SCM from the literature review. Based on the respondents' opinions, the researcher selected seven major SCM facilitators.

In the respondents' opinion, "the advancement of IT" leads to efficient implementation of SCM. "Requirements from the end-customer" are passed through to the source of the products in a very timely way. This creates "process integration among the supply chain network members". These three facilitators are classified as tangible facilitators, while the four intangible enablers of SCM practices identified were "top management understanding and support", "organisational design", "trust and openness among network members" and "the willingness to share knowledge".

The researcher noticses from the opinions of the respondents a relationship between SCM drivers and facilitators. The SCM facilitators of a firm are dependent on its SCM drivers. Thus, the alternative model is proposed as shown in Figure 5-14.

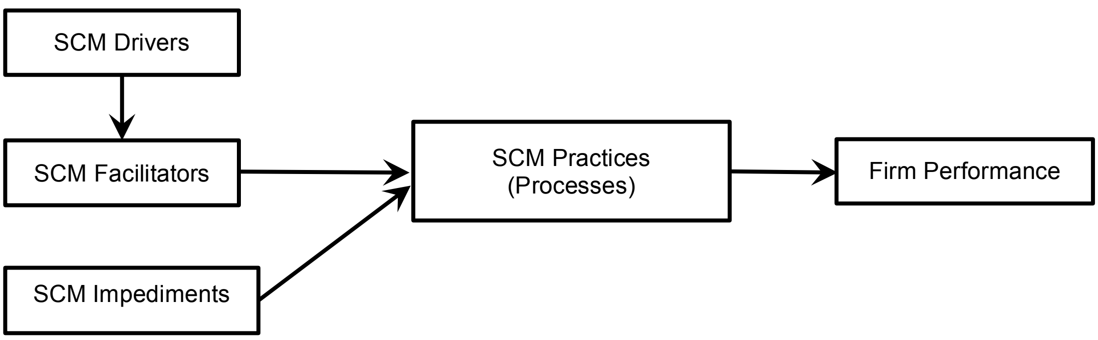


Figure 5-14 The alternative model of SCM practices

SCM impediments

The researcher identified fifteen individual factors that hinder SCM from the literature review. Then, the respondents were asked: “What are the obstacles to SCM implementation?” They mentioned seven major SCM impediments that can be classified as either internal or external.

The internal obstacles came from two main sources: “employees” and “organisation”. The external impediments are caused by “the network members”, and other factors such as “laws and regulations”. The researcher identified the main obstacles to be used in our detailed survey based on the level of difficulty faced by the firms when implementing SCM. These were:

1. employees’ lack of understanding;
2. employees’ resistance;
3. organisation’s “silo” structure;
4. quality problem from network members;
5. communication problems and confidential data;
6. laws and regulations not supportive;
7. some network members do not follow the SCM concept.

SCM practices

As in the framework of the GSCF, the researcher asked the question “What SCM processes are you currently deploying in your firm?” The researcher identified three major processes from the literature review: network relationship management, manufacturing flow management and product development and commercialisation. The respondents' opinions about the three processes led to the identification of 12 practices used by their firms, as shown in Table 5-7.

Table 5-7 The SCM practices

SCM Processes	Material Flow	Information Flow	Resource Flow
Network relationship management	• Jointly manage inventory and logistics in the supply chain	• Use IT to create effective communication	• Build long-term relationships with established guidelines • Have clear vision of SCM
Manufacturing flow management	• Use concept of JIT / Lean as a tool for competitiveness	• Formally exchange manufacturing information on a regular basis, i.e. S&OP meetings	• Implement benchmarking and performance measurement • Have standard quality policy for both products and processes, with established guidelines
Product development and commercialisation	• Alignment of network strategy with product, sourcing, manufacturing and distribution strategy	• Formally share customer requirements and design information with upstream network	• Using the concept of design in the supply chain, in product, process and packaging • Have customer feedback programme as input to product development

Then, the level of practice of each SCM process was measured using the questionnaire survey.

Firm performance

The researcher categorised firm performance measurement into four major areas, cost, time, reliability and asset utilisation, based on the literature review. Then, the interviewees were asked: "What are your expectations from the SCM practices?" It was found that the major expectation from SCM implementation was cost reduction, both of total and logistics costs. In conclusion, the main driver behind executing SCM was the desire to achieve a cost advantage. The second most expected performance improvement for the firm from SCM practices was asset utilisation, which includes inventory turnover, customer satisfaction and market share. Then, time factors such as reducing lead-times and faster delivery were identified. The least important factor was reliability, which includes on-time-and-in-full shipment to customers as needed. Later, the results of the quantitative questionnaire survey regarding these factors will be explored.

5.8.2 Limitations of the exploratory study

There are a number of limitations of this exploratory study that need to be mentioned:

Sample size and number and distribution of industrial sectors

In the exploratory study, our main objective was to verify the literature review in the context of another country. Very few studies have been conducted in Thailand, especially from the SMEs' perspective. The number of respondents in this study was set to 20 and purposive sampling was used. The researcher chose to have half of our study firms be SMEs. Ritchie and Lewis (2003) argued that a qualitative sample size is usually small in size, often under 50. However, the researcher distributed our sample to cover 11 different industrial sectors, identified by ISIC Revision 3.1 (United Nations Statistics Division, 2013). Table 5-8 shows the distribution of the sample firms for the semi-structured interviews by ISIC code.

Thus, the interviews covered 11 different industrial sectors out of a total of 60. This could give rise to a degree of industrial bias arising from the risk that the views expressed are particular to just some industrial sectors. To overcome these potential problems, it was proposed that the research would involve more organisations in the main phase of the research. As the main phase of the research was conducted through a questionnaire survey, the potential bias of the semi-structured interview results should be overcome.

Table 5-8 Distribution of sample for semi-structured interviews

No.	ISIC Code	Description	Number of firms
1	ISIC15	Manufacture of food products and beverages	4
2	ISIC18	Manufacture of wearing apparel; dressing and dyeing of fur	1
3	ISIC19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harnesses and footwear	1
4	ISIC21	Manufacture of paper and paper products	1
5	ISIC24	Manufacture of chemicals and chemical products	3
6	ISIC25	Manufacture of rubber and plastic products	2
7	ISIC28	Manufacture of fabricated metal products, except machinery and equipment	1
8	ISIC34	Manufacture of motor vehicles, trailers and semi-trailers	3
9	ISIC36	Manufacture of furniture; manufacturing n.e.c.	2
10	ISIC52	Retail trade, except for motor vehicles and motorcycles; repair of personal and household goods	1
11	ISIC60	Land transport; transport via pipelines	1
		Total	**20**

Single respondent from each organisation

The interviewees gave their opinions on behalf of their firms. Only one respondent was interviewed per organisation, which could have led to a biased view of SCM based on the respondent's position in the firm. To overcome this problem, the main research embraced more functions, both directly and indirectly related to SCM, involving sales and marketing, finance, logistics, manufacturing and IT staff.

5.9 Summary

This chapter has discussed the exploratory study using qualitative data analysis of semi-structured interviews with Thai organisations. The researcher developed five themes of SCM according to the literature review and verified them using the interview data. The findings from the interviews were used to strengthen our knowledge of SCM practices. The analysis of the qualitative data led to the development of a new, alternative, SCM practices model, to be evaluated using data gained through survey research. The next chapter will present the analysis of these quantitative data based on multivariate data analysis techniques such as factor analysis and regression.

In daily life, a dark sky is no proof that it will rain, but merely a warning;

(Charles E. Spearman, The proof and measurement of association between two things)

CHAPTER 6 CONFIRMATORY STUDY: FACTOR ANALYSIS AND REGRESSION

6.1 Introduction

This chapter is devoted to the results of the study based on the survey questionnaires. The correlations between the observed and predicted variables are of interest here (Spearman, 1987). The first section describes the questionnaires, the profile of the respondents and their industrial sectors. Then, the second section explains the perceptions of SCM practices gained from three groups in the sample, the micro-sized, small-sized and medium-sized firms. The next section presents the factor analysis of the observed measurements for each latent variable (or factor). Then, regression analysis of the factors is applied in order to measure the relationships of the constructs in the SCM practices model. Both a standard model and a model with control variables were used. Finally, the findings regarding the impact of SCM practices on firm performance are presented in the last section.

6.2 Quantitative data: descriptive analysis

In this section, a discussion of the preliminary quantitative data analysis is provided. The returned questionnaires from both the postal mailing and the web-based version were collected and analysed using IBM SPSS Statistics version 20 software.

6.2.1 Data collection and SMEs respondent profiles

The analysis of quantitative data relating to the SCM practices model for Thai SMEs required a substantial amount of information regarding the current practices and performance of the firms.

The participant firms were chosen from among the members of The FTI. Only firms that fit the definition of small and medium-sized firms in terms of the number of full-time employees were selected. According to the FTI's definition of SMEs, a micro-sized business (Mi) has less than 25 full-time employees, a small-sized business (Sm) typically employs 25 to 50 full-time staff members and a business that has 51 to 200 full-time employees is referred to as medium-sized (Me) (Sevilla and Soonthornthada, 2000). The targeted key informants included owner, supply chain manager, logistics manager, manufacturing manager, sales or marketing manager, IT manager, and finance or accounting manager. The respondents were instructed to complete the entire questionnaire (parts A and B) as described in Appendix B.

A pilot test was conducted among SMEs that participated in a food supply chain seminar organised by the Ministry of Industry. 30 volunteer respondents completed the questionnaire, which is a suitable amount for the scale of this research (Saunders et al., 2007). The results showed that the respondents had no problems in answering the questions.

For the main questionnaire survey, several techniques were used to motivate respondents to participate in this research. Saunders et al. (2007) recommended providing an incentive with a relatively high impact. Thus, a booklet about SCM in SMEs was offered to those respondents who returned the questionnaire.

Four weeks after the questionnaires were sent out, 62 completed questionnaires had been returned. Then, two waves of reminder letters were sent out, four weeks apart. In the end, the survey produced 311 valid responses, representing a response rate of 11.5%. This response rate is comparable to that in a previous study of Thai SMEs' approach to SCM (Udomleartprasert et al., 2003) and provided adequate data for further analysis.

Nonresponse bias was examined by testing for statistically significant differences between the early and late responses. The questionnaires returned after the last reminder were considered a proxy for nonrespondents, while the questionnaires returned earlier were used as a proxy for respondents (Arend and Wisner, 2005). The statistical *t* tests based on the two groups showed insignificant results for the means of the independent and dependent variables. The detail of non-response bias was shown in Appendix D. The characteristics of the respondents and their businesses are summarised in Table 6-1.

Table 6-1 Characteristics of the respondents and their businesses

Characteristic	Number of firms	Percentage
Type of industry		
Leather and shoes	8	2.6%
Agricultural processing	14	4.5%
Health care and pharmaceutical	10	3.2%
Motor and spare parts	31	10.0%
Appliances and furniture	21	6.8%
Pulp and paper	12	3.9%
Metal and machinery	16	5.1%
Rubber products	14	4.5%
Clothing and textiles	22	7.1%
Plastics and chemicals	16	5.1%
Electronics	11	3.5%
Food processing and animal nutrition	48	15.4%
Ceramics	15	4.8%
Mass merchandising and retail	15	4.8%
Services	58	18.9%
Number of year in operation		
Less than 5 years	94	30.2%
5 to 10 years	104	33.5%
More than 10 years	113	36.3%
Number of employees		
Micro (Less than 25)	95	30.5%
Small (25 to 50)	71	22.9%
Medium (51 to 200)	145	46.6%
Job function		
Owner	126	40.5%
SCM	32	10.3%
Logistics	48	15.4%
Manufacturing	32	10.3%
Sales and Marketing	59	19.0%
IT	7	2.3%
Finance and Accounting	5	1.6%
Others	2	0.6%
Educational level		
Diploma / Vocational	5	1.6%
Bachelor’s degree	188	60.5%
Master’s degree or higher	118	37.9%
Total	311	100.0%

6.3 Quantitative data analysis: perceptions of the constructs

A five-point scale (1 = unimportant, 5 = very important) was used for SCM drivers, SCM impediments and SCM facilitators.

Perceptions of SCM drivers

Table 6-2 shows the perceptions of the SCM drivers according to the three different firm sizes. The overall result was that cost reduction is a major driver behind the implementation of SCM. After that, the improvement of process capabilities and productivities were considered important. The SCM drivers composite index was calculated by averaging together the individual drivers into a new composite variable. Reliability analysis was conducted to determine whether, from a statistical point of view, these individual drivers should be averaged together. The SCM drivers composite index has an alpha of 0.801, revealing high reliability. The mean for each group and overall are presented in columns 1 to 4 respectively. Columns 5 to 8 show the exact significance values of *t* (*p*-values), and the author is interested in whether these values are less than or greater than 0.05.

The overall column represents the *p*-value of the mean difference among these three groups while each pair of *p*-values can be found in the following columns. This reveals whether or not a company's perception of SCM drivers is positively associated with firm size. It can be concluded from the statistically significant difference for the SCM drivers composite index ($p > 0.05$) that there are no significant differences between the means of these three groups. However, when considering the means of each component, the managers from the micro-sized firms are found to perceive implementing a supply chain in their organisation to be a more important SCM driver than the small and medium-sized firms' managers. The most important SCM driver to each size of firm is cost reduction. Process improvement and end-customer needs are rated second and third, respectively. The collected data show there are no statistically significant differences among these three groups in terms of their perceptions of the importance of SCM drivers.

Table 6-2 The perceptions of SCM drivers

	Mean Evaluation				Significant (*p* – value)			
	Micro	**Small**	**Medium**	**Total**	**Overall**	**Mi - Sm**	**Mi - Me**	**Sm - Me**
SCM drivers composite index (∝ = 0.801)	4.20	4.08	4.13	4.14	0.436	0.427	0.627	0.867
Global competition of our network	3.96	3.70	3.91	3.88	0.310	0.314	0.944	0.407
End-customer needs	4.34	4.27	4.24	4.28	0.683	0.857	0.661	0.974
Process integration among network members	4.07	3.94	3.94	3.98	0.443	0.447	0.621	0.253
Network members' collaboration	3.94	3.83	3.89	3.89	0.731	0.984	0.323	0.327
Cost reduction	4.53	4.39	4.38	4.43	0.358	0.551	0.353	0.991
Improvement of process capabilities and productivities	4.39	4.28	4.33	4.34	0.688	0.669	0.846	0.906
Internal function collaboration	4.18	4.17	4.20	4.19	0.965	0.997	0.981	0.967

Perceptions of SCM facilitators

The respondents were also asked to rank the importance of seven SCM facilitators on a five-point scale. Table 6-3 shows the results. Top management support, IT and focus on the end-customer were rated as the most important. Only the small-sized firms ranked focus on the end-customer higher than IT. In their opinion, IT was not as important as focusing on the end-customer's needs in terms of facilitating SCM. A positive association between a company's perception of SCM facilitators and firm size is not supported by the test for a statistically significant difference for the SCM facilitators composite index (p < 0.05).

Table 6-3 The perceptions of SCM facilitators

	Mean Evaluation				Significant (p – value)			
	Micro	**Small**	**Medium**	**Total**	**Overall**	**Mi - Sm**	**Mi - Me**	**Sm - Me**
SCM Facilitators Composite Index ($\propto$ = 0.855)	4.12	4.07	4.11	4.11	0.840	0.833	0.982	0.891
IT	4.20	4.17	4.18	4.18	0.967	0.967	0.979	0.996
Process integration among network members	4.11	3.93	3.97	4.00	0.309	0.343	0.421	0.928
Focus on end-customers	4.14	4.20	4.06	4.12	0.504	0.887	0.771	0.495
Top management understanding and support	4.23	4.25	4.34	4.29	0.568	0.984	0.582	0.753
Organisation designed to support coordination, cooperation and collaboration	4.13	4.10	4.11	4.11	0.975	0.973	0.987	0.994
Trust and openness among network members	4.03	3.92	4.08	4.03	0.376	0.642	0.885	0.342
Willingness to share knowledge	4.04	3.93	4.03	4.01	0.680	0.696	0.991	0.724

Perceptions of SCM impediments

The respondents were asked to rank the importance of SCM impediments on a five-point scale. Table 6-4 shows the perceptions regarding the seven items. “Empl’yees' lack of understanding”, “quality problems from network members” and “communication problems” were ranked as the main barriers to implementing SCM. Based on the SCM impediments composite index calculation, the research question of whether a company’s perception of SCM impediments is positively associated with firm size is rejected by the statistically significant difference (p < 0.05). Firm size is not related to the importance of SCM obstacles. Statistically significant differences are found on the importance of communication problem, with different means among the three firm sizes. The medium-sized firms seem to have more communication problems than the micro- and small-sized firms. In the ranking, there are different perceptions among the firm sizes. All agree that employees' lack of understanding is the most important obstacle. However, the respondents from micro-sized firms ranked quality problems as a more severe hurdle than communication, while the medium-sized firms' respondents classified communication problems as more important than quality problems. Finally, the managers from the small-sized firms ranked the fact that some network members do not follow the SCM concept more important than communication problems.

Table 6-4 The perceptions of SCM impediments

	Mean Evaluation				Significant (*p* – value)			
	Micro	**Small**	**Medium**	**Total**	**Overall**	**Mi - Sm**	**Mi - Me**	**Sm - Me**
SCM Impediments Composite Index (∝ = 0.815)	3.85	3.84	3.89	3.87	0.795	0.999	0.840	0.843
Employees' lack of understanding	4.21	4.07	4.12	4.14	0.523	0.525	0.668	0.919
Employees' resistance	3.61	3.75	3.72	3.69	0.645	0.678	0.713	0.979
Organisational "silo" structure	3.76	3.56	3.78	3.72	0.286	0.411	0.985	0.278
Quality problems from network members	4.04	4.06	4.06	4.05	0.985	0.994	0.983	0.999
Communication problems and confidential data	3.82	3.89	4.10	3.96	**0.045**	0.882	0.050	0.234
Laws and regulations not supportive	3.74	3.65	3.68	3.69	0.844	0.839	0.912	0.969
A network members do not follow the SCM concept	3.74	3.92	3.79	3.80	0.436	0.410	0.882	0.612

Perceptions of SCM practices

The respondents evaluated the existing level of SCM practices implemented in their company on a five-point scale (1 = not implemented at all, 5 = fully implemented). Table 6-5 shows the results. The questionnaire classified SCM practices into three major processes: network relationship management, manufacturing flow management, and product development and commercialisation. For each process, four practices were listed. Therefore, a total of twelve questions had to be answered. The major finding here is that there is a statistical difference between the three groups ($p < 0.05$). From the SCM practices composite index, the overall level of SCM implementation is statistically different between the three groups and between micro-sized firms and small-sized firms. Furthermore, two of the main processes, network relationship management and manufacturing flow management, were also statistically different between the three groups.

Among the network relationship management processes, the small and medium-sized firms ranked IT coordination as having the highest level of implementation. This was followed by joint inventory management and the enabling of long-term relationships. Meanwhile, the micro-sized firms ranked joint inventory management, IT coordination and the enabling of long-term relationships as the top three, but in that order. Overall, there is an association between firm size and the network relationship management processes implemented, according to the statistical difference among the three groups ($p < 0.05$). The micro-sized firms seem to have implemented joint inventory management, IT coordination and a clear vision of SCM to a greater extent than the small and medium-sized firms.

The level of implementation of manufacturing flow management processes among the three groups showed differences. The micro-sized companies rated the establishment of a quality policy first, then S&OP implementation and JIT/lean implementation, while the small and medium-sized firms ranked quality policy first but JIT/lean implementation and S&OP implementation the other way round. There is an association between firm size and these processes according to the statistical difference among the three groups ($p < 0.05$). The micro-sized firms are more likely to implement JIT/lean implementation, and benchmarking and performance measurement than the small and medium-sized firms.

Table 6-5 The perceptions of SCM practices

	Mean Evaluation				Significant (*p* – value)			
	Micro	**Small**	**Medium**	**Total**	**Overall**	**Mi - Sm**	**Mi - Me**	**Sm - Me**
SCM Practices Composite Index (∝ = 0.959)	3.78	3.44	3.54	3.59	**0.024**	**0.029**	0.081	0.691
Network Relationship Management Composite Index (∝ = 0.898)	3.83	3.45	3.59	3.63	**0.012**	**0.013**	0.073	0.521
• Joint inventory management	3.89	3.46	3.59	3.65	**0.010**	**0.013**	**0.043**	0.661
• IT coordination	3.88	3.63	3.66	3.72	0.126	0.209	0.157	0.987
• Enabling of long-term relationships	3.83	3.41	3.58	3.62	**0.017**	**0.015**	0.118	0.440
• Clear vision of SCM	3.71	3.31	3.52	3.53	**0.033**	**0.024**	0.326	0.272
Manufacturing Flow Management Composite Index (∝ = 0.904)	3.74	3.40	3.48	3.54	**0.039**	0.054	0.091	0.818
• JIT / Lean implementation	3.75	3.34	3.43	3.51	**0.022**	**0.033**	0.059	0.757
• S&OP implementation	3.71	3.41	3.50	3.54	0.156	0.163	0.305	0.802
• Benchmarking and performance measurement	3.69	3.23	3.39	3.44	**0.016**	**0.017**	0.080	0.561
• Quality policy established	3.80	3.65	3.61	3.68	0.341	0.584	0.322	0.969
Product Development and Commercialisation Composite Index (∝ = 0.917)	3.77	3.47	3.55	3.60	0.080	0.093	0.177	0.796
• Material strategy alignment	3.76	3.52	3.50	3.58	0.138	0.312	0.136	0.985
• Sharing information on customer requirements	3.77	3.39	3.51	3.56	0.056	0.062	0.152	0.727
• Design based on supply chain concept	3.67	3.38	3.57	3.56	0.161	0.139	0.715	0.368
• Customer feedback used as input to design	3.87	3.58	3.63	3.69	0.114	0.154	0.178	0.921

In terms of product development and commercialisation, the three firm sizes show similar implementation patterns. Using customer feedback as an input to design is rated as highly implemented. The micro-sized firms had implemented information sharing on customer requirements and material strategy alignment more than the other processes. The small-sized firms ranked material strategy alignment above information sharing on customer requirements, while the medium-sized companies put design based on SCM concepts before information sharing about customer requirements.

Perceptions of firm performance

The respondents evaluated their firm's performance compared to that of their competitors in the past year on a five-point scale (1 = definitely worse than competitors, 5 = definitely better than competitors). The results, covering the four areas of cost, time, reliability and asset utilisation, are illustrated in Table 6-6.

Table 6-6 The perceptions of firm performance

	Mean Evaluation				Significant (p – value)			
	Micro	**Small**	**Medium**	**Total**	**Overall**	**Mi - Sm**	**Mi - Me**	**Sm - Me**
Firm Performance Composite Index ($\propto$ = 0.912)	3.68	3.49	3.53	3.56	0.135	0.187	0.196	0.943
Lower logistics costs	3.52	3.32	3.41	3.42	0.371	0.344	0.652	0.759
Lower total costs	3.44	3.44	3.43	3.43	0.992	0.999	0.991	0.997
Reduced lead-times	3.62	3.54	3.50	3.54	0.526	0.789	0.496	0.945
Shorter delivery times	3.79	3.59	3.62	3.67	0.196	0.264	0.255	0.966
More on time and in full	3.84	3.62	3.60	3.68	0.060	0.185	0.061	0.984
Higher inventory turnover	3.64	3.49	3.48	3.53	0.288	0.486	0.283	0.989
Higher customer satisfaction	3.87	3.54	3.62	3.68	**0.017**	**0.024**	0.052	0.751
Higher market share	3.68	3.42	3.55	3.56	0.151	0.129	0.474	0.554

Overall, there is no association between a firm's size and its performance according to the statistical difference among the three groups (p < 0.05). The respondents ranked their firms highest for customer satisfaction, more on time and in full, and shorter delivery times. For the micro-sized companies, higher customer satisfaction was ranked first, followed by more on time and in full and shorter delivery times. In the small-sized firms, more on time and in full was ranked first, and then shorter delivery times and higher customer satisfaction.

The medium-sized firms ranked shorter delivery times first, followed by higher customer satisfaction and then more on time and in full. Finally, differences were found in terms of the firms' ratings of their success in providing higher customer satisfaction among the three firm sizes. The micro- and small-sized firms were statistically significantly different ($p < 0.05$).

This preliminary quantitative analysis has presented a comparative study of SCM practices in Thai micro-sized, small-sized and medium-sized firms. Through a questionnaire survey and ANOVA analysis, it has been found that Thai micro-sized, small-sized and medium-sized firms have mostly similar characteristics in terms of implementing SCM in their firms. The main driver of SCM implementation is cost reduction and the major supporting factor is top management support, while the strongest obstacle is employees' lack of understanding. The most common area of SCM practices is IT coordination, and the main performance gain from SCM implementation is higher customer satisfaction and more on time and in full delivery.

6.4 Factor analysis

This section examines the factor analysis of each component of the SCM practices model. The correlations among the measures of each component are identified and then combined into a composite score for each factor.

6.4.1 SCM drivers

In the questionnaire, seven SCM drivers were listed and the respondents were asked to indicate the importance of each one. These drivers are global competition to our network, end-customer needs, process integration among network members, network members' collaboration, cost reduction, improvement of process capabilities and productivities, and internal function collaboration. The means of the drivers range from 3.88 to 4.43 as shown in Table 6-7

Table 6-7 The overall importance of the SCM drivers

		Unimportant		*Of little importance*		*Moderately important*		*Important*		*Very important*	
SCM drivers	Mean	N	%	N	%	N	%	N	%	N	%
Global competition of our network	3.88	18	5.8	16	5.1	57	18.3	115	37	105	33.8
End-customer needs	4.28	3	1	7	2.3	37	11.9	118	37.9	146	46.9
Process integration among network members	3.98	2	0.6	12	3.9	59	19	154	49.5	84	27
Network members' collaboration	3.89	2	0.6	14	4.5	77	24.8	141	45.3	77	24.8
Cost reduction	4.43	1	0.3	8	2.6	33	10.6	84	27	185	59.5
Improvement of process capabilities	4.34	3	1	4	1.3	35	11.3	112	36	157	50.5
Internal function collaboration	4.19	1	0.3	8	2.6	61	19.6	103	33.1	138	44.4

Note: Mean score on a five-point Likert scale with 1 denoting unimportant, 2 of little importance, 3 moderately important, 4 important, and 5 very important.

To examine whether or not these seven SCM drivers are related and whether they belong to the same dimension, correlation analysis and factor analysis were conducted. The results of the Pearson's correlation coefficients between all pairs of SCM drivers are presented in Table 6-8. It shows these SCM drivers to be significantly correlated. Next, factor analysis was used to evaluate the factor loadings. The results are shown in Tables 6-9 to 6-12.

Table 6-8 The correlation coefficients matrix for the SCM drivers

SCM drivers	Global competition	End-customer needs	Process integration	Network collaboration	Cost reduction	Process improvement
End-customer needs	0.403***					
Process integration	0.344***	0.418***				
Network collaboration	0.364***	0.399***	0.700***			
Cost reduction	0.278***	0.309***	0.327***	0.313***		
Process improvement	0.191***	0.329***	0.356***	0.305***	0.553***	
Internal collaboration	0.223***	0.329***	0.393***	0.443***	0.387***	0.554***

Note: *** Correlation is significant at the 0.001 level (two-tailed)

Table 6-9 Results of KMO and Bartlett's tests for SCM drivers

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.783
Bartlett's Test of Sphericity	Approx. Chi-Square	691.227
	df	21
	Sig.	0.000

Table 6-9 shows the KMO measure of sampling adequacy (KMO). Field (2009) explained that the KMO represents the ratio of the squared correlation between variables to the squared partial correlation between variables. The KMO statistic ranges from 0 to 1. A value of 0 implies that the sum of partial correlations is large relative to the sum of correlations, indicating diffusion in the pattern of correlations; therefore, factor analysis is not appropriate. A value close to 1 indicates that the patterns of the correlations are relatively compact and so factor analysis should provide distinct and reliable factors (Field, 2009). In our study, the KMO measure of sampling adequacy is 0.783, which is good (Hutcheson and Sofroniou, 1999). Barlett's test of sphericity gives a result of χ^2 (21) = 691.227, p < 0.001, which indicates that the correlations between the items are sufficiently large for principal components analysis.

Table 6-10 Communalities for the SCM drivers

	Initial	Extraction
Global competition	1.000	0.500
End-customer needs	1.000	0.493
Process integration	1.000	0.672
Network collaboration	1.000	0.686
Cost reduction	1.000	0.613
Process improvement	1.000	0.789
Internal collaboration	1.000	0.604

Note: Extraction method: principal components analysis

In factor analysis, the author is interested in finding common underlying dimensions within the data. According to Field (2009), the total variance for a variable consists of two components: common variance that it shares with other variables and unique variance that is specific to the variable. The proportion of common variance is known as the communality. Therefore, a variable that shares none of its variance with any other variables would have a communality of 0, while a measure that has no specific or random variance would have a communality of 1.

To reduce the dimensions of the variables, one can transform observed data into part of linear components using the technique of principal components analysis. For this technique, the initial common variance for each variable is assumed to be 1. Then, after grouping the variables into factors, the common variance will be calculated for each variable. Communality of 1 would mean that each variable is dedicated to each factor. Table 6-10 illustrates the communality of each variable after the application of the principal components analysis extraction method. The communality also measures the proportion of variance explained by the extracted factors.

Table 6-11 Total variance explained for the SCM drivers

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	3.283	46.90	46.90	3.283	46.90	46.90	2.287	32.67	32.67
2	1.073	15.32	62.22	1.073	15.32	62.22	2.068	29.55	62.22
3	0.812	11.60	73.82						
4	0.607	8.67	82.49						
5	0.558	7.98	90.47						
6	0.386	5.52	95.99						
7	0.281	4.01	100.00						

Note: Extraction method: principal components analysis

Table 6-11 shows the total variance explained for each of the SCM drivers. The principal components analysis extraction method gives the eigenvalues for each component. Generally, Kaiser (1960) recommended retaining all factors that have eigenvalues greater than 1. Thus, in our study, the author proposes two extraction factors that can explain a total variance of 62.22%. The results of the factor analysis are presented in Table 6-12.

Four variables – global competition, end-customer needs, process integration and network collaboration – are loaded onto the first factor. Thus, the first factor can be called external SCM drivers. The second factor includes cost reduction, process improvement and internal collaboration, which relates to internal company activities so it can be labeled internal SCM drivers. The alpha coefficients from the summated scales for both internal and external SCM drivers are displayed in Table 6-13.

Table 6-12 The results of the factor analysis for the SCM drivers

SCM driver	Factor 1	Factor 2	Communality
Global competition	**0.705**	0.051	0.500
End-customer needs	**0.652**	0.260	0.493
Process integration	**0.772**	0.276	0.672
Network collaboration	**0.789**	0.252	0.686
Cost reduction	0.196	**0.758**	0.613
Process improvement	0.135	**0.878**	0.789
Internal collaboration	0.300	**0.717**	0.604

Note: Extraction method: principal components analysis
Rotation method: varimax with Kaiser normalisation

Table 6-13 Summary of the factor analysis of the SCM drivers

SCM drivers	Composite score	Mean score	Standard deviation	Alpha coefficient
External SCMD	0.730	4.007	0.912	0.742
Internal SCMD	0.784	4.317	0.823	0.747

In order to examine whether the external and internal SCM drivers have any effect on SCM practice, a regression analysis was performed and will be explained in Section 6.5.

6.4.2 SCM facilitators

From the qualitative study, seven SCM facilitators were identified, namely IT, process integration among network members, focus on end-customers, top management understanding and support, an organisation designed to support coordination, cooperation and collaboration, trust and openness among network members, and willingness to share knowledge. Then, the respondents rated the importance of each one. The mean scores range from 4.00 to 4.29 as shown in Table 6-14.

Table 6-14 The overall importance of the SCM facilitators

		Unimportant		*Of little importance*		*Moderately important*		*Important*		*Very important*	
SCM facilitators	Mean	N	%	N	%	N	%	N	%	N	%
IT	4.18	3	1	6	1.9	40	12.9	144	46.3	118	37.9
Network integration	4.00	3	1	6	1.9	63	20.3	154	49.5	85	27.3
End-customer focus	4.12	3	1	6	1.9	53	17	139	44.7	110	35.4
Top management support	4.29	3	1	3	1	43	13.8	115	37	147	47.3
Organisation designed to support coordination etc	4.11	1	0.3	6	1.9	59	19	136	43.7	109	35
Trust and openness	4.03	1	0.3	9	2.9	68	21.9	135	43.4	98	31.5
Willing to share knowledge	4.01	3	1	10	3.2	71	22.8	124	39.9	103	33.1

Note: Mean score on a five-point Likert scale with 1 denoting unimportant, 2 of little importance, 3 moderately important, 4 important, and 5 very important.

The aim is to examine whether or not these facilitators are related and whether they belong to the same dimension. Thus, correlation analysis and factor analysis were conducted on the seven SCM facilitators. The results of Pearson's correlation coefficients between all pairs of SCM facilitators are presented in Table 6-15. The SCM facilitators are significantly correlated. Factor analysis was used to evaluate the factor loadings. The results are presented in Tables 6-16 to 6-19.

Table 6-15 The correlation coefficients matrix for the SCM facilitators

SCM facilitators	**Network integration**	**End-customer focus**	**Top management support**	**Organisation designed to support**	**Trust and openness**	**Willing to share knowledge**
IT	0.512***					
Network integration	0.345***	0.455***				
End-customer focus	0.386***	0.401***	0.376***			
Top management support	0.438***	0.565***	0.388***	0.499***		
Organisation designed to support	0.349***	0.464***	0.395***	0.495***	0.584***	
Trust and openness	0.404***	0.443***	0.403***	0.421***	0.604***	0.679***

Note: *** Correlation is significant at the 0.001 level (two-tailed)

Table 6-16 The results of KMO and Bartlett's tests for the SCM facilitators

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.864
Bartlett's Test of Sphericity	Approx. Chi-Square	833.336
	df	21
	Sig.	0.000

Table 6-16 shows the KMO measure of sampling adequacy to be equal to 0.864, which is great (Hutcheson and Sofroniou, 1999). Barlett's test of sphericity, with results of χ^2 (21) = 833.336, $p < 0.001$, indicates that the correlations between items are sufficiently large for principal components analysis to be applied.

Table 6-17 gives the communality of each variable after extraction by the principal components analysis extraction method. As shown in Table 6-18, the SCM facilitators can be grouped into a single component according to the eigenvalues. Thus, in this study, the researcher proposes one extraction factor that explains a total variance of 53.81%.

Table 6-17 Communalities for the SCM facilitators

	Initial	Extraction
IT	1.000	0.431
Network integration	1.000	0.561
End-customer focus	1.000	0.408
Top management support	1.000	0.480
Organisation designed to support	1.000	0.654
Trust and openness	1.000	0.618
Willing to share knowledge	1.000	0.614

Note: Extraction method: principal components analysis

Table 6-18 Total variance explained for SCM facilitators

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	3.767	53.811	53.811	3.767	53.811	53.811
2	0.792	11.309	65.120			
3	0.667	9.524	74.644			
4	0.612	8.739	83.383			
5	0.495	7.065	90.447			
6	0.377	5.381	95.829			
7	0.292	4.171	100			

Note: Extraction method: principal components analysis

The results of the factor analysis are shown in Table 6-19.

Table 6-19 The results of the factor analysis for the SCM facilitators

SCM facilitator	Factor 1	Communality
IT	**0.657**	0.431
Network integration	**0.749**	0.561
End-customer focus	**0.639**	0.408
Top management support	**0.693**	0.480
Organisation designed to support	**0.809**	0.654
Trust and openness	**0.786**	0.618
Willing to share knowledge	**0.784**	0.614

Note: Extraction method: principal components analysis
Rotation method: varimax with Kaiser normalisation

The composite score, mean score, standard deviation and alpha coefficient from the summated scale for the SCM facilitators are displayed in Table 6-20.

Table 6-20 The factor analysis summary for the SCM facilitators

SCM facilitators	Composite score	Mean score	Standard deviation	Alpha coefficient
SCMF	0.731	4.106	0.820	0.855

In Section 6.5, the impact of SCM facilitators on SCM practices will be evaluated based on regression analysis.

6.4.3 SCM impediments

Seven SCM impediments were identified, namely, employees' lack of understanding, employees' resistance, organisational "silo" structure, quality problems from network members, communication problems and confidential data, laws and regulations not supportive, and network members not implementing the SCM concept. The respondents evaluated the importance of each SCM impediment. The mean scores range from 3.69 to 4.14 as shown in Table 6-21.

Table 6-21 The overall importance of the SCM impediments

		Unimportant		*Of little importance*		*Moderately important*		*Important*		*Very important*	
SCM impediments	Mean	N	%	N	%	N	%	N	%	N	%
Employees' lack of knowledge	4.14	2	0.6	6	1.9	57	18.3	129	41.5	117	37.6
Employees' resistance	3.69	5	1.6	35	11.3	92	29.6	98	31.5	81	26
Organisational "silo"	3.72	6	1.9	23	7.4	97	31.2	110	35.4	75	24.1
Quality problems	4.05	2	0.6	11	3.5	63	20.3	127	40.8	108	34.7
Communication problems	3.96	3	1	12	3.9	75	24.1	124	39.9	97	31.2
Laws and regulations	3.69	7	2.3	27	8.7	95	30.5	108	34.7	74	23.8
Lack of SCM concept	3.80	3	1	19	6.1	85	27.3	133	42.8	71	22.8

Note: Mean score on a five-point Likert scale with 1 denoting unimportant, 2 of little importance, 3 moderately important, 4 important and 5 very important.

To evaluate whether these SCM impediments can be combined into a common factor, correlation analysis and factor analysis were deployed. The Pearson's correlation coefficients between all pairs of SCM impediments are presented in Table 6-22. The SCM impediments are significantly correlated. Factor analysis was used to evaluate the factor loadings. The results are shown in Tables 6-23 to 6-26.

Table 6-22 The correlation coefficients matrix for SCM impediments

SCM impediments	Employees' lack of knowledge	Employees' resistance	Org."silo"	Quality problems	Communi-cation problems	Laws and regulations
Employees' resistance	0.506***					
Organisation "silo"	0.272***	0.342***				
Quality problems	0.316***	0.283***	0.359***			
Communication problems	0.336***	0.322***	0.390***	0.467***		
Laws and regulations	0.333***	0.383***	0.428***	0.388***	0.465***	
Lack of SCM concept	0.400***	0.411***	0.390***	0.369***	0.469***	0.510***

Note: *** Correlation is significant at the 0.001 level (two-tailed)

Table 6-23 Results of KMO and Bartlett's tests for SCM impediments

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.859
Bartlett's Test of Sphericity	Approx. Chi-Square	589.048
	df	21
	Sig.	0.000

As shown in Table 6-23, the KMO measure of sampling adequacy is equal to 0.859 which is great (Hutcheson and Sofroniou, 1999). Barlett's test of sphericity gives the result χ^2 (21) = 589.048, p < .001, which implies that the correlations between the items are sufficiently large for principal components analysis to be applied.

Table 6-24 Communalities of SCM impediments

	Initial	Extraction
Employees' lack of knowledge	1.000	0.417
Employees' resistance	1.000	0.445
Organisational "silos"	1.000	0.427
Quality problems	1.000	0.427
Communication problems	1.000	0.520
Laws and regulations	1.000	0.543
Lack of SCM concept	1.000	0.557

Note: Extraction method: principal components analysis

Table 6-24 reveals the communality of each variable after extraction by the principal components analysis extraction method. According to Table 6-25, the SCM impediments can be clustered into one component based on the eigenvalues. So, in this study, the researcher proposes one extraction factor that explains a total variance of 47.64%.

Table 6-25 Total variance explained for SCM impediments

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	3.335	47.638	47.638	3.335	47.638	47.638
2	0.895	12.792	60.430			
3	0.688	9.826	70.257			
4	0.627	8.960	79.217			
5	0.507	7.239	86.456			
6	0.483	6.906	93.362			
7	0.465	6.638	100			

Note: Extraction method: principal components analysis

The results of the factor analysis are given in Table 6-26.

Table 6-26 Results of factor analysis for SCM impediments

SCM impediment	Factor 1	Communality
Employees' lack of knowledge	**0.645**	0.417
Employees' resistance	**0.667**	0.445
Organisational "silos"	**0.653**	0.427
Quality problems	**0.653**	0.427
Communication problems	**0.721**	0.520
Laws and regulations	**0.737**	0.543
Lack of SCM concept	**0.746**	0.557

Note: Extraction method: principal components analysis
Rotation method: varimax with Kaiser normalisation

The composite score, mean score, standard deviation and alpha coefficient from the summated scales for SCM impediments are exhibited in Table 6-27.

Table 6-27 Factor analysis summary for SCM impediments

SCM impediments	Composite score	Mean score	Standard deviation	Alpha coefficient
SCMI	0.689	3.866	0.928	0.815

In Section 6.5, the effects of the SCM impediments on SCM practices will be evaluated based on regression analysis.

6.4.4 SCM practices

Twelve SCM practices were proposed covering three major areas of SCM: jointly managing inventory and logistics in the supply chain, using IT to create effective communication, building long-term relationships with established guidelines, having a clear vision of SCM, using the concepts of JIT / Lean as a tool for competitiveness, formally exchanging manufacturing information on a regular basis, implementing benchmarking and performance measurement, having a standard quality policy with guidelines for both product and process, the alignment of network strategy with product, sourcing, manufacturing and distribution strategy, formally sharing customer requirements and design information through the network, using the supply chain concept to design product, process and packaging, and using a customer feedback programme to provide inputs for product development. The respondents indicated the level of implementation of each practice in their organisation. The mean scores range from 3.33 to 3.72 as shown in Table 6-28.

To explore whether or not these practices belong to the same dimension, correlation analysis and factor analysis were conducted. The Pearson's correlation coefficients between all pairs of SCM practices are shown in Table 6-29. These SCM practices are significantly correlated. The factor analysis results are presented in Tables 6-30 to 6-33.

Table 6-28 The overall level of implementation of SCM practices in the organisations

		Not implemented at all		*Barely implemented*		*Partially implemented*		*Implemented*		*Fully implemented*	
SCM practices	Mean	N	%	N	%	N	%	N	%	N	%
Joint inventory management	3.65	9	2.9	24	7.7	95	30.5	121	38.9	62	19.9
IT coordination	3.72	9	2.9	19	6.1	83	26.7	139	44.7	61	19.6
Long-term relationships	3.62	10	3.2	19	6.1	112	36.0	109	35	61	19.6
Clear vision of SCM	3.53	10	3.2	29	9.3	105	33.8	120	38.6	47	15.1
JIT / Lean implemented	3.51	13	4.2	35	11.3	101	32.5	105	33.8	57	18.3
S&OP implemented	3.54	14	4.5	30	9.6	97	31.2	113	36.3	57	18.3
Benchmarking & performance measurement	3.44	19	6.1	34	10.9	104	33.4	98	31.5	56	18.0
Quality policy	3.68	9	2.9	22	7.1	95	30.5	119	38.3	66	21.2
Material strategy alignment	3.58	14	4.5	26	8.4	97	31.2	113	36.3	61	19.6
Sharing of customer requirements	3.56	12	3.9	35	11.3	94	30.2	106	34.1	64	20.6
Using the supply chain concept to design product, process and packaging	3.56	9	2.9	28	9.0	111	35.7	106	34.1	57	18.3
Customer feedback as input to design	3.69	11	3.5	24	7.7	86	27.7	118	37.9	72	23.2

Note: Mean score on a five-point Likert scale with 1 denoting not implemented at all, 2 barely implemented, 3 partially implemented, 4 implemented and 5 fully implemented.

Table 6-30 The results of the KMO and Bartlett's tests for SCM practices

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.961
Bartlett's Test of Sphericity	Approx. Chi-Square	3300.148
	df	66
	Sig.	0.000

Table 6-30 shows that the KMO measure of sampling adequacy is equal to 0.961, which is superb (Hutcheson and Sofroniou, 1999). Barlett's test of sphericity gives χ^2 (66) = 3300.148, $p < 0.001$, which indicates that the correlations between the items are sufficiently large for principal components analysis to be used.

Table 6-31 Communalities for SCM practices

	Initial	Extraction
Joint inventory management	1.000	0.658
IT coordination	1.000	0.581
Long-term relationships	1.000	0.742
Clear vision of SCM	1.000	0.702
JIT / Lean implemented	1.000	0.710
S&OP implemented	1.000	0.693
Benchmarking & performance measurement	1.000	0.700
Quality policy	1.000	0.719
Material strategy alignment	1.000	0.761
Customer requirements shared	1.000	0.708
Using supply chain concept to design	1.000	0.671
Customer feedback as input to design	1.000	0.650

Note: Extraction method: principal components analysis

Table 6-31 gives the communality of each variable after extraction by the principal components analysis extraction method. As Table 6-32 shows, the SCM practices can be grouped into a single component according to the eigenvalues. Thus, in this study a unique extraction factor that explains a total variance of 69.135% is recommended.

The composite score, mean score, standard deviation and alpha coefficient from the summated scale for SCM practices are displayed in Table 6-34.

To examine how the SCM practices impact on a firm's performance, an evaluation based on regression analysis will be presented in Section 6.5.

Table 6-32 Total variance explained for SCM practices

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
1	8.296	69.135	69.135	8.296	69.135	69.135
2	0.713	5.945	75.080			
3	0.536	4.471	79.551			
4	0.390	3.248	82.799			
5	0.333	2.771	85.570			
6	0.319	2.658	88.228			
7	0.306	2.547	90.776			
8	0.272	2.270	93.045			
9	0.250	2.082	95.127			
10	0.206	1.713	96.840			
11	0.200	1.670	98.510			
12	0.179	1.490	100.00			

Note: Extraction method: principal components analysis

The results of the factor analysis are given in Table 6-33.

Table 6-33 The results of the factor analysis for SCM practices

SCM practice	Factor 1	Communality
Joint inventory management	**0.811**	0.658
IT coordination	**0.762**	0.581
Long-term relationships	**0.861**	0.742
Clear vision of SCM	**0.838**	0.702
JIT / Lean implemented	**0.843**	0.710
S&OP Implemented	**0.833**	0.693
Benchmarking & performance measurement	**0.837**	0.700
Quality policy	**0.848**	0.719
Material strategy alignment	**0.873**	0.761
Customer requirements shared	**0.841**	0.708
Using supply chain concept to design	**0.819**	0.671
Customer feedback as input to design	**0.806**	0.650

Note: Extraction method: principal components analysis
Rotation method: varimax with Kaiser normalisation.

Table 6-34 The factor analysis summary for SCM practices

SCM practice	Composite score	Mean score	Standard deviation	Alpha coefficient
SCMP	0.831	3.591	1.011	0.959

6.4.5 Firm performance

Eight measures of a firm's performance were identified and the respondents were asked to evaluate how their firm performed in the previous year compared with their competitors. The firm performance indicators were logistics costs, total costs, lead-time, delivery time, on-time-in-full reliability, inventory turnover, customer satisfaction and market share. The means range from 3.42 to 3.68 as shown in Table 6-35.

Table 6-35 The overall firm performance

		Definitely worse than competitors		*Worse than competitors*		*Comparable with competitors*		*Better than competitors*		*Definitel better tha competitc*	
Firm performance	Mean	N	%	N	%	N	%	N	%	N	%
Lower logistics costs	3.42	0	0.0	42	13.5	134	43.1	96	30.9	39	12.
Lower total costs	3.43	2	0.6	39	12.5	126	40.5	110	35.4	34	10.
Shorter lead-time	3.54	2	0.6	26	8.4	121	38.9	125	40.2	37	11.
Shorter delivery time	3.67	0	0.0	15	4.8	126	40.5	118	37.9	52	16.
More on time and in full	3.68	0	0.0	16	5.1	120	38.6	123	39.5	52	16.
Higher inventory turnover	3.53	1	0.3	26	8.4	130	41.8	115	37.0	39	12.
Higher customer satisfaction	3.68	1	0.3	16	5.1	118	37.9	123	39.5	53	17.
Higher market share	3.56	2	0.6	22	7.1	135	43.4	103	33.1	49	15.

Note: Mean score based on a five-point Likert scale with 1 denoting definitely worse than competitors, 2 worse than competitors, 3 comparable with competitors, 4 better than competitors and 5 definitely better than competitors.

To examine whether or not these measures are related and whether they can be classified into the same dimension, correlation analysis and factor analysis were conducted.

Table 6-36 shows the Pearson's correlation coefficients between all pairs of firm performance measures. They are significantly correlated.

Table 6-36 The correlation coefficients matrix for firm performance

Firm performance	**Lower logistics costs**	**Lower total costs**	**Shorter lead-time**	**Shorter delivery time**	**More on time and in full**	**Higher inventory turnover**	**Higher customer satisfacti**
Lower total costs	0.714***						
Shorter lead-time	0.514***	0.493***					
Shorter delivery time	0.492***	0.418***	0.667***				
More on time and in full	0.524***	0.464***	0.651***	0.764***			
Higher inventory turnover	0.497***	0.417***	0.515***	0.529***	0.556***		
Higher customer satisfaction	0.536***	0.455***	0.643***	0.634***	0.639***	0.555***	
Higher market share	0.631***	0.572***	0.570***	0.622***	0.569***	0.578***	0.662***

Note: *** Correlation is significant at the 0.001 level (two-tailed)

The results of the factor analysis are shown in Tables 6-37 to 6-40.

Table 6-37 The results of the KMO and Bartlett's tests for firm performance

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.900
Bartlett's Test of Sphericity	Approx. Chi-Square	1525.325
	df	28
	Sig.	0.000

Table 6-37 shows the KMO measure of sampling adequacy to be equal to 0.900, which is great (Hutcheson and Sofroniou, 1999). Barlett's test of sphericity results in χ^2 (28) = 1525.325, p < 0.001, which indicates that the correlations between items are sufficiently large for principal components analysis to be used.

Table 6-38 Communalities for firm performance

	Initial	Extraction
Lower logistics costs	1.000	0.597
Lower total costs	1.000	0.502
Shorter lead-time	1.000	0.647
Shorter delivery time	1.000	0.671
More on time and in full	1.000	0.679
Higher inventory turnover	1.000	0.536
Higher customer satisfaction	1.000	0.667
Higher market share	1.000	0.683

Note: Extraction method: principal components analysis

Table 6-38 delineates the communality of each variable after extraction by the principal components analysis extraction method. The communality also measures the proportion of variance explained by the extracted factors. As shown in Table 6-39, the firm performance measures can be grouped into a single component according to the eigenvalues. This single extraction factor explains a total variance of 62.287%.

Table 6-39 Total variance explained for firm performance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	**% of Var.**	**Cum. %**	**Total**	**% of Var.**	**Cum. %**
1	4.983	62.287	62.287	4.983	62.287	62.287
2	0.864	10.796	73.083			
3	0.546	6.827	79.910			
4	0.429	5.365	85.275			
5	0.383	4.786	90.061			
6	0.315	3.942	94.003			
7	0.270	3.377	97.380			
8	0.210	2.620	100			

Note: Extraction method: principal components analysis

The results of the factor analysis are given in Table 6-40. The composite score, mean score, standard deviation and alpha coefficient for the summated scale for firm performance are displayed in Table 6-41.

Table 6-40 The results of the factor analysis for firm performance

Firm performance measure	Factor 1	Communality
Lower logistics costs	**0.773**	0.597
Lower total costs	**0.709**	0.502
Shorter lead-time	**0.804**	0.647
Shorter delivery time	**0.819**	0.671
More on time and in full	**0.824**	0.679
Higher inventory turnover	**0.732**	0.536
Higher customer satisfaction	**0.817**	0.667
Higher market share	**0.827**	0.683

Note: Extraction method: principal components analysis
Rotation method: varimax with Kaiser normalisation

Table 6-41 Firm performance factor analysis summary

Firm performance	Composite score	Mean score	Standard deviation	Alpha coefficient
FP	0.788	3.565	0.840	0.912

In the next section, the results of the regression analysis will be used to examine how SCM practices impact on firm performance.

6.5 Regression analysis

To examine how the antecedents of SCM impact on the SCM practices, regression analysis is conducted based on the standardisation scores of each antecedent and the composite score for SCM practice. The results are presented in this section.

6.5.1 The impact of SCM antecedents on SCM practices

In this section, the dependence of the SCM practices on the SCM antecedents is studied according to the SCM practices model. The antecedents of SCM are SCM drivers, SCM facilitators and SCM impediments. From the factor analysis just described, SCM drivers were categorised into two factors: external and internal. Thus, there are four antecedents acting as carriers (independent variables). SCM practices act as the response or dependent variable.

To predict the level of SCM practices in a firm, multiple regression is used to fit a model to the data, whereby the sum of the squared differences between the line of fit and the actual data points is minimised (Field, 2009). The results of the multiple regressions are presented in Tables 6-42 to 6-45.

Table 6-42 The correlation coefficients matrix for the SCM practices model

Pearson's correlations	SCM practices	External SCM drivers	Internal SCM drivers	SCM facilitators
External SCM drivers	0.418***			
Internal SCM drivers	0.212***	0.000		
SCM facilitators	0.450***	0.488***	0.538***	
SCM impediments	0.434***	0.319***	0.414***	0.600***

Note: *** Correlation is significant at the 0.001 level (one-tailed)

Table 6-42 shows the Pearson's correlation coefficients between every pair of variables. It can be seen that the internal and external SCM drivers are not correlated at all. This is because they were extracted and separated from the SCM driver scores into two different factors. Furthermore, SCM practices have a positive correlation with all the predictors. The one-tailed significance of each correlation was tested and is shown in the table. Multicollinearity is not found to be a problem because no predictors correlate too highly with each other. Tabachnick and Fidell (2007) advised that correlations between predictors higher than 0.7 should be avoided.

Table 6-43 SCM practices model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.542	0.293	0.284	0.84608053	0.293	31.763	4	306	0.000

Note : Predictors: (Constant), SCM Impediment Factor Regression, External SCM Driver Factor Regression, Internal SCM Driver Factor Regression, SCM Facilitator Factor Regression

Dependent Variable: SCM Practice Factor Regression

Table 6-43 gives a summary of the results of the multiple regression model. *R* = 0.542 shows the value of the multiple correlation coefficient between the predictors and the outcome. The R^2 is a measure of how much variability in the outcome is accounted for by the predictors. The value of .293 means that all of the SCM antecedents together account for 29.3% of the variation in SCM practice. The adjusted R^2 is used to explain how well this model applies to the population instead of the sample. In this case, if the model were used with the population rather than the sample it would account for approximately 0.9% less variance in the outcome. The significance of R^2 can be tested statistically using an F-ratio.

Table 6-44 gives the results of the ANOVA that tests whether the model is significantly better at predicting the outcome than using the mean. The *F*-ratio explains the ability to improve the prediction of the model.

Table 6-44 shows the regression sum of squares, which is calculated as the difference between the mean value of the dependent variable and the regression line. The residual sum of squares, meanwhile, is based on the difference between each observed data point and the value predicted by the regression line. The regression mean square and residual mean square are computed by dividing the regression sum of squares and the residual sum of squares by their degrees of freedom. The ratio of the regression mean square to the residual mean square is the *F*-ratio. SPSS also produces the Sig., which explains the significance of the fit of the data overall. A Sig. value less than 0.05 would show that the model had a significant fit with the data.

Table 6-44 SCM practices ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	90.949	4	22.737	31.763	0.000
	Residual	219.051	306	0.716		
	Total	310.000	310			

Note: Dependent Variable: SCM Practice Factor Regression

Predictors: (Constant), SCM Impediment Factor Regression, External SCM Driver Factor Regression, Internal SCM Driver Factor Regression, SCM Facilitator Factor Regression

Table 6-45 presents valuable information about the importance of each predictor to the dependent variable. The standardised coefficients (beta) indicate that the external SCM drivers are more important than the internal SCM drivers. The external SCM drivers and SCM impediments have a comparable degree of importance in the model. The t-statistics imply that the internal SCM drivers have no significance in the model.

This shows that an increase in the external SCM drivers by one score of importance would increase the score for the implementation of SCM practices in an organisation by 0.262. An increase of one score of perception in SCM impediments would increase the implementation score by 0.245. Finally, an increase of one in the SCM facilitators would increase the implementation score by 0.153. When firms realise the importance of external SCM drivers, SCM facilitators and SCM impediments, they will implement SCM in their organisation.

Table 6-45 SCM practices coefficients

Coefficients

Model		Unstandardised Coefficients B	Unstandardised Coefficients Std. Error	Standardised Coefficients Beta	t	Sig.
1	(Constant)	-0.003	0.050		-0.068	0.946
	External SCM Driver Factor Regression	0.275	0.061	0.262	4.476	0.000
	Internal SCM Driver Factor Regression	0.038	0.062	0.039	0.624	0.533
	SCM Facilitator Factor Regression	0.149	0.074	0.153	2.017	0.045
	SCM Impediment Factor Regression	0.258	0.064	0.245	4.019	0.000

Note: Dependent Variable: SCM Practice Factor Regression

6.5.2 The impact of SCM practices on a firm's performance

To examine how SCM practices impact on a firm's performance, a simple regression model was conducted based on the factor score for SCM practices and the factor score for firm performance. The results are presented in Table 6-46.

Table 6-46 The impact of SCM practices on firm performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	0.558	0.311	0.309	0.83115937	0.311	139.738	1	309	0.000

Note : Predictors: (Constant), SCM Practice Factor Regression

Dependent Variable: FP Factor Regression

Table 6-46 gives a summary of the multiple regression model. R = 0.558 shows the value of the multiple correlation coefficient between the predictors and the outcome. The R^2 of 0.311 means that all the SCM practices together account for 31.1% of the variation in a firm's performance. The adjusted R^2 shows that, if the model were used with the population rather than the sample, it would account for approximately 0.2% less variance in the outcome.

Table 6-47 shows the results of the ANOVA that tests whether the model is significantly better at predicting the outcome than the mean would be.

Table 6-47 Firm performance ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96.535	1	96.535	139.738	.000[b]
	Residual	213.465	309	0.691		
	Total	310.000	310			

Note: Dependent Variable: FP Factor Regression

Predictors: (Constant), SCM Practice Factor Regression

Table 6-48 Firm performance coefficient

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.000	0.047		0.000	1.000
	SCM Practice Factor Regression	0.558	0.047	0.558	11.821	0.000

Note: Dependent Variable: FP Factor Regression

Table 6-48 explains the valuable information about the importance of the predictor to the dependent variable. From the *t*-statistics, the SCM practices are significant to the model. It can be concluded that an increase by one in the score for implementation of SCM practices will increase the score for a firm's performance advantage compared to its competitors by 0.558. This leads to the conclusion that SCM practices improve firm performance.

6.6 Impact of number of years of operation and firm size on SCM practices and firm performance: the control variables study

In order to study the impacts of the number of years for which a company has been operating and firm size on the level of SCM practices and firm performance, dummy variables were created and included in the model. These dummy variables act as predictors in the regression model. They are independent variables, which are not part of the research study however their influence cannot be ignored (Field, 2009). This part of the study was conducted in two parts. First, the two control variables were added to the regression model of SCM practices from Section 6.5.1. Then, the variables were added to the firm performance regression model from Section 6.5.2. The control variables are defined as in Table 6-49 below.

Table 6-49 Variables for the number of years of operation and firm size

	Control variables			
Firm has	**No_Y_OP1**	**No_Y_OP2**	**F_S_1**	**F_S_2**
Less than 25 employees and has been operating less than 5 years	0	0	0	0
Less than 25 employees and has been operating 5 - 10 years	1	0	0	0
Less than 25 employees and has been operating more than 10 years	1	1	0	0
25 - 50 employees and has been operating less than 5 years	0	0	1	0
25 - 50 employees and has been operating 5 - 10 years	1	0	1	0
25 - 50 employees and has been operating more than 10 years	1	1	1	0
51 - 200 employees and has been operating less than 5 years	0	0	1	1
51 - 200 employees and has been operating 5 - 10 years	1	0	1	1
51 - 200 employees and has been	1	1	1	1

operating more than 10 years

6.6.1 Impact of number of years of operation and firm size on SCM practices

In Section 6.5.1, the independent variables were internal SCM drivers, external SCM drivers, SCM facilitators and SCM impediments. The dummy variables were then included in order to predict the level of SCM practices of the firm. The results are presented in Tables 6-50 to 6-53.

Table 6-50 SCM practices model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	df1	df2	Sig. F Change
1	0.547[a]	0.299	0.290	0.708	0.299	32.643	4	306	0.000
2	0.587[b]	0.344	0.331	0.687	0.044	10.474	2	304	0.000
3	0.592[c]	0.351	0.333	0.686	0.006	1.466	2	302	0.232

Note : Dependent Variable: Composite SCMP

a. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF

b. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF, Dummy1 No of Years Operating, Dummy2 No of Years Operating

c. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF, Dummy1 No of Years Operating, Dummy2 No of Years Operating, Dummy1 No of Employees, Dummy2 No of Employees

Table 6-50 summarises the multiple regression model. The *R* for model 1 = 0.547 showing the value of the multiple correlation coefficient between the predictors and the outcome. The R^2 value of 0.299 means that all SCM antecedents jointly account for 29.9% of the variation in SCM practices. In model 2, the dummy variables 1 and 2 for the number of years for which the company has been operating are included in the model. The *R* for model 2 = 0.587. The R^2 value of 0.344 means that all the SCM antecedents combined with the number of years the company has been operating for jointly account for 34.4% of the variation in SCM practices. The significance of R^2 can be statistically tested using an F-ratio. In model 2 *F* changes by 10.474 which is statistically significant. Including the number of years the company has been operating helps the model to better explain the level of SCM practices. Lastly, model 3 includes firm size in the SCM practices regression model. The *R* for model 3 = 0.592. The R^2 value of 0.351 means that all SCM antecedents, the number of years the company has been operating for, and firm size together account for 35.1% of the variation in SCM practices. In model 3, *F* is changed by only 1.466 which is not statistically significant. The inclusion of firm size does not help to explain the level of SCM practices.

Table 6-51 shows the results of the ANOVA testing whether the models are significantly better predicting the outcome than using the mean. For model 1, the *F*-ratio is 32.643, which is very unlikely to have happened by chance ($p < .001$). For the second model the value of the *F*-ratio is 26.600, which is also highly significant ($p < .001$). In the third model, the value of the *F*-ratio is 20.378, which is also highly significant ($p < .001$). This means that the initial model significantly improved the ability to predict the outcome variable, but that the second and the third model (including the number of years the company has been operating and firm size) also have the ability to predict the outcome variable and are statistically significant.

The model parameters for the three steps in the hierarchy of models are shown in Table 6-52. The first step in the hierarchy is to include only SCM antecedents (as in Section 6.5.1) and so the parameters for the first model are identical to the parameters shown in Table 6-45. In the second step the dummy variables for the number of years for which the company has been operating are included in the model. Now, the parameters change: if the company has been operating for 5 to 10 years, the SCM practices score decreases by 0.292, while if the company has been operating for more than 10 years, the SCM practices score decreases by 0.443, compared to a company that has been operating for less than 5 years. Finally, the firm size dummy variables are added into the third model. The parameters show that firm size does not have a significant impact on the SCM practices score. Table 6-53 shows the results of all three SCM practices regression models.

Table 6-51 SCM practices ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1[a]	Regression	65.441	4	16.36	32.643	0.000[b]
	Residual	153.366	306	0.501		
	Total	218.808	310			
2[b]	Regression	75.328	6	18.530	26.600	0.000[c]
	Residual	143.480	304	0.715		
	Total	218.808	310			
3[c]	Regression	76.708	8	9.589	20.378	0.000[d]
	Residual	142.100	302	0.471		
	Total	218.808	310			

Note: Dependent Variable: Composite SCMP

a. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF

b. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF, Dummy1 No of Years Operating, Dummy2 No of Years Operating

c. Predictors: (Constant), Composite SCMI, Composite External SCMD, Composite Internal SCMD, Composite SCMF, Dummy1 No of Years Operating, Dummy2 No of Years Operating, Dummy1 No of Employees, Dummy2 No of Employees

Table 6-52 SCM practices coefficients

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.248	0.316		0.785	0.433
	External SCM Drivers Composite	0.355	0.075	0.289	4.727	0.000
	Internal SCM Drivers Composite	-0.062	0.081	-0.050	-0.767	0.443
	SCM Facilitators Composite	0.225	0.105	0.161	2.155	0.032
	SCM Impediments Composite	0.327	0.079	0.249	4.131	0.000
2	(Constant)	0.639	0.319		2.001	0.046
	External SCM Drivers Composite	0.319	0.073	0.260	4.345	0.000
	Internal SCM Drivers Composite	-0.036	0.079	-0.029	-0.463	0.644
	SCM Facilitators Composite	0.245	0.102	0.175	2.408	0.017
	SCM Impediments Composite	0.281	0.078	0.213	3.617	0.000
	Dummy1 No of Years Operating	-0.292	0.098	-0.164	-2.969	0.003
	Dummy2 No of Years Operating	-0.443	0.098	-0.254	-4.534	0.000
3	(Constant)	0.710	0.322		2.208	0.028
	External SCM Drivers Composite	0.313	0.073	0.255	4.256	0.000
	Internal SCM Drivers Composite	-0.041	0.079	-0.033	-0.523	0.601
	SCM Facilitators Composite	0.245	0.101	0.175	2.420	0.016
	SCM Impediments Composite	0.288	0.078	0.219	3.697	0.000
	Dummy1 No of Years Operating	-0.258	0.105	-0.145	-2.467	0.014
	Dummy2 No of Years Operating	-0.411	0.105	-0.235	-3.917	0.000
	Dummy1 No of Employees	-0.190	0.111	-0.095	-1.707	0.089
	Dummy2 No of Employees	-0.081	0.099	-0.048	-0.818	0.414

Note: Dependent Variable: SCM Practice Factor Composite

Table 6-53 Regression model of SCM practices

Model	Regression prediction for SCM practices model
1	$SCMP = b_0+b_1EXSCMD+ b_2INSCMD+b_3SCMF+ b_4SCMI$
	$= 0.248+0.355EXSCMD-0.062INSCMD+0.225SCMF+0.327SCMI$
2	$SCMP = b_0+b_1EXSCMD+ b_2INSCMD+b_3SCMF+ b_4SCMI+ b_5DNY1+ b_6DNY2$
	$= 0.639+0.319EXSCMD-0.036INSCMD+0.245SCMF+0.281SCMI-0.292DNY1-0.443DNY2$
3	$SCMP = b_0+b_1EXSCMD+ b_2INSCMD+b_3SCMF+ b_4SCMI+ b_5DNY1+ b_6DNY2+ b_7DFS1+ b_8DFS2$
	$= 0.710+0.313EXSCMD-0.041INSCMD+0.245SCMF+0.288SCMI-0.258DNY1-0.411DNY2$ $-0.190DFS1-0.081DFS2$

Note:

SCMP	SCM Practices Regression
EXSCMD	External SCM Drivers Composite
EXSCMD	Internal SCM Drivers Composite
SCMF	SCM Facilitators Composite
SCMI	SCM Impediments Composite
DNY1	Dummy1 No of Years Operating
DNY2	Dummy2 No of Years Operating
DFS1	Dummy1 No of Employees
DFS2	Dummy2 No of Employees

6.6.2 Impact of number of years of operation and firm size on firm performance

Section 6.5.2 showed the impact of SCM practices on firm performance based on the regression model. In this section, the number of years for which the company has been operating and firm size are included in that regression model. Therefore, the dummy variables defined earlier are included in the model to predict the level of a firm’s performance compared to its competitors. The results of the multiple regressions are presented in Tables 6-54 to 6-57.

Table 6-54 Firm performance model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.559[a]	0.313	0.310	0.549	0.313	140.465	1	309	0.000
2	0.562[b]	0.315	0.309	0.550	0.003	0.641	2	307	0.527
3	0.563[c]	0.317	0.305	0.551	0.001	0.273	2	305	0.761

Note: Dependent Variable: Composite FP

a. Predictors: (Constant), Composite SCMP

b. Predictors: (Constant), Composite SCMP, Dummy1 No of Years Operating, Dummy2 No of Years Operating

c. Predictors: (Constant), Composite SCMP, Dummy1 No of Years Operating, Dummy2 No of Years Operating, Dummy1 No of Employees, Dummy2 No of Employees

Table 6-54 summarised the firm performance regression model results. The *R* for model 1 = 0.559. The R^2 value of 0.313 means that the SCM practices account for 31.3% of the variation in firm performance. In model 2, the dummy variables for the number of years for which the company has been operating are included. The *R* is 0.562. The R^2 value of 0.315 means that all of the SCM practices combined with the number of years a company has been operating account for 31.5% of the variation in firm performance. The significance of R^2 can be tested statistically using an *F*-ratio. In model 2 *F* is changed by 0.641 which is statistically insignificant. The inclusion of the number of years the company has been operating does not help the model to explain the level of firm performance. Lastly, model 3 includes firm size. The *R* is 0.563. The R^2 value of 0.317 means that all the SCM practices combined with the number of years for which the company has been operating and firm size account for 31.7% of the variation in firm performance. In model 3, *F* changes by 0.273 which is not statistically significant. The inclusion of firm size does not contribute to explaining the level of firm performance either.

Table 6-55 shows the results of the ANOVA. For model 1, the *F*-ratio is 140.465, which is very unlikely to have happened by chance ($p < .001$). For the second model the value of the *F*-ratio is 47.141, which is also highly significant ($p < .001$). For the third model the value of the *F*-ratio is 28.260, which is also highly significant ($p < .001$). This means that the initial model significantly improved the ability to predict the outcome variable, but that the second and third models (including the number of years of operation and firm size) are less able to predict the outcome variable and are statistically significant.

Table 6-55 Firm performance ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1[a]	Regression	42.403	1	42.403	140.465	.000[a]
	Residual	92.279	309	0.302		
	Total	135.682	310			
2[b]	Regression	42.791	3	14.264	47.141	.000[b]
	Residual	92.891	307	0.303		
	Total	135.682	310			
3[c]	Regression	42.957	5	8.591	28.260	.000[c]
	Residual	92.725	305	0.304		
	Total	135.682	310			

Note: Dependent Variable: Composite FP

a. Predictors: (Constant), Composite SCMP

b. Predictors: (Constant), Composite SCMP, Dummy1 No of Years Operating, Dummy2 No of Years Operating

c. Predictors: (Constant Composite SCMP, Dummy1 No of Years Operating, Dummy2 No of Years Operating, Dummy1 No of Employees, Dummy2 No of Employees

The model parameters for the three steps in the model hierarchy are shown in Table 6-56. The first step in the hierarchy is to include only SCM practices (as in Section 6.5.2) and so the parameters for the first model are identical to the parameters shown in Table 6-48. In the second step, when the dummy variables for the number of years the company has been operating are included in the model, the parameters change depending on the number of years of operation: if the company has been operating for 5 to 10 years, the firm performance score decreases by 0.039 and if the company has been operating for more than 10 years, the firm performance score increases by 0.046 in comparison with a company that has been operating for less than 5 years. The parameters show that the number of years of operation does not have a significant impact on the firm performance score, however. Finally the firm size dummy variables are added into the third model. The parameters show that firm size does not have a significant impact on the firm performance score. Table 6-56 shows the results of all three firm performance regression models.

Table 6-56 Firm performance coefficients

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.984	0.137		14.483	0.000
	Composite SCMP	0.440	0.037	0.559	11.852	0.000
2	(Constant)	1.962	0.163		12.068	0.000
	Composite SCMP	0.445	0.039	0.565	3.617	0.000
	Dummy1 No of Years Operating	-0.039	0.080	-0.028	-0.488	0.626
	Dummy2 No of Years Operating	0.046	0.080	0.034	0.577	0.565
3	(Constant)	1.986	0.169		11.772	0.000
	Composite SCMP	0.445	0.039	0.565	11.381	0.000
	Dummy1 No of Years Operating	-0.019	0.084	-0.013	-0.223	0.824
	Dummy2 No of Years Operating	0.068	0.085	0.049	0.729	0.429
	Dummy1 No of Employees	-0.039	0.089	-0.024	-0.432	0.666
	Dummy2 No of Employees	-0.058	0.079	-0.044	-0.738	0.461

Note: Dependent Variable: Firm Performance Composite

Table 6-57 shows the three firm performance regression models.

Table 6-57 Regression models of firm performance

Model	Regression prediction: firm performance model
1	$FP = b_0 + b_1 SCMP$
	$= 1.984 + 0.440 SCMP$
2	$FP = b_0 + b_1 SCMP + b_2 DNY1 + b_3 DNY2$
	$= 1.962 + 0.445 SCMP - 0.039 DNY1 + 0.046 DNY2$
3	$FP = b_0 + b_1 SCMP + b_2 DNY1 + b_3 DNY2 + b_4 DFS1 + b_5 DFS2$
	$= 1.986 + 0.445 SCMP - 0.019 DNY1 + 0.068 DNY2 - 0.039 DFS1 - 0.058 DFS2$

Note:

FP	Firm Performance Score
SCMP	SCM Practices Score Composite
DNY1	Dummy1 No of Years Operating
DNY2	Dummy2 No of Years Operating
DFS1	Dummy1 No of Employees
DFS2	Dummy2 No of Employees

6.7 The effects of SCM drivers on SCM facilitators and SCM practices: mediation model

To confirm the effects of SCM drivers on SCM facilitators and SCM practices, the mediating relationship is explored according to Baron and Kenny's *casual steps strategy* (Preacher and Hayes, 2008). A mediating relationship happens when some variable influences the relationship between two other variables (Howell, 2002). According to our interviews, a higher perception of SCM drivers leads firms to increase their SCM facilitators so as to gain a higher level of SCM practices. It was also explained in the interviews that SCM facilitators mediate the relationship between SCM drivers and SCM practices. The path diagram of the relationship, depicting a causal chain, is shown in Figure 6-1. This model shows two causal paths feeding into the outcome variable (SCMP): the direct impact of the independent variable (Path *c*) and the impact of the mediator (Path *b*). There is also a path from the independent variable to the mediator (Path *a*)

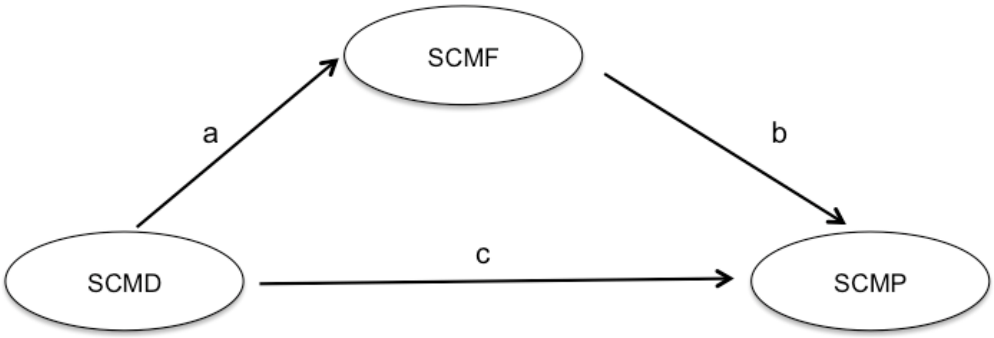


Figure 6-1 Mediator relationship path diagram

SCMF functions as a mediator when it satisfies the following criteria (Baron and Kenny, 1986):

(a) variations in the level of SCMD significantly accounts for variations in SCMF;

(b) variations in SCMF significantly account for variations in SCMP;

(c) when Paths a and *b* are controlled, a previously significant relation between SCMD and SCMP is no longer significant, with the strongest demonstration of mediation occurring when Path *c* is zero. Furthermore, when Path c is reduced to zero, it can be concluded that a model has a single, dominant mediator. However, the most likely occurrence is that Path c is not zero but instead becomes weaker but still significant.

To satisfy these initial conditions of Baron and Kenny, Table 6-58 shows the simple correlations among SCMD, SCMF and SCMP. The results demonstrate that SCMD is correlated with SCMF and with SCMP, and SCMF is also correlated with SCMP. These relationships satisfy Baron and Kenny's basic prerequisites. The next step is to use both SCMD and SCMF as predictors of SCMP. This is shown in Table 6-59.

Table 6-58 Correlations among variables

Correlations

	SCMD	SCMF	SCMP
SCMD	1	0.715**	0.462**
SCMF	0.715**	1	0.450**
SCMP	0.462**	0.450**	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).

Table 6-59 SCMP coefficients

Coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	0.873	0.3		2.906	0.004
	SCMD	0.657	0.072	0.462	9.146	0.000
2	(Constant)	0.494	0.315		1.569	0.118
	SCMD	0.406	0.101	0.286	4.026	0.000
	SCMF	0.345	0.099	0.246	3.472	0.001

Note: Dependent Variable: SCMP

In this situation the direct path from SCMD to SCMP remains significant, and the mediating path from the independent variable to the mediator to the dependent variable has to be tested for significance. The regression coefficients and their standard errors for the paths in the mediating chain are shown in Table 6-60.

Table 6-60 Regression coefficients and standard errors for the two parts of the mediating path

Path a		Path b	
SCMD $\longrightarrow$	SCMF	SCMF $\longrightarrow$	SCMP
$\boldsymbol{\beta_a}$	0.7262	β_b	0.3449
$\boldsymbol{S_a}$	0.0404	$\boldsymbol{S_b}$	0.0993
t	17.9761**	t	3.4721**

Note: ** Significant at the 0.01 level (2-tailed).

The regression coefficient for the path SCMD → SCMF → SCMP is equal to β_aX β_b, where a and *b* refer to the relevant paths. (Path *c* is the direct path from SCMD to SCMP.) The standard error of this two-part path (Howell, 2002) is given by

$$S_{\beta_a\beta_b} = \sqrt{\beta_a^2 S_b^2 + \beta_b^2 S_a^2 - S_a^2 S_b^2}$$

where β_a and β_b are the paths, and S_a and S_b are the corresponding standard errors of the standardised regression coefficients for those paths. The standard error of the combined path is calculated as:

$$S_{\beta_a\beta_b} = \sqrt{\beta_a^2 S_b^2 + \beta_b^2 S_a^2 - S_a^2 S_b^2}$$

$$= \sqrt{0.7262^2(0.0993^2) + 0.3449^2(0.0404^2) - (0.0404^2)(0.0993^2)}$$

$$= \sqrt{0.0054}$$

$$= 0.0733$$

The path *c* coefficient is calculated by multiplying the beta values of path *a* and path *b* (0.7262 X 0.3449 = 0.2505). Dividing by its standard error (0.0733) gives the *t* ratio:

$$t = \frac{\beta_a \beta_b}{S_{\beta_a \beta_b}} = \frac{0.2505}{0.0733} = 3.42$$

According to Sobel (1982), this *t* value is asymptotically normally distributed for large samples, and would lead to the rejection of the null hypothesis at $\alpha = 0.05$ when the value exceeds ±1.96. In this study the path is clearly significant as confirmed by our interview findings. Therefore, it can be concluded that there is convincing evidence of a strong mediating pathway from SCMD through SCMF to SCMP. Appendix D shows the details of the mediating relationships obtained from PROCESS procedure for SPSS (Hayes, 2013).

6.8 The effects of firm size on the relationship between the SCM drivers and SCM practices: moderation model

To study the situations in which the relationship between the SCM drivers and SCM practices changes as a function of firm size, a moderating relationships study is conducted. Baron and Kenny (1986) recommended the moderation model of three causal paths feeding into the outcome variable, which this study applies as in Figure 6-2.

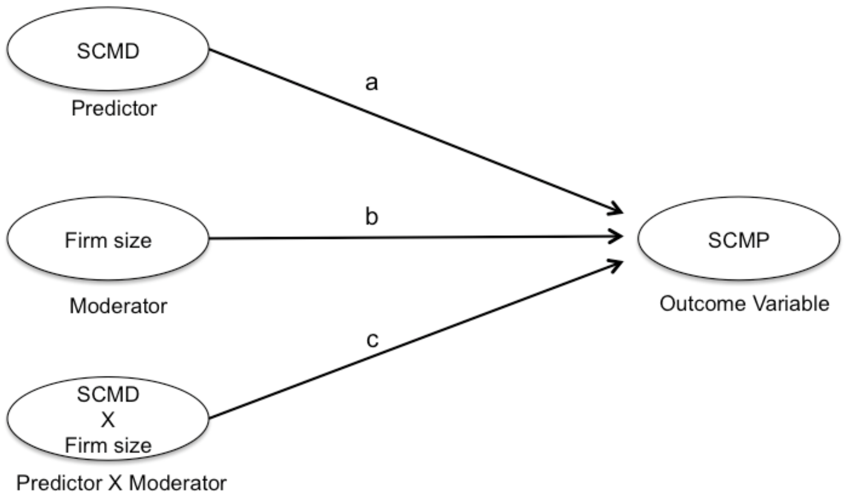


Figure 6-2 Moderation model

The model has three paths: the SCM drivers as predictors (Path a), firm size as moderator (Path *b*), and the interaction or product of these two (Path *c*). The moderator hypothesis is supported if the interaction (Path *c*) is significant. In addition to these basic conditions, it is preferable that the moderator variable be uncorrelated with both the predictor and the outcome variable to give a clearly interpretable interaction term (Baron and Kenny, 1986). The first step is to look at the relationships between these variables. The correlation matrix is shown in Table 6-61.

Table 6-61 Correlations among variables

Correlations

	SCMD	Firm size	SCMP
SCMD	1	-0.047	0.462**
Firm size	-0.047	1	-0.111
SCMP	0.462**	-0.111	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).

As expected, there is a significant relationship between the SCM drivers and SCM practices (r = 0.462), although firm size is not related to the SCM drivers, or to the SCM practices. In order to study the moderating effects, the interaction of the predictor and the moderator is calculated. Howell (2002) recommended centring the data before creating the interaction of predictor and moderator. This eliminates multicollinearity in the data and the problem of evaluating one main effect at an extreme value of the other main effect. To centre the data, each variable's mean is subtracted from the individual observations. Now, a score of 0 for the (centred) SCM drivers represents a firm with the mean level of SCM drivers, which seems an appropriate place to examine any effects of firm size. Meanwhile, any firm with a 0 for (centred) firm size represents a firm with the mean level of firm size.

Having centred the variables, the product of the centred variables is computed, and this represents the interaction term. The means for SCMD, firm size and SCMP are 4.14, 2.16 and 3.59, respectively, and the equations for creating the centred variables and their interaction are as follows:

cSCMD = SCMD – 4.14

cFirm size = Firm size – 2.16

cSCMDXFirm size = cSCMD X cFirm size

The correlations among the centred (and uncentred) variables are shown in Table 6-62.

Table 6-62 Correlations among centred variables

Correlations

	SCMD	Firm size	SCMP	cSCMD	cFirm size	cSCMDX Firm size
SCMD	1	-0.047	.462**	1.000**	-0.047	-0.013
Firm size	-0.047	1	-0.111	-0.047	1.000**	0.048
SCMP	.462**	-0.111	1	.462**	-0.111	-.135*
cSCMD	1.000**	-0.047	.462**	1	-0.047	-0.013
cFirm size	-0.047	1.000**	-0.111	-0.047	1	0.048
cSCMDX Firm size	-0.013	0.048	-.135*	-0.013	0.048	1

Note: ** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Next, the interaction of the two predictor variables is examined by including the interaction term in the regression with the other centred predictors. The dependent variable is SCMP. This regression is shown in Tables 6-63 to 6-65.

Table 6-63 SCM practices model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.486	0.237	0.229	0.73764

Note : Predictors: (Constant), cSCMD, cFirm size, cSCMDXFirm size
Dependent Variable: SCMP

From Table 6-63 and Table 6-64, the R^2 = 0.237 is significant. From Table 6-65, both centred SCM drivers and the interaction term is significant (p = 0.000 and 0.013, respectively), but the firm size variable is not significant. By convention, firm size is left in the regression solution, because it is involved in the interaction, even though the associated t value shows that deleting that variable would not lead to a significant decrease in R^2.

Table 6-64 SCM Practices ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	51.767	3	17.256	31.714	.000[b]
	Residual	167.040	307	.544		
	Total	218.808	310			

Note: Dependent Variable: SCMP

Predictors: (Constant), cSCMD, cFirm size, cSCMDXFirm size

Table 6-65 SCM Practices coefficients

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.586	0.042		85.633	0.000
	cSCMD	0.649	0.071	0.456	9.135	0.000
	cFirm size	-0.081	0.049	-0.083	-1.669	0.096
	cSCMDXFirm size	-0.214	0.085	-0.125	-2.502	0.013

This result leads to the conclusion that firm size does moderate the relationship between the SCM drivers and SCM practices. It is helpful to show the moderation graphically. Then, the relationship between the SCM drivers and SCM practices for a fixed firm size can be drawn as a straight line according to the regression equation. Table 6-66 shows the calculated predicted values for SCMP at low, neutral and high levels of cSCMD for each level of firm size: micro, small and medium. Appendix D shows the details of the moderating relationships obtained from PROCESS procedure for SPSS (Hayes, 2013).

Table 6-66 SCM Practices calculated at different level of SCM drivers and firm size

		SCMD		
		Low	Neutral	High
	Micro	3.1639	3.6561	4.1482
Firm size	Small	3.2030	3.5860	3.9690
	Medium	3.2408	3.5180	3.7952

These predicted values are plotted separately for the different levels of firm size. It is shown that, with the medium firm size, an increase in the SCM drivers is associated with a relatively small increase in the SCM practices. For the small firm size, increasing the SCM drivers leads to a greater increase in the SCM practices. Finally, at the micro firm size, an increase in the SMC drivers leads to a dramatic increase in the SCM practices. This is shown graphically in Figure 6-3.

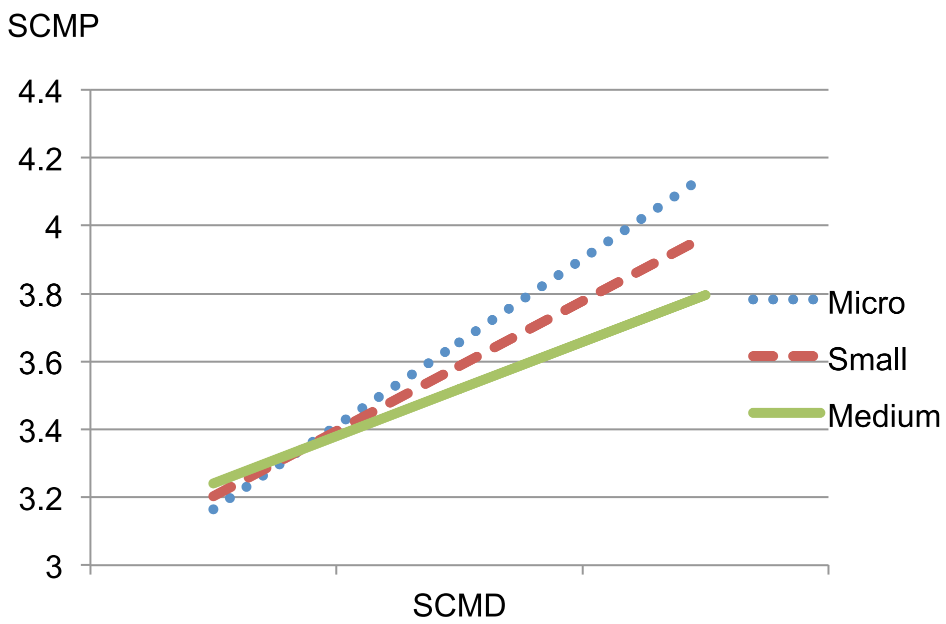


Figure 6-3 Plot of SCMP as a function of SCMD at different level of firm size

6.9 The impact of SCM practices on the level of firm performance

To compare the SCM practices between organisations that perceive their performance to be worse than, comparable to or higher than their competitors', the respondents are classified into three different performance groups. The composite score of firm performance is calculated by summing the eight individual measures. The summed score ranges from 8 (scoring 1 for each question/measure) to 40 (answering 5 for each). Scores 1 and 2 imply that a firm's performance is worse than its competitors', a score of 3 indicates its performance is comparable to that of its competitors, while scores 4 and 5 mean that a firm's performance is better than its competitors'. The researcher assigns the range of low performance to be a total score from 8 to 23, medium performance to be a score from 24 to 31, and high performance to be a score higher than 31. Table 6-67 shows the dispersion of the level of performance.

Table 6-67 Companies categorised by level of firm performance

Level of performance	Total score (range)	Frequency	Percentage	Mean (Std. Score)	Standard Deviation	Standard Error
Low performance	8 - 23	45	14.5%	-0.5826	1.1575	0.1726
Medium performance	24 - 31	172	55.3%	-0.2286	0.9280	0.0708
High performance	32 - 40	94	30.2%	0.6972	0.6031	0.0622
Total		311	100.0%	0.0000	1.0000	0.0567

An ANOVA was conducted to investigate the differences in firm performance and SCM practices among these three groups of firms. The results are shown in Table 6-68.

Table 6-68 Differences in SCM practices among firm performance groups

	Firm Performance				Significant (*p* – value)			
	Low	**Medium**	**High**	**Total**	**Overall**	**L - M**	**L - H**	**M - H**
SCM Practices Average Standard Score	-.5826	-.2286	.6972	0.000	0.000	0.017	0.000	0.000
Network Relationship Management								
• Joint inventory management	3.16	3.47	4.22	3.65	0.000	0.037	0.000	0.000
• IT Coordination	3.33	3.53	4.26	3.72	0.000	**0.183***	0.000	0.000
• Long-term relationships enabled	3.09	3.45	4.18	3.62	0.000	0.017	0.000	0.000
• Clear vision of SCM	3.13	3.33	4.10	3.53	0.000	**0.199***	0.000	0.000
Manufacturing Flow Management								
• JIT / Lean implementation	3.00	3.30	4.13	3.51	0.000	**0.061***	0.000	0.000
• S&OP implementation	3.04	3.37	4.11	3.54	0.000	0.048	0.000	0.000
• Benchmarking and performance measurement	2.93	3.22	4.11	3.44	0.000	**0.094***	0.000	0.000
• Quality policy established	3.22	3.50	4.22	3.68	0.000	**0.069***	0.000	0.000
Product Development and Commercialisation								
• Material strategy alignment	2.98	3.42	4.17	3.58	0.000	0.006	0.000	0.000
• Customer requirements information shared	3.04	3.38	4.15	3.56	0.000	0.043	0.000	0.000
• Using supply chain concept to design	3.07	3.35	4.17	3.56	0.000	**0.056***	0.000	0.000
• Customer's feedback as input to design	3.22	3.48	4.32	3.69	0.000	**0.105***	0.000	0.000

Note: *No difference in SCM practices between firm performance levels

Table 6-68 shows that, overall, SCM practices seem to radically influence the firm performance level. A higher level of SCM practices results in higher firm performance. This confirms the correlation between SCM practices and firm performance. Different levels of SCM practices have a high impact on whether a firm has a medium or high level of performance. The difference between low and medium performance seems to be moderate. Some of the SCM practices are no different between low and medium performing firms, such as IT coordination, a clear vision of SCM, JIT/Lean implementation, benchmarking and performance measurement, establishment of a quality policy, using supply chain concept to design, and customer's feedback being used as an input to design.

6.10 Summary

This chapter has focused on the results of the study based on self-completed questionnaires. In the first section, the profiles of the SME respondent organisations are discussed. Then, a comparison is made between the micro-, small- and medium-sized companies in the following section. Later, the descriptive statistics, factor analysis and correlations of SCM antecedents, SCM practices and their consequences are investigated. Next, regression models for both SCM practices and firm performance, with and without control variables, are introduced. Furthermore, the mediation effect from SCM drivers through SCM facilitators to SCM practices is confirmed with Sobel test. It is also finds out that the firm size does moderate the relationship between SCM drivers and SCM practices. Finally, the effects of differences in SCM practices on firm performance are discussed.

The next chapter will utilise SEM techniques, which include path analysis and CFA, to specify models and determine whether they are identified. Then, the findings and their implications will be discussed in the final chapter.

If a model is consistent with reality,
then the data should be consistent with the model.
But, if the data are consistent with the model,
this does not imply that the model corresponds to reality.
(Kenneth A. Bollen, Structural equations with latent variables)

CHAPTER 7 CONFIRMATORY STUDY: STRUCTURAL EQUATION MODELLING

7.1 Introduction

This chapter presents the procedural validation of the SCM practices model constructs. In order to discover a model that is generated by the exploratory study, the SEM technique is used. According to Bagozzi and Yi (2012: 12), *"SEMs provide a useful forum for sense-making and in so doing link philosophy of science criteria to theoretical and empirical research".* SEM is increasingly being applied to several areas of study (Kline, 2011). In this study, the technique is deployed to validate the SCM practices model. In accordance with Hoyle's (1995) approach, this chapter applies SEM by starting with the justification of the measurement models. Then, the model fit is evaluated. Additionally, model modifications are proposed. Finally, the models are discussed and interpreted.

7.2 The SCM practices conceptual model and hypotheses

The SCM antecedents are expected to influence SCM practices. The SCM antecedents can be defined as the factors that enhance or impede the implementation of SCM in SMEs (Mentzer et al., 2001b). In this study, the SCM antecedents are classified into three broad categories: SCM drivers, SCM facilitators and SCM impediments.

SCM drivers are strategic factors which result in a competitive advantage and which help to determine the appropriate level of SCM practices (Marien, 2000). The researcher classified SCM drivers into three categories related to their effects on the firm as external drivers of SCM, intra-supply-chain-network drivers and internal company drivers.

External drivers of SCM are the factors that drive a supply chain network to compete against other networks such as to enhance competitive advantage (Tan et al., 2002, Chin et al., 2004), global supply chain competition (Ayers, 2006, Storey et al., 2006, Fawcett et al., 2009, Christopher, 2011). Intra-supply-chain-network drivers are the ingredients that influence network members to implement supply chain management such as collaboration (Tan et al., 2002, Ayers, 2006), and competition which has shifted from between companies to between supply chain networks (Fawcett et al., 2009, Christopher, 2011). Lastly, internal company drivers are the aspects of firm that lead it to adopt the supply chain management concept to manage their processes and functions for sustainable growth and cost reduction (Chin et al., 2004). Olhager and Selldin (2004) conducted research with Swedish manufacturing firms and found that resource utilisation and cost minimisation were the main internal company drivers SCM practices. Therefore, this leads to the first hypotheses:

Hypothesis 1: SMEs with higher perceptions of the importance of SCM drivers will have higher levels of implementation of SCM practices.

SCM facilitators are the elements that enable SCM practices. They represent the environment of the supply chain network that assists SCM practices. Mentzer et al. (2000) used the term “enablers” interchangeably with facilitators which included ideas, tools, actors and organisational factors that move SCM forward. There are two types of facilitators those support the growth of network namely structural and infrastructural (Finch, 2008). In order to enhance understanding, the researcher classified structural SCM facilitators as tangible SCM facilitators and the infrastructural SCM facilitators were defined as intangible SCM facilitators. Tangible SCM facilitators relate to such tangibles as information technology, workflow structure, communication structure, planning and control method and knowledge management (Lambert, 2008). Alternatively, intangible SCM facilitators, relate to systems used to enhance the structural facilitators and to control those elements so the supply network achieves high levels of performance (Finch, 2008). Intangible SCM facilitators include organisational structure (Thakkar et al., 2008b) and top management support (Chin et al., 2004, Larson et al., 2007). This discussion suggests the following hypothesis:

Hypothesis 2: SMEs with higher perceptions of the importance of SCM facilitators will have higher levels of implementation of SCM practices.

SCM impediments are circumstances that can potentially cause SCM practices to fail. These factors are identified by literature (Goh and Pinaikul, 1998, Mentzer et al., 2000, Udomleartprasert et al., 2003). These obstacles can be divided into two groups, organisational or internal SCM impediments and social dilemma-based or external, SCM impediments (Fawcett et al., 2009). Mentzer (2001) cited that organisations that comprehended the obstacles of SCM practices planned more effectively to implement SCM. Doggett (2004) cited in the root cause analysis tools study that a recognition and understanding of a problem's root cause was of utmost importance for identifying and eliminating the problem. Therefore, the higher level of understanding of SCM obstacles, which was a root cause of SCM failure, led to higher levels of SCM practices being applied. This observation provides the following hypothesis:

Hypothesis 3: SMEs with higher perceptions of the importance of SCM impediments will have higher levels of implementation of SCM practices.

Similarly, the SCM practice conceptual framework developed in this study proposes that SCM practices are expected to increase a firm's performance through the dimensions of cost, time, reliability (Banomyong and Supatn, 2011) and asset utilisation (Closs and Mollenkopf, 2004, Petrovic-Lazarevic et al., 2007). The firm's performance is a consequence of its SCM practices. Various SCM practices will have an impact on various aspects of the firm's performance. Therefore, the fourth hypothesis is set as:

Hypothesis 4: SMEs with higher levels of implementation of SCM practices will have higher levels of firm performance.

A summary of the hypotheses of the SCM practices structural model are displayed in Figure 7-1.

In the next section, SEM is applied to analyse the quantitative data gathered from the self-completed questionnaires.

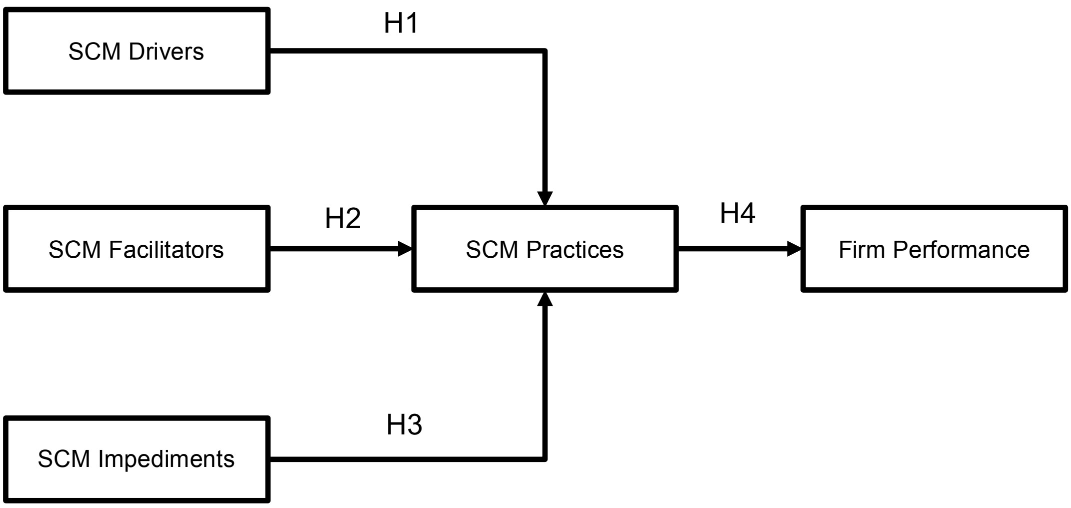


Figure 7-1 The hypotheses of the SCM practices structural model

7.3 Confirmatory Factor Analysis

This section explains the process of SEM through the application of CFA (first-order CFA). The process includes (1) defining individual constructs, (2) developing an overall measurement model and (3) assessing the measurement model's validity.

IBM SPSS Statistic 20 with IBM SPSS AMOS 20 was used for the SEM analysis. Table 7-1 shows all the measurement items of the constructs included in this study, which were based on the literature review. In order to examine the validity of each latent variable (construct) and its multiple measured variables (items), first-order CFA was conducted using maximum likelihood estimation. In order to test the goodness of the data and to strengthen the quality of the research, validity and reliability were examined before conducting the data analysis. Dunn et al. (1994) recommended a process of scale development and validation, and the details of the validity and reliability are provided later in this section.

Table 7-1 Summary of the reliability of the measures, standardised item loadings, and means and standard deviations of the survey measurement items from the first-order CFA

Construct	Cronbach's alpha (∝)	Standardised item loading	Mean	Standard deviation
SCM Drivers	0.809			
1. Global competition of our network		0.502	3.88	1.112
2. End-customer needs		0.595	4.28	0.831
3. Process integration among network members		0.684	3.98	0.821
4. Network members' collaboration		0.681	3.89	0.851
5. Cost reduction		0.517	4.43	0.807
6. Improvement of process capabilities		0.527	4.34	0.802
7. Internal function collaboration		0.592	4.19	0.860
SCM Facilitators	0.855			
1. IT		0.564	4.18	0.800
2. Network integration		0.689	4.00	0.801
3. End-customer focus		0.556	4.12	0.823
4. Top management support		0.646	4.29	0.810
5. Organisation designed to support coordination		0.786	4.11	0.797
6. Trust and openness		0.726	4.03	0.825
7. Willingness to share knowledge		0.759	4.01	0.882
SCM Impediments	0.816			
1. Employees' lack of knowledge		0.506	4.14	0.824
2. Employees' resistance		0.542	3.69	1.029
3. Organisational "silo" structure		0.593	3.72	0.974
4. Quality problems		0.591	4.05	0.865
5. Communication problems		0.669	3.96	0.892
6. Laws and regulations		0.706	3.69	1.001
7. Lack of SCM concept		0.696	3.80	0.893
SCM Practices	0.959			
1. Joint inventory management		0.753	3.65	0.978
2. IT coordination		0.689	3.72	0.945
3. Long-term relationships		0.911	3.62	0.973
4. Clear vision of SCM		0.787	3.53	0.966
5. JIT / Lean implemented		0.787	3.51	1.047
6. S&OP implemented		0.780	3.54	1.040
7. Benchmarking & performance measurement		0.794	3.33	1.094
8. Quality policy		0.824	3.68	0.980
9. Material strategy alignment		0.850	3.58	1.037
10.Sharing of customer requirements		0.786	3.56	1.057
11.Using the supply chain concept to design		0.767	3.56	0.985
12.Customer feedback as input to design		0.753	3.69	1.022
Firm performance	0.913			
1. Lower logistics costs		0.688	3.42	0.876
2. Lower total costs		0.618	3.43	0.870
3. Shorter lead-time		0.783	3.54	0.833
4. Shorter delivery time		0.751	3.67	0.810
5. More on-time and in-full		0.795	3.68	0.811

6. Higher inventory turnover	0.677	3.53	0.830
7. Higher customer satisfaction	0.893	3.68	0.827
8. Higher market share	0.833	3.56	0.862

SCM practices model fit
Model fit: χ^2 (752) = 1319.556, χ^2 /df = 1.755 GFI = 0.830, NFI = 0.848, CFI = 0.928, RMSEA = 0.049

7.3.1 Content validity

Content validity or face validity (Bryman, 2008) is the degree to which the measurement reflects the content of the concept in question. It shows the meaning of a particular construct that is aimed to be evaluated (Dunn et al., 1994). Furthermore, Garver and Mentzer (1999) argued that the researcher's judgement and expert insight must be applied because of the lack of statistical tests for content validity.

In this study, the constructs were defined from the literature and the researcher established content validity by carrying out 20 interviews with SCM experts in the field. Each construct was carefully assessed regarding its importance and relevance to the latent variables. Only measures that reflected the concept of each latent variable were identified. For example, the study aimed to measure SCM drivers, and fourteen measures were identified from the literature. However, only seven of them were validated for the context of Thailand through the semi-structured interviews.

7.3.2 Substantive validity

Substantive validity describes the theoretical linkage between the latent variable and the measurements (Garver and Mentzer, 1999). Substantive validity refers to each individual measurement of a construct while content validity deals with a set of measures. Thus, it is not plausible for a latent variable to have content validity without having substantive validity (Dunn et al., 1994). Dunn et al.

(1994) proposed a method of testing items' substantive validity by calculating item-to-total correlations or contribution to Cronbach's alpha coefficient.

7.3.3 Reliability

Reliability or scale reliability refers to the internal consistency of an item in measuring a latent variable. It consists of three dimensions: stability, internal reliability and inter-observer consistency (Dunn et al., 1994, Garver and Mentzer, 1999, Bryman, 2008). Reliability does not assess accuracy of the measurement scale but evaluates the consistency of it (Garver and Mentzer, 1999). Commonly, Cronbach's alpha is used to estimate the reliability. In this research, Cronbach's alpha is calculated for each of the five constructs. The values are included in Table 7-1 and range from 0.816 to 0.959. As all are greater than 0.7, this indicates that the questionnaires were developed with reliability. Another measure of construct reliability is also recommended, namely composite reliability (CR), whose value is required to be greater than 0.60 (Hsu et al., 2009). Table 7-2 displays the CR values for the constructs.

7.3.4 Unidimensionality

Unidimensionality is defined as the degree to which the measures represent a single latent variable (Anderson and Gerbing, 1988, Garver and Mentzer, 1999, Chen and Paulraj, 2004). Scales have construct validity as long as they are unidimensional (Dunn et al., 1994). Anderson and Gerbing (1988) also argued that unidimensionality can be tested by CFA. All items are loaded into the scale and then the overall model fit is assessed.

In this research, the fit indices and acceptable values as illustrated in Table 7-3 are applied to evaluate unidimensionality. As recommended by Hinkin (1998), several fit criteria are exploited to assess the tenability of the measurement models. The traditional measure for evaluating overall model fit is the model's chi-square. A good model fit would have insignificant statistics at the 0.05 level (Hooper et al., 2008). It is widely accepted and recommended that an acceptable fit be given by the ratio of the chi-square statistic to the degrees of freedom. A ratio of less than 2 would indicate a good fit, while a value less than 3 would be acceptable. The other measures of model fit include the goodness-of-fit index (GFI), the normed fit index (NFI), the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). The details are as follows:

1. *"the goodness-of-fit index (GFI) is a measure of the relative amount of variance and covariance in Σ that is jointly explained by Σ"* (Byrne, 2010: 77) GFI ranges from 0 to 1 and it can be influenced by sample size;
2. the normed fit index (NFI) or Bentler and Bonnet's NFI is calculated by the ratio of the difference between the chi-square of the independence model (baseline model) and the chi-square of the target model to the chi-square of the independence model; NFI is also affected by sample size (Schermelleh-Engel et al., 2003);
3. the comparative fit index (CFI) is an adjusted version of the relative noncentrality index (RNI), and avoids the underestimation of fit often noted in small samples for the NFI (Schermelleh-Engel et al., 2003);

4. the root mean square error of approximation (RMSEA) is a measure of approximate fit in the population and is concerned with the discrepancy due to approximation. RMSEA values less than 0.05 indicate a good fit, and values as high as 0.08 represent reasonable errors of approximation in the population (Byrne, 2010).

7.3.5 Construct validity

Dunn et al. (1994) explained construct validity as the extent to which a measurement assesses the construct it is intended to quantify. The criteria that support construct validity are convergent validity and discriminant validity:

> *"Convergent validity is the degree to which there is agreement between two or more attempts to measure the same construct through dissimilar methods. Discriminant validity depends on the degree to which scales measure distinct constructs. When convergent validity and discriminant validity are found, construct validity is supported."* (Dunn et al., 1994: 163)

Convergent validity can be tested by conducting different research methods and checking whether the correlations between measures of similar constructs are significantly different from zero and sufficiently large (Hinkin, 1998).

In the study, the convergent validity is tested through a CFA of the data using three methods as recommended by Hair Jr. et al. (2010) as:

a) Factor loadings: standardised factor loadings (SFLs) should be higher than 0.5 or ideally higher than 0.7 (Igbaria et al., 1997).

b) Average variance extracted (AVE) measures the amount of variance captured by a construct. AVE should be greater than 0.5 (Fornell and Larcker, 1981).

c) Reliability: Composite reliability (CR) assesses the internal consistency of a measure and is calculated by the squared sum of the standardised factor loadings for the observed variables divided by the total of the squared sum of standardised factor loadings and the sum of the indicator measurement error. A CR value between 0.6 and 0.7 may be acceptable (Fornell and Larcker, 1981).

This use of CR and AVE also features in the two-step procedure suggested by Anderson and Gerbing (1988). The results for the SFLs are shown in Table 7-1.

Discriminant validity is the degree to which a construct is truly disparate from the other constructs. Therefore, high discriminant validity provides an indication that a construct is unique and has some meaning that the other measures do not have (Hair Jr. et al., 2010).

In this research, discriminant validity is assessed by CFA with a chi-square difference test (paired constructs test), according to Anderson and Gerbing (1988). Any two constructs that contain items that are suspected to have induced confusion among the respondents should be tested (Zait and Bertea, 2011). For example, suppose Y1 and Y2 are tested for discriminant validity. The parameter estimate for the two factors (Y1 and Y2) is constrained to 1.0 (constrained model) and this is compared to a model where this parameter is freely estimated (unconstrained model) as shown in Figure 7-2. If the unconstrained model, with the drop of one degree of freedom, returns a chi-square value that is more than 3.84 higher than in the constrained model, then a two-factor solution provides a better fit to the data, and discriminant validity between Y1 and Y2 is supported (Farrell, 2010).

The results of the chi-square difference tests for each pair of constructs are displayed in Table 7-2.

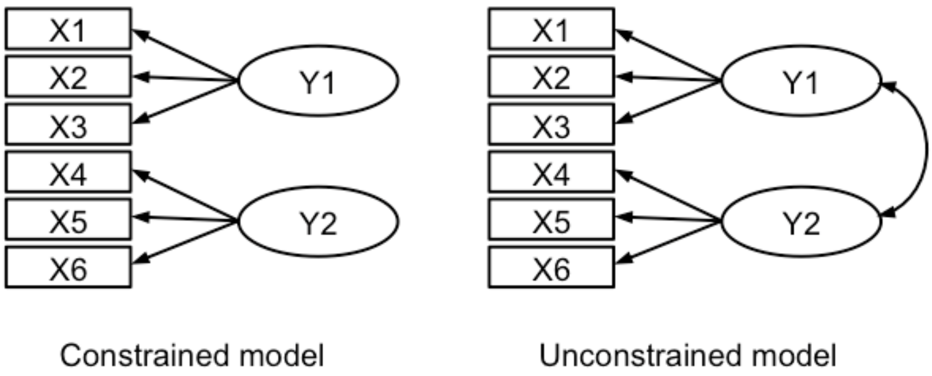


Figure 7-2 Chi-square difference test

Table 7-2 CR, AVE and chi-square differences for the constructs of the SCM practices model

	CR[+]	AVE[++]	SCMD	SCMF	SCMI	SCMP
SCMD	0.785	**0.346**				
SCMF	0.856	**0.464**	219.3***			
SCMI	0.812	**0.384**	97.1***	147.0***		
SCMP	0.957	0.648	70.6***	68.7***	64.7***	
FP	0.912	0.568	41.2***	22.6***	17.8***	112.8***

Note: +, ++ CR and AVE calculated according to CFA from AMOS
*** Chi-square difference statistically significant at α = 5%

The AVEs for SCMD, SCMF and SCMI are less than 0.5. This shows convergent validity concerns. However, the CR for those three constructs exhibit values higher than the minimum threshold recommended in Fornell and

Larcker (1981). It can be concluded that convergent validity is not a problem. The difference between the chi-squares of the constrained and unconstrained models is greater than 3.84 for each pair of constructs, revealing that discriminant validity is supported.

7.3.6 Assessing common method bias

Common method variance represents the amount of spurious covariance shared among variables because of the common method used to collect the data (Malholtra et al., 2006). In order to assess common method bias, a common latent factor test was conducted. In the test, another "latent common method variance factor" is set as a common loading from all factors in the model (Podsakoff et al., 2003). Then, the standard regression weights for every path are compared between two models: one with the "latent common method variance factor" and a normal model without it. In this study, the differences for all paths were no greater than 0.2. This demonstrates that the common method variance is not a problem in the data for this study. Detail of common method variance test is illustrated in Appendix D.

7.3.7 Analysis of CFA measurement models

The SCM practices structural model consists of five construct measurement models. In order to identify the structural model, the measurement models have to be identified (Hoyle, 1995). To measure the degree to which a model represents the data, which is known as model fit, many indices have been introduced to determine what can be classified as a good fit level or an acceptable threshold fit level (Schermelleh-Engel et al., 2003, Hooper et al., 2008). In this study, the fit indices and acceptable values illustrated in Table 7-3 are used.

Table 7-3 Fit indices and their acceptable values

Fit Index	Good fit level	Acceptable threshold fit level
Relative χ^2 (χ^2/df)	Less than 2	Less than 3
GFI	Value greater than 0.95	Value greater than 0.90
NFI	Value greater than 0.95	Value greater than 0.90
CFI	Value greater than 0.97	Value greater than 0.95
RMSEA	Value less than 0.05	Value less than 0.08

The SCM drivers (SCMD) measurement model was evaluated based on the seven factors shown in Table 7-1. It has standard loading factors ranging from 0.46 to 0.76 with the following indices: χ^2/df = 2.327, GFI = 0.994, NFI = 0.990, CFI = 0.994 and RMSEA = 0.065. 'Network collaboration' has the highest loading factor onto the latent construct, SCM drivers, while 'global competition' contributes the least to the SCM drivers construct. The author finds an error covariance among many factors in the model and these are included in the model as shown in Figure 7-3.

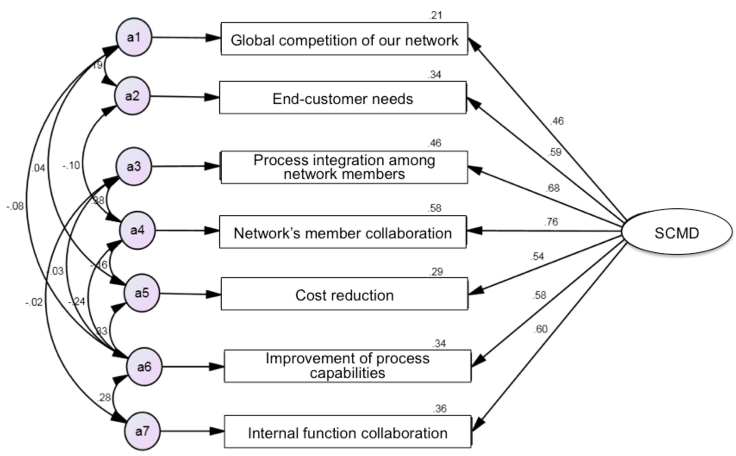


Figure 7-3 The SCM drivers measurement model

Next, the SCM facilitators (SCMF) measurement model is loaded with the seven factors shown for that construct in Table 7-1. The SCMF model has standard loading factors ranging from 0.55 to 0.81 with the following fit indices: χ^2/df = 1.797, GFI = 0.987, NFI = 0.983, CFI = 0.992 and RMSEA = 0.051. ‘Willingness to share knowledge’ (among network members) has the highest loading on the latent construct SCM facilitators, while ‘end-customer focus’ contributes the least to the construct. The author finds an error covariance among some factors in the model and these are incorporated within the model as shown in Figure 7-4.

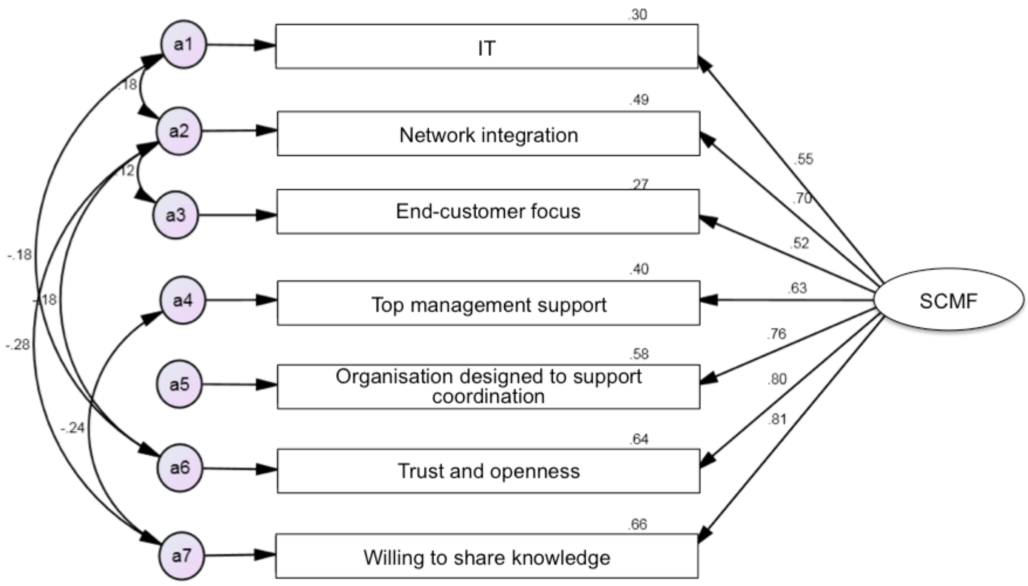


Figure 7-4 The SCM facilitators measurement model

The SCM impediments (SCMI) measurement model also has seven factors, as shown in Table 7-1. It has standard loading factors ranging from 0.51 to 0.71, with fit indices of χ^2/df = 0.612, GFI = 0.994, NFI = 0.989, CFI = 1.000 and RMSEA = 0.000. These indices show a very high fit between the model and the data. ‘Laws and regulations’ and a ‘lack of SCM concept’ have the two highest loadings on to the SCM impediments construct. ‘Employees’ lack of SCM knowledge’ contributes the least to this construct. The author identifies an error covariance among ‘employees’ resistance’ and ‘communication problems in the organisation’, as well as between ‘employees’ lack of SCM knowledge’ and ‘employees’ resistance’. Thus, an error covariance among the factors is included in the model as shown in Figure 7-5.

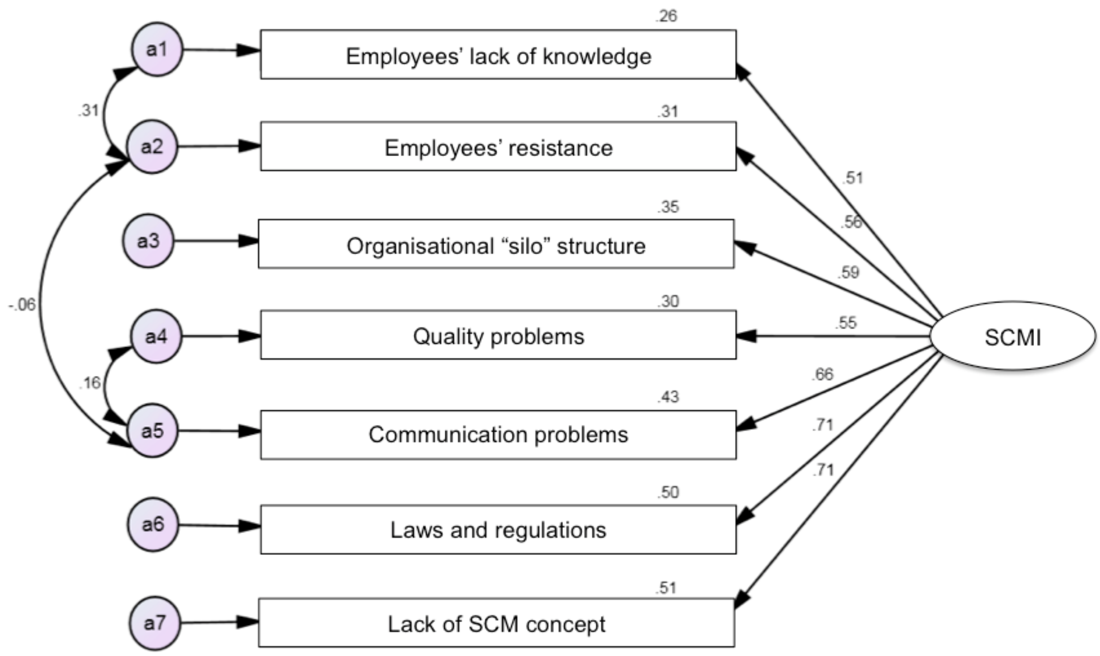


Figure 7-5 The SCM impediments measurement model

Next, the SCM practices (SCMP) measurement model identifies12 factors, as shown in Table 7-1. Based on the three main processes of Lambert (2008) which were identified in this study as Network Relationship Management (NRM), Manufacturing Flow Management (MFM) and Product Development and Commercialisation (PDC), two alternative competing models were proposed as follows: (1) a model in which all measures were loaded onto a single first-order and (2) a model in which the three first-order factors were loaded onto a second-order factor of SCMP. These models were tagged as Model 1 and Model 2. Figure 7-6 and 7-7 show the results and estimation of these two competing models.

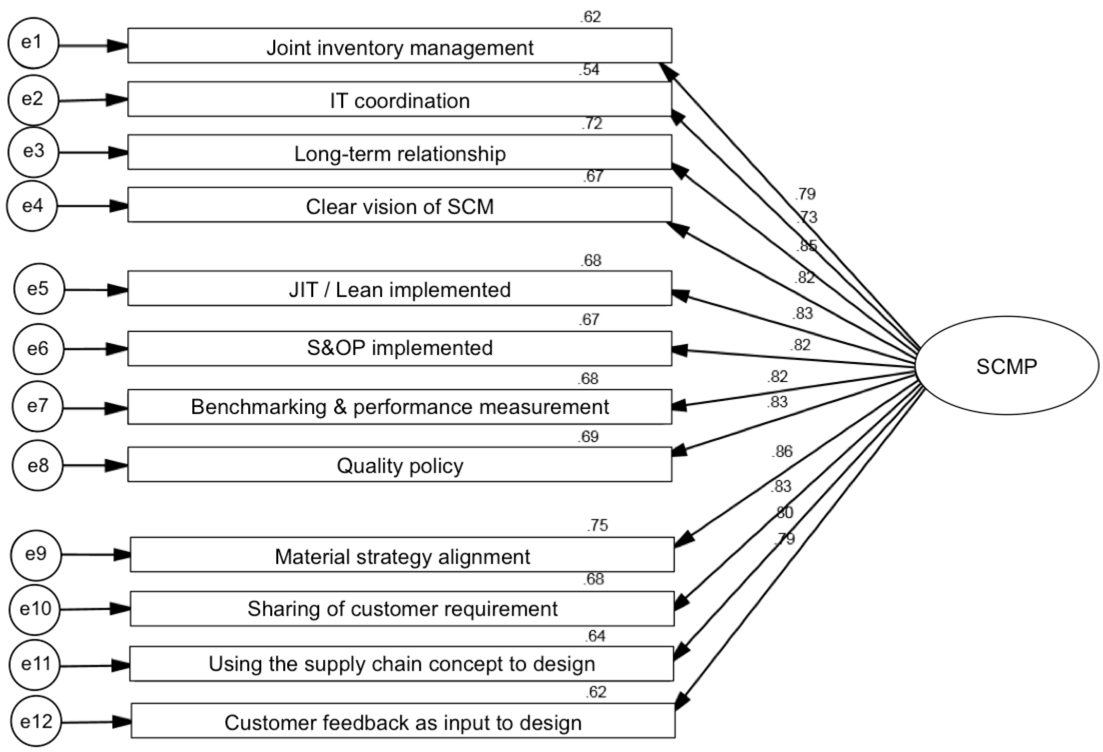


Figure 7-6 The SCM practices one factor first-order model

The standard factor loadings of Model 1 ranged from 0.73 to 0.86 with fit indices of χ^2/df = 4.843, GFI = 0.859, NFI = 0.922, CFI = 0.937, CAIC = 423.266 and RMSEA = 0.111. This model was unacceptable because most of its goodness-of-fit measures failed to meet the threshold criteria. In contrast the standard factor loadings of Model 2 ranged from 0.78 to 0.89 with fit indices of χ^2/df = 2.761, GFI = 0.928, NFI = 0.958, CFI = 0.973, CAIC = 322.793 and RMSEA = 0.075. This model's goodness-of-fit indices all met to the threshold criteria according to Schermelleh-Engel et al. (2003) and Hooper et al. (2008).

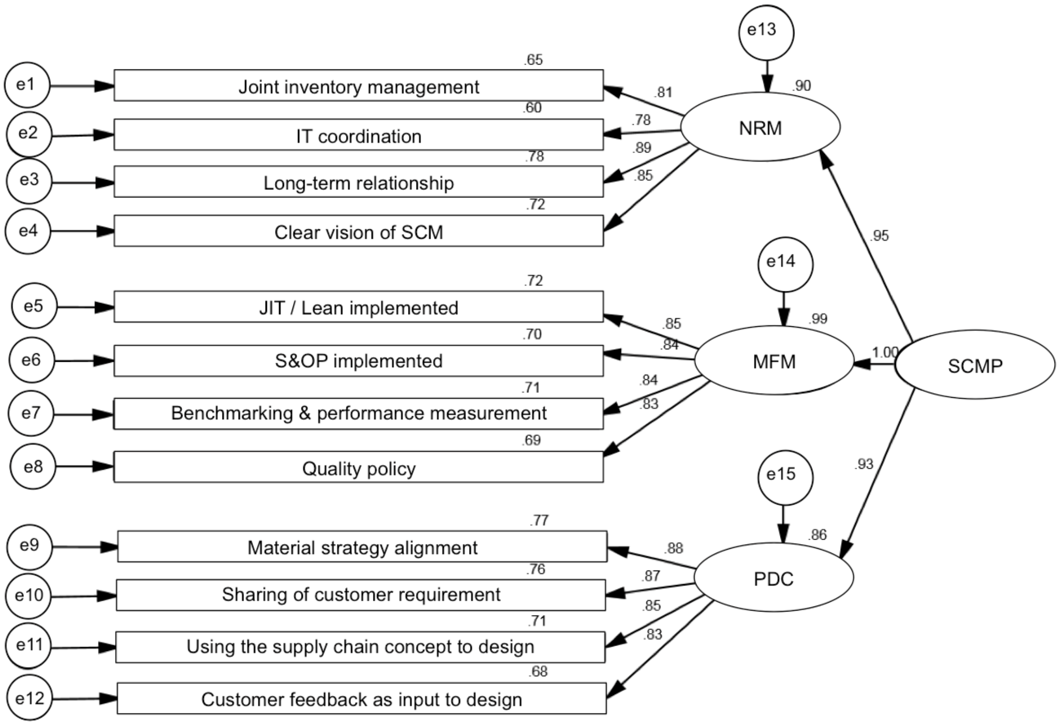


Figure 7-7 **The SCM practices three-factor second-order model**

To compare the efficacy of these two competing models, the researcher continued to check the values of the Consistent Akaike Information Criteria (CAIC). (Milfont and Duckitt, 2004) argued that the lower CAIC values indicated the model with the better fit. This lower CAIC also demonstrated more parsimonious explanation (Moon et al., 2012).

Furthermore, the target (T) coefficient was computed by dividing the χ^2 value of the first-order model by the χ^2 value of the second-order model. This T coefficient explained whether a second-order construct justified the variation in its sub-constructs (Yu and Ramanathan, 2012). The higher T coefficient value indicated that the relationship among lower-order factors was sufficiently captured by the higher-order factor (Moon et al., 2012). In this study the T coefficient was moderate (0.54), indicating that the second-order model exceptionally increase the χ^2 value. Consequently, the SCMP measurement model can be conceptualised as a multidimensional measure consisting of NRM, MFM and PDC, and that it was governed by a second-order latent variable.

Finally, the firm performance (FP) measurement model was evaluated with eight factors as shown in Table 7-1. The standard factor loadings ranged from 0.61 to 0.81 with fit indices of χ^2/df = 2.886, GFI = 0.962, NFI = 0.966, CFI = 0.978 and RMSEA = 0.078. These indices also show a very high fit between the model and the data. 'Higher customer satisfaction' and 'higher market share' have the two highest loadings onto firm performance. 'Lower logistics costs' has the lowest loading. Error covariances among the 'lower logistics cost' and 'lower total cost', and 'shorter delivery time' and 'more on-time and in-full' were found, and are included in the model as shown in Figure 7-8.

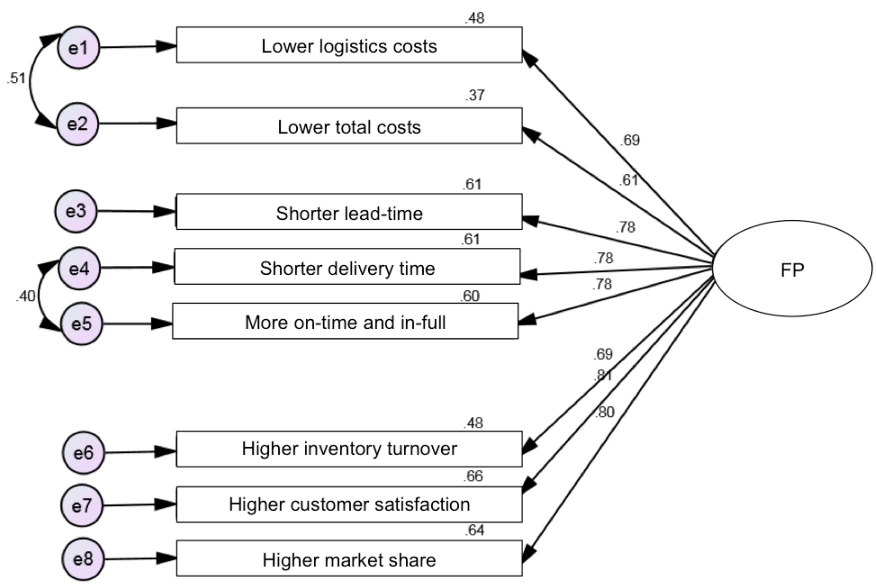


Figure 7-8 The firm performance measurement model

All model fit indices for each of the measurement models are better than the common requirements given in Table 7-3. This means that the measurement models fit the sample data well.

7.4 Analysis CFA structural model and hypotheses

The CFA structural model was analysed based on the five measurement models of each of the latent variables, which are identified in the previous section. The maximum likelihood estimation method was used to estimate the parameters as it is the most commonly used method (Harrington, 2009). The structural model based on the hypotheses was tested. The goodness-of-fit indices and the structural model results suggested that there was no cause for concern. The overall model fit was assessed following Harrington's (2009) recommendation that one should examine multiple indices. It is possible for a model to be acceptable on one fit index but to also demonstrate inadequacy on many other fit indices. In this study, the ratio of the chi-square to the degrees of freedom (normed-chi-square), the GFI, the NFI, the CFI and the RMSEA were used as the criteria for model fitting. A non-significant chi-square (i.e. $p > 0.05$) would indicate that the proposed model was an adequate representation of the entire set of relationships. However, in cases of significant chi-squares and a high number of degrees of freedom, the value of the normed-chi-square should be used (Byrne, 2010). The acceptable maximum threshold value of the normed chi-square is 3, the GFI, CFI and NFI should not be lower than 0.90, while a RMSEA higher than 0.10 is not acceptable (Schermelleh-Engel et al., 2003). The model's fit indices are χ^2/df = 1.806, GFI = 0.827, NFI = 0.845, CFI =

0.923 and RMSEA = 0.051. Figure 7-9 shows the overall indicators for the model. In conclusion, the model achieves an acceptable threshold fit level.

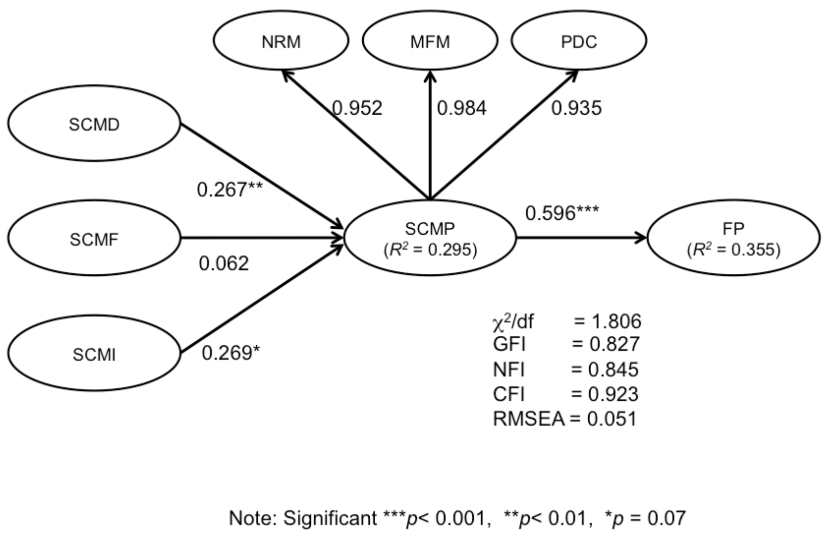


Figure 7-9 The SCM practices structural model

7.5 Assessment of CFA model

Now SEM will be utilised to test the hypotheses presented earlier. The model shown in Figure 7-8 fits the sample data well. The result of hypotheses testing is shown in the table 7-4.

Table 7-4 Maximum likelihood estimates used for testing the hypotheses

	Hypothesis statement	Estimate	S.E.	C.R.	*p*
H1:	SCM drivers → SCM practices	0.422	0.235	1.796	0.072
H2:	SCM facilitators → SCM practices	0.101	0.242	0.417	0.677
H3:	SCM impediments → SCM practices	0.471	0.172	2.741	0.006
H4:	SCM practices → Firm performance	0.468	0.053	8.903	< 0.001

Consistent with *H1*, SCM drivers have a positive and statistically significant impact on SCM practices ($p < 0.1$). This implies that an organisation performed SCM practices based on its perceptions of the importance of SCM drivers. The findings confirm the literature reviewed (Tan, 2002, Olhager and Selldin, 2004, Ayers, 2006, Fawcett et al., 2009, Christopher, 2011) and the opinions of the experts identified in the interviews undertaken.

Next, the relationship between the SCM facilitators and SCM practices are positive as predicted but not statistically significant ($\beta = 0.101$, $p > 0.10$). Therefore, *H2* is not supported. The SMEs with higher perceptions of the importance of SCM facilitators do not have higher levels of implementation of SCM practices.

SCM impediments also have a statistically significant relationship with SCM practices. The SMEs who have a higher understanding and awareness of the problems that impede firms to be succeeding in SCM practices have a higher level of implementation of SCM practices. The *p*-value = 0.006 indicates a very strong relationship. Accordingly, *H3* is supported. The relationship of SCM impediments with SCM practices are cited in prior studies (Chin et al., 2004).

Finally, the relationship between SCM practices and firm performance is statistically confirmed with $p < 0.001$. Therefore, *H4* is also supported. SCM practices lead to improved firm performance in at least four major areas: cost, time, reliability and asset utilisation (Banomyong and Supatn, 2011).

The R^2 value of SCM practices is 30% and that of firm performance is 35%. These results show that there are strong relationships in the SCM practices model.

7.6 Conclusions

This chapter has examined the perceptions of Thai SMEs' SCM practices based on SEM. The structural model was developed from the literature review and confirmed by supply chain executive experts through semi-structured interviews. In general, data from the self-reported questionnaire survey provided empirical evidence supporting the structural model that is proposed. This study appears to confirm that the antecedents of SCM, which include drivers, facilitators and impediments, have significant relationships with SCM practices for Thai SMEs. The most important result of the study is the support for *H4*, which states that SCM practices lead to improved firm performance in at least four major areas: cost, time, reliability and asset utilisation.

The next chapter provides the conclusions and recommendations of this research based on the major findings that have been presented in Chapters 5, 6 and 7, as well as presenting the limitations and gaps that can be dealt with in future research.

The three distinct stages that every science has gone through are:
classification, correlation and Effect-Cause-Effect.
(Eliyahu M. Goldratt, Theory of Constraints)

CHAPTER 8 FINDINGS AND DISCUSSION

8.1 Introduction

In the previous chapter, a structural equation model representing the inter-relationships among the SCM drivers, facilitators, impediments, practices and firm performance was developed. The model was refined based upon the literature and expert interviews. Then, it was assessed using quantitative analysis procedures such as EFA, CFA and SEM.

According to a survey of senior managers of production-oriented US firms, Arend and Wisner (2005) argued that SCM and SMEs are not a good fit. They advised that SMEs' performance suffers when they implement SCM extensively. This finding aroused the researcher's interest in studying the SCM practices of SMEs in Thailand. Then, the following main research question was formulated: 'What SCM practices are suitable for Thai SMEs?' This study therefore set out to explore in greater depth whether and to what extent Thai SMEs are implementing SCM. Furthermore, this research has explored the antecedents and consequences of SCM practices in order to measure the causal relationships among them. This chapter discusses the key findings from both the qualitative and quantitative research methods used.

8.2 Findings from the interviews

In accordance with the research objective of developing a model of suitable SCM practices to help Thai SMEs improve their competences, semi-structured interviews were conducted. The questions were classified into five areas based on the components of the SCM practices model already developed from the literature. The aim of the interviews was to achieve a better understanding of the current SCM practices of Thai firms. The specific interview questions were:

1. *How are SCM practices related to their firm performance?*
2. *What are the main reasons that drive their firm to decide to implement SCM?*
3. *What are the main facilitators that help their firm to implement SCM?*
4. *What are the main impediments that prevent their firm from implementing SCM, and how important are they?*
5. *What are the current SCM practices of their firm?*

The discussion of the findings from the interviews can be arranged into five sub-sections, reflecting the five issues above. The first sub-section summarises the findings regarding the relationship between SCM and firm performance. The next three sub-sections cover each antecedent of SCM practices. Finally, the generic model of SCM practices is identified.

8.2.1 Firm performance resulting from SCM

In a previous study, Bayraktar et al. (2009) found SCM practices to make a significant contribution to Turkish SMEs' firm performance. An empirical study of Malaysian firms also concluded that SCM practices improve firm performance

(Chong and Chan, 2011). A study of the Australian manufacturing industry carried out by Petrovic-Lazarevic et al. (2007) reported the same result that SCM enhances firm performance.

However, Bhanomyong and Supatn's (2011) study suggested that, on average, SMEs that implemented SCM did not have a cost advantage over their competitors. Koh et al. (2007) also argued that a firm's performance would usually be influenced by several factors and it would be difficult to state directly whether SCM practices were one of them. In their study of US manufacturing firms, Li et al. (2006) found that SCM practices lead to competitive advantage but do not directly contribute to a firm's performance.

In this study, the preliminary interview findings validate, at least in a Thai context, the theory that SCM practices lead to higher firm performance. Our results suggest that four main areas of firm performance as cost, time, reliability and asset utilisation are focused on by the top management.

Firstly, the costs dimension reflects efficiency of the supply chain network. SCM implementation is expected to improve efficiency and effectiveness across the supply chain. Many of the participants considered lowering total and logistics costs to be the top priorities of performance improvement. Cost-saving programmes were a goal of the firms' SCM implementation. The majority (90%) of the interviewees said they achieved cost reductions from SCM practices. Of those who reported successful cost reductions, network collaboration was cited as the main reason for this. Efficient operations were mentioned as the next most important source of cost reduction performance.

The second firm performance measurement is the time dimension. Generally, time is essential to a firm's performance regardless of cost (Chan and Qi, 2003a, Chan and Qi, 2003b). The informants suggested both production lead-times and delivery lead-times as important aspects of their firm's performance measurement programme. In the literature, an ability to reduce the lead-time between receiving an order and delivering to the customer is mentioned as an aspect of firm performance (Koh et al., 2007). Some of our respondents interpreted time performance as meaning delivery speed within the customer service function. This confirms the study of SMEs in the Swedish engineering industry, conducted by Söderberg and Bengtsson (2010). Moreover, Chin et al. (2004), SCM practices were found to lead to a significantly higher customer service level. The respondents in our interviews also claimed that their customers expected suppliers to have 'the ability to accommodate faster delivery speeds'.

The third firm performance aspect is the reliability dimension. Reliability has been classified as a certain quality of products and services that the customer can depend on from a firm (Banomyong and Supatn, 2011). It includes effectiveness in meeting customers' requirements (Petrovic-Lazarevic et al., 2007) and an ability to handle unexpected requirements (Closs and Mollenkopf, 2004, Chin et al., 2004, Fawcett et al., 2009). The supply chain executives interviewed in this study mentioned delivery reliability. The ability to meet quoted or anticipated delivery dates and quantities on a consistent basis is measured by a metric named "on time and in full". The other reliability metrics mentioned by the informants included order accuracy and transportation accuracy. However, on time and in full was used in this study as it encompasses both of those. Firms could not achieve delivery reliability without them.

The last dimension of firm performance is asset utilisation. It reflects the ability of a firm to manage its resources (Chan and Qi, 2003b). Asset utilisation could refer to a firm's financial performance (Söderberg and Bengtsson, 2010). In our interviews, the supply chain experts acknowledged both overall firm performance and financial performance. They stated that firm performance could be classified into two major areas. First, assets were used to generate income, measured by aspects such as inventory turnover, cost of goods sold, return on assets, return on investment, net profit margin etc. The second group concerns overall corporate performance measures such as customer satisfaction, sales growth and market share. Asset utilisation in this study is discussed in terms of (1) the ratio of the cost of goods sold to the average inventory during a time period – named inventory turnover, (2) the perception regarding the extent to which perceived company performance matches customer expectations – termed customer satisfaction, and (3) the company share of the total market size – termed market share.

Overall, the analysis reveals that SCM practices are related to firm performance for SMEs. The informants argued that their SCM practices lead to higher firm performance. The quantitative survey was conducted to validate this argument and the findings from it are reported in Section 8.3.

8.2.2 Reasons why SMEs implement SCM

Globalisation, technology and an increasingly competitive business environment are reportedly the factors that induce a firm to implement SCM

(Jacoby, 2009). Fawcett et al. (2009) defined these reasons for implementing SCM as drivers. 'SCM drivers' are described as the set of driving forces that affect a firm's desire to implement SCM. The literature lists several SCM drivers that originate from outside of a firm. These include economic globalisation, the information revolution and computing power, changes in trade regulations and end-customers' demand for higher-quality products and services (Ayers, 2006, Storey et al., 2006, Fawcett et al., 2009, Christopher, 2011).

Additionally, some drivers develop among a supply chain network's members. These include the desire to enhance the network's competitiveness, integration efforts to enhance supply chain capability, and the desire to improve product quality and process capabilities (Tan et al., 2002, Olhager and Selldin, 2004, Ayers, 2006, Fawcett et al., 2009). Furthermore, drivers exist within the focal firm, and these can be considered internal SCM drivers. Examples include the desire for cost minimisation, a faster customer response and improved customer satisfaction (Tan et al., 2002, Chin et al., 2004, Ayers, 2006, Fawcett et al., 2009).

The semi-structured interviews were used to gain insights into the rise in popularity of SCM. A list of SCM drivers drawn from the literature review was prepared for the interviewees. They were found to focus particularly on cost reduction, followed by the improvement of process capabilities and productivities. Global competition and end-customer needs were ranked next. One possible explanation might be that cost reductions are a major KPI for firms. To achieve their targets, firms identify cost reduction as a driver of SCM.

To justify this explanation, the quantitative survey analysis was used, as described in Section 8.3.

8.2.3 Enablers that assist SMEs to implement SCM

There are certain enablers that can facilitate SCM practices. These can include ideas, tools, actors and organisations that enhance SCM implementation. The most obvious, tangible, facilitator is IT and information systems. Information and communication technologies such as EDI, Internet technologies and others are used to transfer data in a standard format among supply chain network members in order to reduce data entry operations and increase accuracy and control (Cigolini et al., 2004, Larson et al., 2007). Technology advancements also reduce communication times and make managing the supply chain network more efficient (Tan et al., 2006). Thakkar et al. (2008) argued that information and IT help a firm to analyse data, reduce inventory and reduce lead-times. Intangible enablers, meanwhile, include top management support, organisational design and coordination tools (Mentzer et al., 2000, Cigolini et al., 2004, Storey et al., 2006, Larson et al., 2007, Lambert, 2008).

The respondents referred to IT as a major supporter of SCM. This finding is consistent with the literature review. The explanation for the importance of IT lies in the complexity of supply chain networks and collaboration. Without IT, systems and communications, SCM cannot be implemented effectively.

After this, top management support was highlighted by the interviewees. SCM involves many resources. Top management approval is needed to effectively organise those resources. Next, process integration among supply chain network members was identified, followed by an organisation designed to support coordination, cooperation and collaboration. Appropriate organisational design can reduce conflict among supply chain network members and enhance strategic alliances. The qualitative study also identified trust among network members and a focus on the end-customer as enablers of SCM. The list gathered from the interviews were used as measures in the quantitative study.

8.2.4 Obstacles to SCM implementation for SMEs

There are a number of things that could cause SCM practices to fail. These can be termed SCM impediments. The following are identified in the literature: employees' resistance to change, ineffective IT systems, a lack of trust and sharing between supply chain network members and improper allocation of resources (Goh and Pinaikul, 1998, Mentzer et al., 2000, Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009).

According to the expert opinions gathered in the semi-structured interviews, the major obstacle to SCM is employees' lack of understanding and resistance to change. These are internal obstacles. A firm can engage in education and training to eliminate them. Another obstacle occurs when the organisation is designed in terms of functional areas, which is sometimes termed the "silo" mentality. The informants explained that some of their employees have a limited view of the entire supply chain, and focus only on their own function, while failing to coordinate and collaborate with others. Implementing a supply chain collaboration programme could solve this "silo" mentality. Focusing on the long-term benefits would also be helpful. Other impediments include quality problems and communication problems among supply chain network members.

A checklist of SCM impediments was generated for the quantitative questionnaire survey.

8.2.5 A generic model of SCM practices

From the literature review, 98 items were identified as measures for the SCM practices model. Five underlying factors were constructed to form the structural model (the constructs). Then, in the semi-structured interviews, 41 items were identified based on importance ranking. The details were discussed in Sections 5.6 and 5.7. Three of the five constructs were specified as antecedents of SCM practices and treated as exogenous factors. They were the SCM drivers, SCM facilitators and SCM impediments. The two remaining constructs were the SCM practices and firm performance. Both are endogenous factors. Firm performance is also identified as a consequence of SCM practices.

However, the interview's respondents identified a relationship between the SCM drivers and the SCM facilitators. The SCM facilitators of a firm depend on its SCM drivers. Each company has different facilitators in line with its drivers.

8.3 Findings from the questionnaire survey

In Section 6.2, the preliminary analysis of the quantitative self-completed questionnaire study was presented. A comparative study was made of SCM practices within small-sized, medium-sized and large-sized firms in Thailand. It was discovered that there were no differences between the three groups in terms of their perceptions of the constructs. In this section, the findings from the questionnaires are discussed in depth. A latent variable analysis of the survey data regarding the SCM practices model reveals the common factor among the observed variables. Then, the relationships between the SCM practices and their antecedents and consequences are reported. The findings are divided into sub-sections.

8.3.1 The SCM practices measurement model

This sub-section explains the factor model of each latent variable in the SCM practices measurement model.

(1) The SCM drivers measurement model

In the questionnaires, the SCM drivers were measured by seven observed variables. The result of the factor analysis showed that there were two common factors among the variables under consideration.

The first common factor can be identified as external SCM drivers. It consists of global competition, end-customer needs, process integration and network collaboration. These factors drive an organisation to implement SCM. Their common ground is that they all originate from outside of the firm. It is necessary for a firm to remain competitive by responding to these forces. The literature also refers to these factors. Nix (2001) argued that the firm's globalisation objectives and strategies must be clearly understood prior to designing supply chain practices. It is also indicated that the integration of business processes with key members of the network leads to successful SCM implementation (Lambert, 2008). End-customer needs should be taken into account in the demand management of a firm. Failing to match supply with demand causes the bullwhip effect (Jacoby, 2009). To avoid the bullwhip effect, the SCM practice of strategic partnerships is recommended (Simchi-Levi et al., 2008). In the factor analysis, a Cronbach's alpha of 0.742 is calculated for the external SCM drivers scales. This means that the questionnaire consistently reflects this construct. The results of the factor analysis confirm the literature. When the data are loaded into the hypothesised model, it shows acceptable goodness-of-fit. The global competition scale correlates with the end-customer needs scale. This seems intuitive, since globalisation leads to higher competition and the need to offer more choice to the end-customer. This can concludes that the end-customer in today's marketplace is more demanding because of global competitors offering better products and services.

The second common factor is identified as internal SCM drivers. It is composed of cost reduction, process improvement and internal collaboration. As discussed in Section 2.3, these factors are determined by internal aims and objectives. In the factor analysis, a Cronbach's alpha of 0.747 is calculated from these internal SCM driver measures. The questionnaire accurately reflects this construct. The results of the factor analysis confirm the literature once again. When the data are loaded into the hypothesised model, it has adequate goodness-of-fit. The cost reduction measurement correlates with internal collaboration. This is unsurprising since cost reduction could not happen without internal collaboration.

Finally, the external and internal SCM drivers have a reported covariance of 0.59. This shows that the two latent variables are related to each other.

(2) SCM facilitators measurement model

As discussed in Section 6.2, the SCM facilitators are measured by seven items. The results of the factor analysis show a single common factor onto which all the variables load. The Cronbach's alpha is 0.855, showing that the questionnaire accurately reflects this construct. When the data are loaded into the hypothesised model, it shows a good goodness-of-fit. As a model with a single common factor, the correlations between the scales are identified from the suggestion of modification indices. The first measure, network integration, is correlated with IT, end-customer focus, trust and openness, and willingness to share knowledge with network partners. This can be explained by the following: (a) Network integration can only be effective with IT system support; (b) The end-customer is considered a part of the supply chain network. Therefore, network integration may be associated with end-customer focus. (c) In a similar way, a firm shows trust and openness towards its supply chain network members through integration. (d) Finally, in order to have effective network integration, a willingness to share knowledge with one's partners is required. Next, top management support correlates with a willingness to share knowledge. Support from top management can make knowledge sharing more productive. The final correlation between IT and trustful and open communication can be explained by the fact that using IT is an effective means of communication.

(3) SCM impediments measurement model

The SCM impediments construct was measured by seven items in the questionnaire. The results of the factor analysis show a single common factor.

Cronbach's alpha is 0.815. Thus, the questionnaire accurately reflects this construct. When the data are loaded into the hypothesised model, it shows a good goodness-of-fit. As a model with a single common factor, the correlations between the scales are suggested by the modification indices. Employees' resistance shows a correlation with employees' lack of knowledge and communication problems. Obviously, the resistance of the employees to SCM implementation could be caused by inadequate knowledge and poor communication. Next, communication problems and quality problems are correlated. This may be because quality problems cannot be solved if the feedback is poor.

(4) SCM practices measurement model

SCM practices are assessed with twelve measures in the questionnaire. The factor analysis produces a single common factor. Cronbach's alpha is 0.959 showing that the questionnaire reflects the construct accurately. When the data are loaded into the hypothesised model, it shows a good goodness-of-fit. The modification indices suggest that the measures of the latent variable include several correlations. The SCM practices measurement model was therefore modified accordingly to reflect the additional error covariance terms as was shown in Figure 7-6, Section 7.3.

(5) Firm performance measurement model

Finally, firm performance was assessed with eight measures in the questionnaire. The factor analysis showed a single common factor. Cronbach's alpha was 0.912 showing that the questionnaire accurately reflected the construct. When the data were loaded into the hypothesised model, it showed a high goodness-of-fit. The modification indices showed several correlations between the measures of the construct. Thus, the firm performance measurement model was modified accordingly to reflect the additional error covariance terms, as was shown in Figure 7-7, Section 7.3.

8.3.2 The SCM practices structural model

This sub-section on the structural model discusses four different models from the study. First, the multiple regressions based on the quantitative data are discussed. Then the first-order CFA structural models, both original and modified, are evaluated. Finally, the results of the second-order CFA structural model are reported.

(1) The multiple regression models

From the empirical study reported in Chapter 6, four SCM antecedents were identified, namely external SCM drivers, internal SCM drivers, SCM facilitators and SCM impediments. Then, multiple regressions were run between the four predictors and SCM practices. The results reported in Section 6.5 showed the R^2 to be 0.293. This means that the four predictors represent 29.3% of the variation of SCM practices in a firm. Thus, there is 70.7% of the variation in perceptions of SCM practices that is not explained. Therefore, other variables must have an influence as well. Next, the *F*-ratio value that describes how much the model has corrected the prediction of outcome compared to the level of inaccuracy of the model (Field, 2009). The *F*-ratio was 31.763, significant at $p < 0.001$. According to the null hypothesis, the predictors are better at predicting than the regression model. This result illustrates that there is less than a 0.1% chance that an F-ratio this large would happen if the null hypothesis were true.

The last topic to be discussed is the model parameters. The standardised coefficients indicate the level of importance of each predictor. The external SCM drivers are considered more important than the internal SCM drivers. The external SCM drivers and SCM impediments have a comparable degree of importance in the model. However, from the t-statistics, it can be concluded that the internal SCM drivers have no statistically significance in the model.

Next, the impact of SCM practices on firm performance should be discussed. The relationship between SCM practices and firm performance was tested with a simple regression method whereby SCM practices are now acting as the predictor of firm performance. The R^2 of 0.311 shows that the 31.1% of the variation in perceptions of firm performance can be explained by the perceptions of SCM practices. This means that 68.9% of the variation in the perceptions of firm performance is explained by other variables. The F-ratio is 139.738 which is statistically significant. This implies that the model is significantly better at predicting the outcome variable than simply using the mean would be. The standardised beta shows a value of 0.558, which represents that an increase of one in the score for SCM practices would increase the score for firm performance compared to one's competitors by 0.558. The regression model with relationships among the latent variables is shown in Figure 8-1.

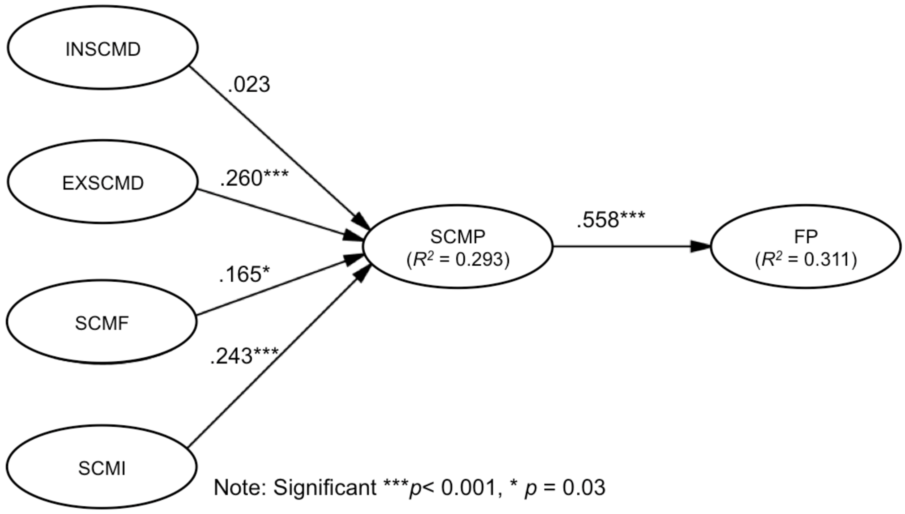


Figure 8-1 The SCM practices regression model evaluation

(2) The CFA structural model

According to the analysis presented in Section 7.4, the structural model from the literature was formulated as a CFA structural model shown in Figure 7-9. The dependent variables of the structural model are SCM practices and firm performance. The independent variables are SCM drivers, SCM facilitators and SCM impediments. The model is explained below.

The results from Section 7.4 demonstrate the impact of the antecedents of SCM on SCM practices, with an R^2 of 0.295. This means that the three antecedents represent 29.5% of the variation in perceptions of SCM practices in a firm. This means that these three antecedents cannot explain 70.5% of the variation in SCM practices. Therefore, other variables must have an influence as well. The standardised beta of 0.267 for the SCM drivers means that an increase of one in the score for SCM drivers will increase the score for SCM practices by 0.267. Meanwhile, the standardised beta for the SCM facilitators of 0.062 means that an increase of one in the score for SCM facilitators will increase the score for SCM practices implementation by 0.062. Finally, the standardised beta of the SCM impediments of 0.269 demonstrates that an increase of one in the score for SCM impediments will increase the score for SCM practices implementation by 0.269. It should also be noted that the SCM facilitators are statistically insignificant in the model.

Next, the impact of SCM practices on firm performance is quite similar to the result identified in the regression model. The R^2 of 0.355 shows that 35.5% of the perception of firm performance can be explained by the perception of SCM practices. This means that 64.5% of the variation in the perception of firm performance is accounted for by other variables. The standardised beta of 0.596 shows that an increase of one in the score for implementation of SCM practices will increase the score for firm performance compared to competitors by 0.596.

Altogether, the SCM practices model results are reported in Table 8-1.

Table 8-1 Summary of SCM practices models

Model	Predictors of SCM practices	Standardised beta	R^2 of SCM practices	R^2 of Firm performance
Regression Model	External SCM drivers	0.260	0.293	0.311
	Internal SCM drivers *	0.023		
	SCM facilitators	0.165		
	SCM impediments	0.243		
	SCM practices (predictors of firm performance)	0.558		
CFA Structural Model	SCM drivers	0.267	0.295	0.355
	SCM facilitators *	0.062		
	SCM impediments	0.269		
	SCM practices (predictors of firm performance)	0.596		

Note: * Statistically insignificant

8.4 The impact of the number of years of operation and firm size on the SCM practices model

Next, the number of years for which the company has been operating is included in the SCM practices model as a control variable. The result shows that including the number of years of operation helps the model to explain both the level of SCM practices and firm performance. Then, firm size is included in the model as another control variable. Firm size does not contribute towards explaining either the level of SCM practices or firm performance.

This means that firm size does not have any influence on the level of SCM practices or firm performance, while the number of years of operation makes a positive contribution to both. The longer a firm has been operating, the greater will be its management's experience at managing its supply chain. This finding is in line with the study conducted by Ates et al. (2013), which concluded that SMEs' knowledge is acquired through experience and correlated with tacit knowledge.

8.5 The effect of SMEs' use of SCM practices on firm performance

To assess the level of SCM practices among firms with different levels of perceived performance, an ANOVA was conducted. The overall SCM practices level absolutely contributes to variation in firm performance. A higher level of SCM practices leads to a higher level of firm performance. This confirms the correlation between SCM practices and firm performance. The firms with medium and high levels of performance apply SCM practices to different degrees. Meanwhile, the low- and mid-performance firms have moderately different levels of practices. Some of the SCM practices are indifferent to whether the performance level of the firm is low or medium, however, namely IT coordination, a clear vision of SCM, JIT/Lean implementation, benchmarking and performance measurement, a quality policy having been established, using the supply chain concept to design product, process and packaging, and using customer feedback as an input to design.

8.6 Comparative analysis of exploratory and survey findings

This study focused on SMEs in Thailand. It applied SCM processes identified by the GSCF (Lambert, 2008) to investigate the SCM practices of Thai SMEs and their performance. First, an exploratory study using semi-structured interviews with SCM executives of Thai companies was conducted. Then, a questionnaire survey was developed to fulfil the research objectives. The findings from the interviews and survey contributed significantly to the body of knowledge on the SCM practices in Thai SMEs. These significant additions enhanced the SCM knowledge base in a developing world context. The findings of the comparison between the exploratory semi-structured interviews and self-completion questionnaire survey are summarised below in Table 8-2.

Table 8-2 Comparative analysis of the findings

	Exploratory	Survey	Previous study
1	The SCM practices assisted firms to achieve higher firm performance.	The higher level of implementation of SCM practices led to greater levels of firm performance in comparison with its competitors.	(Petrovic-Lazarevic et al., 2007, Bayraktar et al., 2009, Chong and Chan, 2011)
2	Firm implemented SCM in order to reduce cost and improve process capabilities and productivities.	External factors such as global competition and the desire to enhance competitiveness forced the firm to implement SCM. Whilst internal factors such as cost reduction and process improvement drove firm to implement SCM.	(Nix, 2001, Tan, 2002, Chin et al., 2004, Ayers, 2006, Storey et al., 2006, Fawcett et al., 2009, Jacoby, 2009, Christopher, 2011)
3	The major supporters of SCM implementation consisted of IT, top management support and process integration among supply chain network members.	In SCM facilitators, the network integration was enhanced by IT system integration, trust and openness among network members and end-customer focused.	(Mentzer et al., 2000, Cigolini et al., 2004, Storey et al., 2006, Larson et al., 2007, Lambert, 2008, Thakkar et al., 2008a)
4	The crucial obstacles to implement SCM in an organisation were employees' lack of understanding and resistance to change.	Employee resistance to implement SCM in a firm had strong relationship with employees' lack of knowledge and communication problems.	(Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009)
5	SCM drivers of the firm determined its SCM facilitators.	SCM drivers had very high prediction of the variation in the SCM facilitators.	Such a study has not previously been conducted in the usage of SCM within Thai SMEs.

Questioning and evaluation of interview research with Thai practitioners in this study revealed SCM practices being associated with firm performance. This finding was confirmed by the survey research through identifying that a greater level of firm performance in comparison with its competitors could be achieved by increasing the level of implementation of SCM practices. Conclusions from the questionnaire survey demonstrated the detail of the relationships in the measurements, which were explained by descriptive and inferential statistics techniques enhanced by the interview respondents' judgements. Table 8-2 concluded that findings from the questionnaire survey enhanced understandings in every aspects of the SCM practices model.

8.7 Summary

This chapter demonstrates the key findings from the qualitative and quantitative research methods. They were discussed in relation to the research questions. A new perspective on SMEs' implementation of SCM practices and the impact on firm performance was identified. The next chapter provides the conclusions, implications, recommendations and ideas for future developments. Then, a final conclusion will be drawn.

"No great discovery was ever made without a bold guess..."

(Isaac Newton)

CHAPTER 9 CONCLUSIONS

9.1 Introduction

The previous chapters have examined the background and research methods for this study, the data collection and analysis, and discussed the findings. This final chapter provides an overview of the entire study with a particular focus on the contribution it makes to theory development and practical knowledge. An analysis of the weaknesses and limitations of the study is made. The findings of the study are considered to highlight some potentially interesting areas for future research.

9.2 Summary of the literature review

The study of SCM has been of substantial importance since the mid-1980s and has recently become a topic of increasing interest to practitioners and academic researchers (Cooper et al., 1997, Mentzer et al., 2001a, Sweeney, 2009). A number of academic researchers have defined SCM by including the end-customer's satisfaction as a key driver (Cooper et al., 1997, Lambert et al., 1998, Coyle et al., 2003, Long, 2003, Jespersen and Skjøtt-Larsen, 2005, Lambert, 2008, Jacoby, 2009, Harrison and Hoek, 2011). In addition, SCM is said to incorporate both the minimisation of system-wide costs and the delivery of superior customer value to the end-customer through integration, coordination and control among the supply network members (Keebler et al., 1999, Handfield and Nichols, 2002, Mentzer, 2004, Bowersox et al., 2013). The initial literature review conducted for this study revealed a research gap on current supply chain implementation in the context of Thai SMEs. The controversy over SCM in SMEs is deliberated by both academics and practitioners (Li et al., 2006, Koh et al., 2007, Petrovic-Lazarevic et al., 2007, Bayraktar et al., 2009, Banomyong and Supatn, 2011, Chong and Chan, 2011).

In order to clearly understand SCM practices, both antecedents and consequences of SCM were investigated. The antecedents to SCM are the factors that enable or obstruct the implementation of a supply chain philosophy in a firm, while the consequences are what result from practising SCM (Mentzer et al., 2001a). Understanding both the antecedents and the consequences of SCM allows an organisation to introduce SCM practices at a proper level (Thakkar et al., 2008a).

The first type of antecedent is SCM drivers. These are strategic factors that help to determine an appropriate level of SCM practice. Fawcett et al. (2009) defined SCM drivers as the set of driving forces that affect a firm’s likelihood of implementing SCM. The next set of antecedents is the SCM facilitators. These are defined as the enablers that move SCM forward. They can be people, organisations or technology (Mentzer et al., 2000). Finally, SCM impediments hinder an organisation from successfully implementing SCM. Moreover, they lead to unfavourable firm performance (Goh and Pinaikul, 1998, Mentzer et al., 2000, Mentzer, 2001, Tan et al., 2006, Fawcett et al., 2008, Bayraktar et al., 2009, Fawcett et al., 2009).

The consequence of SCM practices is the performance of the firm. The firm's performance reflects the efficiency and effectiveness of its processes in producing its products and services. Firm performance can be measured in terms of cost, time, reliability and asset utilisation (Closs and Mollenkopf, 2004, Chin et al., 2004, Fawcett et al., 2009, Banomyong and Supatn, 2011). The literature review contributed to the development of the SCM practices model for this study.

9.3 Contribution to theoretical understanding

This study has focused on SMEs in Thailand. It adopted SCM processes identified by the GSCF (Lambert, 2008) to investigate the SCM practices of Thai SMEs and their performance. Such a study has not previously been conducted in the usage of SCM within Thai SMEs. This study addressed three main practices of SCM as: network relationship management, manufacturing flow management, and product development and commercialisation. It also described the antecedents and consequences of SCM practices in order to gain more understanding of the justifications for SCM implementation. The contextual-level implications of the study are recapped below:

(1) As indicated in Section 8.2, there are arguments both for and against the implementation of SCM in SMEs. For example, Banomyong and Supatn's (2011) study demonstrated that, in a sample group of SMEs, the SCM

performance metrics were on a par with Thai multinational companies in the supply chain past performance database, but still very far from major Thai companies. This thesis has thus looked at how and why SCM practices are correlated with firm performance. Antecedents and consequences were developed and included in the SCM practices model in order to obtain insights. The findings add to theoretical knowledge, in the Thai SMEs' context; both the qualitative and quantitative results provide further statistically significant evidence of the relationships of SCM practices and firm performance. This supports the claim that SCM implementation is suitable for SMEs (Petrovic-Lazarevic et al., 2007, Bayraktar et al., 2009, Chong and Chan, 2011).

(2) The research performed in this thesis contributes an empirical analysis of the SCM practices model of Thai SMEs. Lists of measures of the SCM practices model's constructs were collected. The constructs were categorised at a second level. For example, SCM facilitators were segregated into tangible and intangible ones. The different aspects of the sub-level constructs allowed for multidimensional theoretical analysis. Additionally, this paves the way for academics to adopt these scales for further research in the SCM practices area. Furthermore, the items were associated to each latent construct and rated in terms of importance according to expert opinion. This research also extended a record of constructs in SCM practices model and their relationships identified in previous studies (Tan et al., 2002, Chen and Paulraj, 2004, Min and Mentzer, 2004, Larson et al., 2007). With regard to future research, it would be interesting to measure whether and how these scales differ for SMEs in other countries.

(3) There were no differences found between the segments of micro, small, and medium-sized firms in terms of SCM and its consequences. The level of SCM practices and firm performance perceptions were compared between these three groups. The research enhanced the prior study by Fawcett et al. (2009). Fawcett et al. suggested that there was no pattern of statistical differences of performance improvement from SCM practices among the diversity of firm's size. In this study, the relationship between firm performance and SCM practices was similar among the three groups. This is particularly crucial since few studies conducted in Thailand have made such a comparison.

(4) The effective SCM facilitated firms to improve their performance (Chow et al., 2008). The overall level of SCM practices in the study is found to have a radical and positive influence on the level of firm performance. The impact was particularly high between mid-performance and high-performance firms, while the difference between low and mid-performance firms was moderate. Some of the SCM practices differed little between low and mid-performance firms, such as IT coordination, a clear vision of SCM, JIT/Lean implementation, benchmarking and performance measurement, a quality policy having been established, using supply chain concept to design, and customer feedback being used as an input to design.

(5) SCM practices may be influenced by contextual factors, such as the firm size, the length of firm has been operating and the type of industry (Li et al., 2006). Therefore, the findings of this research support the view that the number of years for which a company has been operating has a positive relationship with the level of SCM practices and firm performance. The longer a firm has

been operating, the more experience there is in managing its supply chain. However, firm size has no relationship with either the level of SCM practices or a firm's performance.

(6) The research applied the *causal steps strategy,* familiarized by Baron and Kenny (1986), in which the researcher estimated the paths of the model using ordinary least square regression and determined the degree to which several conditions were met. The results of the study revealed that there was convincing evidence of a strong mediating pathway from the SCM drivers through the SCM facilitators to the SCM practices. This urged researchers to be more sensitive to the statistical data analysis technique used (Hayes, 2013). It contributed to conceptual clarity in summarising empirical study.

(7) The study demonstrated that SCM drivers had a positive relationship with SCM practices. The author investigated this relationship for the different levels of firm size and found that an increase in SCM drivers led to an expansion in SCM practices at different levels. For the medium firm size, SCM drivers were associated with a relatively small gain in SCM practices. For the small-sized firms, increasing the SCM drivers led to a greater increase in SCM practices. For the micro firm size, an increment in the SCM drivers contributed to a powerful rise in SCM practices. Vaaland and Heide (2007) studied SCM practices in SMEs and found that some practices had strong associations with company size. Similar to this research, the firm size moderated relationships between SCM drivers and SCM practices. This contributed to a study of moderating relationships theory.

This study has contributed significantly to the body of knowledge on the SCM practices in Thai SMEs. This enhanced knowledge base will benefit the academic community in their understanding of SCM in a developing world country. The contributions are summarised in Table 9-1.

Table 9-1 Theoretical contributions

	Contribution	Body of knowledge
1	Scales and measurements development in SCM practices model with antecedents and consequences	Thematic analysis (Bryman, 2008)
2	Providing new data and empirical insights into the relationship between SCM practices and firm performance	Correlation and regression (Hair Jr. et al., 2010)
3	Level of SCM practices has a radical and positive impact on the level of firm performance	One-way independent ANOVA (Field, 2009)
4	Disclosing the influence of SCM facilitators on the relationship between SCM drivers and SCM practices	Mediating relationships (Sobel, 1982)
5	Explaining the effects of firm size on the relationship between SCM drivers and SCM practices	Moderating relationships (Baron and Kenny, 1986)
6	Identifying various SCM factors so as to develop key SCM indicators according to the SCM practices model	Factor analysis (Field, 2009)
7	Evaluating developed measurements of the SCM practices model	EFA (Kline, 2011)
8	Investigating relationships among the antecedents and consequences in the SCM practices model	Path analysis and SEM (Byrne, 2010)

9.4 Implications for practice

This study has implications for both SCM practitioners and policy makers. For SCM practitioners, six major guidelines are summarised below. Following that, the implications for policy makers will be discussed.

9.4.1 Implications for SCM practitioners

(1) The results from the study reveal that SCM drivers and facilitators have a solid relationship. There are several supply chain facilitators that a firm may target. This research recommends that firms prioritise those facilitators that are related most strongly to its driver. For example, the SCM driver of an automotive manufacturing company might be cost reduction. Thus, facilitators related to cost reduction, such as process integration, should be considered before SCM is implemented.

(2) The root causes of SCM impediments need to be understood. From the questionnaire in this study, the questions about SCM impediments aim to measure understanding of the barriers to implement SCM practices in the firm. Moreover, the enhanced understanding of SCM barriers of the firm, improves the possibilities to plan successfully and effectively implement SCM practices. Therefore, according to the correlation analysis of the measures, some of the SCM obstacles can be regarded as influencing factors that lead to failure in implementing SCM. For instance, employee resistance to SCM is caused by employees' lack of knowledge and poor communication. Addressing these issues will lead to decreased resistance to change from employees.

(3) In network relationship management, the material flow of SCM is the most important. SCM practitioners perceive material management as crucial to managing their business. The efficient management of material flow across supply chain network members leads to competitive advantage from both lower costs and a higher service level provided to the end-customer.

(4) Effective communication can be achieved through timely and adequate information sharing. Effective communication leads to supply chain competence. Therefore, a firm should give priority to sharing information with supply chain network partners.

(5) Firm performance is connected to SCM practices. Proficient SCM leads to higher firm performance. Unsuccessful SCM practices usually originate from improper SCM antecedents, resulting in unfavourable firm performance

(6) In the evaluation of SCM practices mean scores, the SMEs were found to focus on day-to-day material management rather than strategic-level planning. Their limited resources compel SMEs to undertake short-term, quick-return SCM practices instead of those with long-term yields.

9.4.2 Implications for policy makers

(1) This study affirms that SCM practices lead to a higher level of firm performance. The Office of Small and Medium-sized Enterprises Promotion in Thailand should make it a priority to educate SMEs so that they understand SCM. Furthermore, the standard SCM processes should be developed so as to enhance the interconnections among supply chain network members.

(2) Providing IT availability to enhance the competence of SMEs. IT is the backbone of SCM. The government should provide a countrywide communications infrastructure in order to support connectivity among supply chain network members.

(3) Developing SCM facilitators to aid SMEs' operations. The SCM facilitators were identified in this study. These enablers should be the development and

promotion priorities in the action plan for SMEs' promotion. For instance, SMEs could more effectively implement SCM if they used standard performance measures.

9.5 Research limitations

This research has attempted to enhance the understanding of how Thai SMEs implement SCM. The findings have a number of managerial implications. Some of the Thai SMEs have resisted implementing SCM because they believe that SCM practices will lead to lower profits. This research provides evidence against such beliefs. However, this study, like others, has its limitations:

(1) In the qualitative sampling, a non-probability, quota sampling approach was used. Members of the FTI were approached. It could be argued that this approach introduced bias by attracting firms that already fully comprehended SCM practices. However, based on the semi-structured interviews, the levels of SCM understanding and implementation varied among the sample firms. Thus, the sample should be treated as providing a random distribution of SCM understanding.

(2) In the quantitative sampling, the members of the FTI were used as a representative sample of Thai SMEs; thus, the results are generalisable only to the extent that FTI members resemble the population of Thai SMEs. However, this was considered the most convenient and effective method of reducing bias although some may have remained.

(3) The response rate of this study is somewhat low; however, given the subject matter and its complexity, it is deemed acceptable. The response rate is comparable to a previous study of SMEs in Thailand, on the subject of SMEs' approach to SCM (Udomleartprasert et al., 2003), and provides adequate data for analysis.

(4) The definitions of small and medium enterprises, both in terms of number of employees and asset value, are not uniform across the globe (Ayyagari et al., 2007). These inconsistencies in the SME definitions may lead to distortions of the conclusions about SCM practices model for countries other than Thailand.

(5) Lambert (2008) identified eight supply chain management processes, this study included the major four processes. A further limitation of this study is that another four processes were not included in the study. The relationship of SCM antecedents and SCM consequences to the remaining processes of SCM practices could add more explanation to the relationships in the SCM practices model.

(6) Another limitation of this study is the use of respondents from various industries. The different supply chain environments in each industry could have led the respondents to answer the questionnaire differently. Research focused on a particular industry could solve this issue but it would make the results less generalisable.

9.6 Future developments

This study proposes a SCM practices model with a set of construct measurements. Therefore, the empirical study can be replicated using different samples and research settings. This would be expected to contribute further evidence regarding the validity and generalisability of the research results. The researcher identifies the following avenues of future research in order to advance the provided solution to the studied:

(1) Lambert (2008) identified eight SCM processes which this study examined four main processes as customer relationship management, supplier relationship management, manufacturing flow management and product development and commercialisation. Further study of the SCM practices model should focus on the remaining four SCM processes identified by, namely customer service management, demand management, order fulfilment and returns management. It would be interesting to study the relationship of the SCM antecedents and the SCM consequences to these remaining SCM practices. This broader area of study covers the supply chain management processes both strategic and operational sub-processes. Extending processes should strengthen the model proposed and existing research results.

(2) With regard to the structural model presented here, it would be worthwhile to analyse whether there are moderating effects on the variables. Moderators such as type of industry and number of years of operation of the firm could be taken into account. For example, it would be interesting to determine whether moderators influence the effect of SCM practices on firm performance. In

comparison to standard regression approaches, such complex extensions of these concepts of moderation would be interesting.

(3) There is an opportunity to extend this study to include aspects that are specific to particular types of supply chain or industries. Given the considerable interest in automotive supply chain in Thailand, which is one of its most important industries. The International Organization of Motor Vehicle Manufacture reported that Thailand assembled 2.53 million cars in 2013 (OICA, 2013). This made Thailand the 9th largest motor vehicle manufacturing country in the world. Main multinational automotive industry leaders in Thailand contain Toyota Motors, Isuzu, Honda Automobile, Nissan Motors, General Motors, Mitsubishi Motors, Suzuki Motors, BMW Manufacturing, Tata Motors, Ford Motor and Mazda (BOI, 2014). There are more than 2,400 firms with 500,000 employments in the whole supply chain network members. The proposed SCM practices model can be extended to address specific requirements of the automotive industry on SCM practices.

(4) It would be interesting to investigate the applicability of the SCM practices model in different settings i.e. different countries and different sectors such as the tourism supply chain. The World Travel & Tourism Council reported that travel and tourism contributed 15.3 Billion Pounds to the GDP of Thailand (WTTC, 2013). This SCM practices model replication to the tourism sector in Thailand could enable further understanding of its drivers, facilitators and influences on firm performance.

(5) Finally, this research can be extended by conducting a case study of Thai SMEs to gain a thorough understanding of how SCM practices are

implemented, which exact drivers, facilitators and impediments influence these practices, and what the results are in terms of the performance of firms and their supply chains.

9.7 Concluding remarks

Studies of SCM in SMEs are scarce, especially in Thailand. However, the Thai government has recently become more interested in SMEs. Evidence of the promotion of SMEs can be found in several government support programmes. This research aims to help Thai SMEs improve their competences by suggesting a SCM practices model. A research methodology including both qualitative and quantitative approaches is applied. An EFA and a CFA, along with a full structural equation model detailing SCM practices, were formulated and tested on a large sample of 311 cases. This model identified relationships among the constructs of the SCM practices model and verified the fit of the data. The model not only contributes towards enhances understanding of the SCM practices of Thai SMEs but also presents a useful conceptualisation, which practitioners and policy makers can use to promote SCM.

This study should thus make a valuable contribution towards the improvement of Thai SMEs' competences, especially with regard to SCM practices. Such future developments among Thai SMEs are eagerly awaited.

APPENDIX A: QUALITATIVE INTERVIEW TOPIC GUIDE

Part (A) Supply Chain Management

(1) SCM Drivers

SCM drivers are strategic factors which result in a competitive advantage and which help to determine the appropriate level of SCM practices.

1. To what extent do you agree that the following SCM drivers apply to your company?
    a. Drivers external to the supply network:
        i. Global competion to our network
        ii. Trade regulations
        iii. Information revolution
        iv. End-customer needs
        v. Network wants to be more competitive
        vi. Others______________________________
    b. Within-supply-network drivers:
        i. Improvement of product quality, process capabilities and/or productivities
        ii. Process integration among network
        iii. Real-time information exchange among network
        iv. Outsourcing to network members in order to reduce costs
        v. Competition shift from company base to network base
        vi. Others________________________________
    c. Within-company drivers:
        i. Sustainable growth and competitive advantage
        ii. Internal functions collaboration
        iii. Focus on core competency of process and/or function
        iv. Logistics cost reduction
        v. Others________________________________

(2) SCM Facilitators

SCM facilitators are the elements that make SCM practices easier to accomplish. They represent aspects of the environment of the supply chain network that help SCM practices.

1. To what extent do you agree that the following SCM facilitators apply to your company?
    a. Tangible SCM facilitators:
        i. Information technology
        ii. Focus on end-customer
        iii. Process integration among network members
        iv. Customer database available for our network members
        v. Equal benefit-sharing framework for our network members
        vi. Re-engineering working processes among our network members
        vii. Effective communication channels
        viii. Established performance measurement within network

ix. Quality management system implemented in our network
x. Others________________________________

b. Intangible SCM facilitators:
   i. Willingness to share knowledge
   ii. Top management understanding and support
   iii. Network culture of supporting customer requirements
   iv. Trust and openness among network members
   v. Organisation designed to support coordination, cooperation and collaboration
   vi. Others__________________________________

(3) SCM Impediments

SCM impediments are obstacles, which can potentially cause SCM practices to fail.

1. To what extent do you agree that the following SCM impediments apply to your company?
   a. Internal SCM impediments:
      i. Employees' resistance
      ii. Organisational "silo" structure
      iii. Employees' lack of understanding
      iv. Top management does not allocate sufficient budget and resources
      v. Lack of long-term strategic vision to implement supply chain
      vi. Unstable processes due to machine breakdowns
      vii. Lack of ability to manage network partners
      viii. Others________________________________
   b. External SCM impediments:
      i. Laws and regulations do not support cooperation
      ii. Time constraints on collaboration
      iii. Communication problems and/or confidential information
      iv. Lack of trust among network members
      v. Incompatible information systems among network members
      vi. Network members have different visions, strategies and objectives for SCM
      vii. Quality problems from network members
      viii. Some network members do not support the SCM concept Others__________________________________

(4) SCM Processes

SCM is the management across a network of upstream and downstream organisations of material, information and resource flow that leads to the creation of value in the form of products and/or services.

1. To what extent do you implement the following SCM processes in your company?
   a. Network relationship management

b. Manufacturing flow management
c. Product development and commercialisation

2. Explain each process according to the three main flows:
    a. Material flow
    b. Information flow
    c. Resource flow (Inter-firm relationships, Finance, HR, Equipment)

(5) SCM Performance

SCM performance refers to improvements in network capability according to the end-customer's requirements. It can be measured by various elements.

1. To what extent do you agree that the following SCM performance measures have improved in your company?
    a. Costs
        i. Logistics costs
        ii. Total costs
        iii. Others______________________________
    b. Time
        i. Delivery speed
        ii. Delivery time flexibility
        iii. Others________________________________
    c. Reliability
        i. Product flexibility
        ii. Delivery dependability
        iii. Order fill capacity
        iv. Order flexibility
        v. Others________________________________
    d. Asset utilisation
        i. Return on Assets (ROA)
        ii. Inventory turnover
        iii. Customer satisfaction
        iv. Market share
        v. Others________________________________

Part (B) Personal, Company and Network Information

(6) General Information

6.1 Company name ______________________________

Please mark the appropriate box with a tick (√) or cross (X).

6.2 Type of industry

Appliances, Furniture and Hardware		Food Processing and Distribution	
Motor and Transportation		Mass Merchandising and Retail	
Clothing and Textiles		All Others	

6.3 Number of full-time employees

1	Less than 25	
2	25 to 50	
3	51 to 200	
4	More than 200	

6.4 Your position in the company

1	Owner / Partner / MD / CEO / President	
2	Supply Chain Director / VP / Manager	
3	Logistics Director / VP / Manager	
4	Manufacturing Director / VP / Manager	
5	Sales or Marketing Director / VP / Manager	
6	IT Director / VP / Manager	
7	Finance or Accounting Director / VP / Manager	
8	All Other	

6.5 Your work experience

Work experience with	**Number of years**
Current employer	
Related to SCM area	
Total work experience	

6.6 Your highest education level

1	High school	
2	Diploma / Vocational	
3	Bachelor's degree	
4	Master's degree or above	
5	Other (please specified)	

Thank you for your kind participation in this survey. Your answers will be kept confidential.

APPENDIX B: QUANTITATIVE QUESTIONNAIRE SURVEY

Part (A) Supply Chain Management

1. SCM Drivers

SCM drivers are strategic factors which result in a competitive advantage and which help to determine the appropriate level of SCM practices. ***How important are the following SCM drivers in terms of influencing your SCM implementation?***

1= Unimportant (U), 2= Of Little Importance (LI), 3= Moderately Important (MI), 4= Important (I), 5= Very Important (VI).		**U**	**LI**	**MI**	**I**	**VI**
1.1 Drivers external to the supply chain network						
1	Global competition of our network	1	2	3	4	5
2	End-customer needs	1	2	3	4	5
1.2 Within-supply-network drivers						
3	Process integration among network members	1	2	3	4	5
4	Network members' collaboration	1	2	3	4	5
1.3 Within-company drivers						
5	Cost reduction	1	2	3	4	5
6	Improvement of process capabilities and productivities	1	2	3	4	5
7	Internal function collaboration	1	2	3	4	5

2. SCM Facilitators

SCM facilitators are the elements that make SCM practices easier to implement. They represent the aspects of the environment of the supply chain network that help SCM practices. ***How important do you think the following SCM facilitators are in supporting SCM implementation?***

1= Unimportant (U), 2= Of Little Importance (LI), 3= Moderately Important (MI), 4= Important (I), 5= Very Important (VI).		**U**	**LI**	**MI**	**I**	**VI**
2.1 Tangible SCM facilitators						
8	Information technology	1	2	3	4	5
9	Process integration among network members	1	2	3	4	5
10	Focus on end-customers	1	2	3	4	5
2.2 Intangible SCM facilitators						
11	Top management understanding and support	1	2	3	4	5
12	Organisation designed to support coordination, cooperation and collaboration	1	2	3	4	5
13	Trust and openness among network members	1	2	3	4	5
14	Willingness to share knowledge	1	2	3	4	5

3. SCM Impediments

SCM impediments are obstacles, which can potentially cause SCM practices to fail. ***How important are the following SCM impediments in preventing SCM implementation?***

1= Unimportant (U), 2= Of Little Importance (LI), 3= Moderately Important (MI), 4= Important (I), 5= Very Important (VI).		U	LI	MI	I	VI
3.1 Internal SCM impediments						
15	Employees' lack of understanding	1	2	3	4	5
16	Employees' resistance	1	2	3	4	5
17	Organisation's "silo" structure	1	2	3	4	5
3.2 External SCM impediments						
18	Quality problems from network members	1	2	3	4	5
19	Communication problems and confidential data	1	2	3	4	5
20	Laws and regulations not supportive	1	2	3	4	5
21	Some network members do not support SCM concept	1	2	3	4	5

4. SCM Practices

SCM is the management across a network of upstream and downstream organisations of material, information and resource flow that leads to the creation of value in the form of products and/or services. ***To what degree are the following SCM practices implemented in your organisation?***

1= Not at all Implement (NI), 2= Of Little Implement (LI), 3= Partially Implement (PI), 4= Implement (I), 5= Fully Implement (FI).		NI	LI	PI	I	FI
4.1 Network relationship management						
	4.1.1 Material flow					
22	Our network members jointly manage inventory and logistics in the supply chain	1	2	3	4	5
	4.1.2 Information flow					
23	Our network uses IT to create effective communication	1	2	3	4	5
	4.1.3 Resource flow (Inter-firm relationships, Finance, HR, Equipment)					
24	Our network builds long-term relationships with established guidelines	1	2	3	4	5
25	Our network has a clear vision of SCM	1	2	3	4	5
4.2 Manufacturing flow management						
	4.2.1 Material flow					
26	Our network uses the concept of JIT / Lean as a competitiveness tool	1	2	3	4	5
	4.2.2 Information flow					
27	Our network members formally exchange manufacturing information on a regular basis, i.e. S&OP meeting	1	2	3	4	5
	4.2.3 Resource flow (Inter-firm relationships, Finance, HR, Equipment)					
28	Our network implements benchmarking and performance measurement	1	2	3	4	5
29	Our network has a standard quality policy for both product and process, with established guidelines	1	2	3	4	5
4.3 Product development and commercialisation						
	4.3.1 Material flow					
30	Our network has aligned network strategy with product, sourcing, manufacturing and distribution strategy	1	2	3	4	5

	4.3.2 Information flow	1	2	3	4	5
31	Our network members formally share customer requirements and design information through the upstream network	1	2	3	4	5
	4.3.3 Resources flow (Inter-firm relationships, Finance, HR, Equipment)	1	2	3	4	5
32	Our network uses the supply chain concept to design product, process and packaging	1	2	3	4	5
33	Our network has a customer feedback programme which provides inputs into product development	1	2	3	4	5

5. Firm Performance

Firm performance here relates to network capability based on end-customer requirements. ***Please specify the performance of your firm in relation to its major competitors over the past year (2011) for each indicated measure.***

1= Definitely Worse than Competitors (DW), 2= Worse than Competitors (W), 3= Comparable with Competitors (CC), 4= Better than Competitors (B), 5= Definitely Better than Competitors (DB).		**DW**	**W**	**CC**	**B**	**DB**
5.1 Cost dimension:						
34	Lower logistics costs: The ability to achieve lower total cost of logistics through efficient network collaboration and efficient operations	1	2	3	4	5
35	Lower total costs: The competence of product from lower total unit cost	1	2	3	4	5
5.2 Time dimension:						
36	Reduced lead-time: The ability to reduce the lead-time between order receipt and customer delivery	1	2	3	4	5
37	Better delivery time: The ability to accommodate faster delivery times for customers	1	2	3	4	5
5.3 Reliability dimension:						
38	More on time and in full: The ability to meet quoted or anticipated delivery dates and quantities on a consistent basis (on time and in full)	1	2	3	4	5
5.4 Asset utilisation dimension:						
39	Higher inventory turnover: The ratio of the cost of goods sold to the average inventory during a time period	1	2	3	4	5
40	Higher customer satisfaction: The perception regarding the extent to which perceived company performance matches customer expectations	1	2	3	4	5
41	Higher market share: The company's share of total market	1	2	3	4	5

Part (B) Personal, Company and Network information

6. General Information

6.1 Company name ____

Please mark the appropriate box with a tick (√) or cross (X).

6.2 Type of industry

Leather and Shoes		Agricultural Processing	
Health Care and Pharmaceutical		Motor and Spare Parts	
Appliances and Furniture		Pulp and Paper	
Metal and Machinery		Rubber Products	
Clothing and Textiles		Plastics and Chemicals	
Electronics		Food Processing and Animal Nutrition	
Ceramics		Mass Merchandising and Retail	
Services		Other (Specified)	

6.3 Number of years the company has been operating

Less than 5 years		5 - 10 years		More than 10 years	

6.4 Number of full-time employees in your company

1	Less than 25	
2	25 to 50	
3	51 to 200	
4	More than 200	

6.5 Your position in the company

1	Owner / Partner / MD / CEO / President	
2	Supply Chain Director / VP / Manager	
3	Logistics Director / VP / Manager	
4	Manufacturing Director / VP / Manager	
5	Sales or Marketing Director / VP / Manager	
6	IT Director / VP / Manager	
7	Finance or Accounting Director / VP / Manager	
8	All Other	

6.6 Your work experience

Work experience	**Number of year**
With current employer	
Related to SCM area	
Total work experience	

6.7 Your highest education level

1	High school	
2	Diploma / Vocational	
3	Bachelor’s degree	
4	Master’s degree of above	
5	Other (please specified)	

Thank you for your kind participation in this survey. Your answers will be kept confidential.

APPENDIX C: SEMI-STRUCTURED INTERVIEW WORKSHEET

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
01 Managing Director	ISIC19 SMEs	1.Internal function collaboration 2.Database management 3.Cost reduction 4.Network members' collaboration i.e. transportation, quality management 5.Global competition of our network	1. IT 2. Process integration among network members 3. Trust and openness among network members	1. Employees' resistance 2. Inconsistency of material supplies 3. Cost of materials	1.Cost -> Total Cost 2. Time -> Production Lead Time 3. Reliability -> Delivery Dependability 4. Asset Utilisation -> ROI, ROE, Inventory Turnover
02 Sales & Marketing	ISIC15 LEs	1.Cost reduction 2.Internal efficiency 3.Internal function collaboration 4.Network members' collaboration	1.IT 2.Focus on end-customer 3.Effective communication channels 4.Established performance measurement within network 5.Organisation designed to support coordination, cooperation and collaboration	1. Employees' lack of understanding	1.Cost -> Total Cost 2.Time -> On Time In Full 3. Reliability -> Dependability 4. Asset Utilisation -> Inventory Turnover

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
03 Finance	ISIC36 SMEs	1.Global competition of our network 2.Cost reduction 3.Outsourcing to network members in order to reduce costs 4.Improvement of process capabilities and productivities	1.Focus on end-customer 2.Trust and openness among network members	1.Quality problems from network members 2. Employees' lack of understanding	1.Cost -> Total Cost 2.Time -> Delivery Time
04 Finance	ISIC15 SMEs	1.Process integration among network members 2.Cost reduction	1.IT 2.Network culture of supporting customer requirements 3.Top management understanding and support	1.Communication problems and confidential information 2.Employees' lack of understanding 3.Laws and regulations not supportive, or distort SCM such as the government promoting certain crops and then the farmers planting them without understanding demand	1.Cost -> Total Cost 2.Time -> Delivery Time 3.Asset Utilisation -> Inventory Turnover

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
05 Managing Director	ISIC28 SMEs	1.Cost reduction 2.Improvement of process capabilities and productivities 3.Process integration among network members	1.IT 2.Organisation designed to support coordination, cooperation and collaboration	1.Employees' lack of understanding 2.Laws and regulations not supportive, or distort SCM	1.Cost -> Total Cost 2.Time -> Delivery Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover
06 Information Technology	ISIC15 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.IT 2.Network culture of supporting customer requirements 3.Top management understanding and support	1.Employees' lack of understanding 2.Communication problems and confidential information	1.Cost -> Total Cost 2.Time -> Delivery Time, Order Fulfillment 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
07 Manufacturing	ISIC34 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities 3.End-customer needs	1. IT 2. Process integration among network members 3.Willingness to share knowledge	1.Some network members do not support SCM concept	1. Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3. Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
08 Logistics	ISIC24 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.Process integration among network members 2.Willingness to share knowledge	1.Employees' lack of understanding	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
09 Finance	ISIC18 SMEs	1.Cost reduction	1. IT 2. Process integration among network members	1.Employees' lack of understanding 2.Centralised organisational structure (decision from headquarters)	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
10 SCM	ISIC25 LEs	1.End-customer needs 2.Improvement of process capabilities and productivities 3. Cost reduction	1.IT 2.Organisation designed to support coordination, cooperation and collaboration 3.Top management understanding and support	1.Quality problems from network members	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
11 SCM	ISIC21 LEs	1.End-customer needs 2.Improvement of process capabilities and productivities 3. Cost reduction	1.IT 2.Organisation designed to support coordination, cooperation and collaboration 3.Top management understanding and support	1.Employees' resistance	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
12 Managing Director	ISIC36 SMEs	1.Cost reduction 2.Network members' collaboration	1.IT 2.Top management understanding and support	1.Incompatible information systems among network members	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time, Order Fulfillment 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
13 SCM	ISIC24 SMEs	1.Cost reduction 2.Global competition of our network 3. Focus on core competency of processes and functions	1.IT 2.Focus on end-customer 3.Top management understanding and support	1.Employees' resistance	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
14 Logistics	ISIC60 SMEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.IT 2.Process integration among network members	1.Employees' resistance 2.Employees' lack of understanding	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
15 Sales & Marketing	ISIC52 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.IT 2.Focus on end-customer 3.Organisation designed to support coordination, cooperation and collaboration	1.Employees' lack of understanding 2.Organisational "silo" structure	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share, Cash Flow
16 Managing Director	ISIC25 SMEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.IT 2.Focus on end-customer 3.Organisation designed to support coordination, cooperation and collaboration	1.Employees' lack of understanding 2.Some network members do not support SCM concept	1.Cost -> Total Cost, Logistics Cost 2.Time -> Lead Time
17 SCM	ISIC15 LEs	1.End-customer needs 2.Global competition of our network	1.IT 2.Process integration among network members	1.Employees' lack of understanding 2.Organisational "silo" structure	1.Cost -> Logistics Cost 2.Time -> Lead Time

Company	Business Segment	Drivers	Facilitators	Impediments	Performance Measurement
18 Sales & Marketing	ISIC24 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities 3.Global competition of our network 4.Network members' collaboration	1.IT 2.Customer database available for our network members 3.Quality management system implemented in our network 4. Top management understanding and support	1.Employees' lack of understanding 2.Organisational "silo" structure	1.Cost -> Total Cost 2.Time -> Lead Time, Order Fulfillment 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
19 Managing Director	ISIC34 SMEs	1.Cost reduction 2.Improvement of process capabilities and productivities 3.Global competition of our network	1.IT 2.Top management understanding and support	1.Employees' lack of understanding	1.Cost -> Total Cost 2.Time -> Lead Time, Order Fulfillment 3.Asset Utilisation -> Customer Satisfaction, Inventory Turnover, Market Share
20 Manufacturing	ISIC34 LEs	1.Cost reduction 2.Improvement of process capabilities and productivities	1.IT 2.Top management understanding and support 3.Process integration among network members	1.Employees' lack of understanding 2.Organisational "silo" structure	1.Cost -> Total Cost 2.Time -> Delivery Time, Order Fulfillment 3.Asset Utilisation -> Customer Satisfaction

APPENDIX D: SPSS AND AMOS OUTPUT

(A) Non-response bias test

Statistics

Wave Response

N	Valid	311
	Missing	0

Wave Response

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	First Responders	62	19.9	19.9	19.9
	Second Responders	129	41.5	41.5	61.4
	Last Responders	120	38.6	38.6	100.0
	Total	311	100.0	100.0	

Group Statistics

	Wave Response	N	Mean	Std. Deviation	Std. Error Mean
Composite SCMD	First Responders	62	4.1866	.65111	.08269
	Last Responders	120	4.1298	.61144	.05582
Composite SCMF	First Responders	62	4.2442	.63224	.08029
	Last Responders	120	4.0798	.58384	.05330
Composite SCMI	First Responders	62	3.9839	.62624	.07953
	Last Responders	120	3.8536	.67806	.06190
Composite SCMP	First Responders	62	3.5995	.77366	.09826
	Last Responders	120	3.6333	.95121	.08683
Composite FP	First Responders	62	3.4980	.54907	.06973
	Last Responders	120	3.6104	.69004	.06299

Independent Samples Test

		Levene's Test for Equality of Varainces		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
Composite SCMD	Equal var. assumed	.016	.899	.582	180	.562	.05687	.09778	-.13607	.24981
	Equal var. not assumed			.570	116.819	.570	.05687	.09977	-.14071	.25446
Composite SCMF	Equal var. assumed	.669	.415	1.751	180	.082	.16448	.09395	-.02090	.34986
	Equal var. not assumed			1.707	115.136	.091	.16448	.09637	-.02642	.35537
Composite SCMI	Equal var. assumed	2.669	.104	1.260	180	.209	.13030	.10338	-.07369	.33429
	Equal var. not assumed			1.293	132.381	.198	.13030	.10078	-.06905	.32965
Composite SCMP	Equal var. assumed	6.702	.010	-.242	180	.809	-.03387	.13998	-.31009	.24235
	Equal var. not assumed			-.258	147.404	.797	-.03387	.13113	-.29300	.22526
Composite FP	Equal var. assumed	6.061	.015	-1.113	180	.267	-.11243	.10099	-.31172	.08685
	Equal var. not assumed			-1.196	149.979	.233	-.11243	.09397	-.29811	.07325

(B) Mediation Relationship test

Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Release 2.10 ****************

Written by Andrew F. Hayes, Ph.D. www.afhayes.com

Documentation available in Hayes (2013). www.guilford.com/p/hayes3

****

Model = 4

Y = SCMP

X = SCMD

M = SCMF

Sample size

311

****

Outcome: SCMF

Model Summary

R	R^2	F	df1	df2	p
.7150	.5112	323.1419	1	309	.0000

Model

	coeff	se	*t*	*p*
constant	1.0990	.1689	6.5052	.0000
SCMD	.7262	.0404	17.9761	.0000

****

Outcome: SCMP

Model Summary

R	R^2	F	df1	df2	p
.4926	.2427	49.3522	2	308	.0000

Model

	coeff	se	*t*	*p*
constant	.4936	.3145	1.5691	.1176
SCMF	.3449	.0993	3.4721	.0006
SCMD	.4062	.1009	4.0256	.0001

************************** TOTAL EFFECT MODEL ****************************

Outcome: SCMP

Model Summary

R	R^2	F	df1	df2	p
.4616	.2131	83.6557	1	309	.0000

Model

	coeff	se	*t*	*p*
constant	.8726	.3002	2.9065	.0039
SCMD	.6566	.0718	9.1464	.0000

***************** TOTAL, DIRECT, AND INDIRECT EFFECTS ********************

Total effect of X on Y

Effect	SE	t	p
.6566	.0718	9.1464	.0000

Direct effect of X on Y

Effect	SE	t	p
.4062	.1009	4.0256	.0001

Indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.2505	.0943	.0553	.4268

Partially standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.2981	.1126	.0599	.5088

Completely standardized indirect effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.1761	.0675	.0405	.2993

Ratio of indirect to total effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.3814	.1465	.0880	.6572

Ratio of indirect to direct effect of X on Y

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.6167	.5766	.0956	1.9110

R-squared mediation effect size (R-sq_med)

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.1732	.0448	.0932	.2691

Preacher and Kelley (2011) Kappa-squared

	Effect	Boot SE	BootLLCI	BootULCI
SCMF	.1388	.0512	.0375	.2374

Normal theory tests for indirect effect

Effect	se	Z	p
.2505	.0736	3.4040	.0007

******************** ANALYSIS NOTES AND WARNINGS *************************

Number of bootstrap samples for bias corrected bootstrap confidence intervals: 1000

Level of confidence for all confidence intervals in output:95.00

------ END MATRIX -----

(C) Moderation Relationship test

Run MATRIX procedure:

***************** PROCESS Procedure for SPSS Release 2.10 ****************

Written by Andrew F. Hayes, Ph.D.   www.afhayes.com

Documentation available in Hayes (2013). www.guilford.com/p/hayes3

****

Model = 1

Y = SCMP

X = cSCMD

M = Firm size

Sample size

311

****

Outcome: SCMP

Model Summary

R	R^2	F	df1	df2	p
.4864	.2366	32.5117	3	307	.0000

Model

	coeff	se	*t*	*p*	LLCI	ULCI
constant	3.5860	.0425	84.4297	.0000	3.5024	3.6696
Firm size	-.0810	.0476	-1.7011	.0899	-.1748	.0127
cSCMD	.6486	.0723	8.9753	.0000	.5064	.7908
int_1	.2136	.0882	-2.4213	.0160	-.3871	-.0400

Interactions:

int_1   cSCMD   X   Firm size

****

Conditional effect of X on Y at values of the moderator(s):

Firm size	Effect	se	*t*	*p*	LLCI	ULCI
-.8650	.8334	.1053	7.9123	.0000	.6261	1.0406
.0000	.6486	.0723	8.9753	.0000	.5064	.7908
.8392	.4694	.1032	4.5474	.0000	.2663	.6725

Values for quantitative moderators are the mean and plus/minus one SD from mean.

Values for dichotomous moderators are the two values of the moderator.

NOTE: For at least one moderator in the conditional effects table above, one SD above the mean was replaced with the maximum because one SD above the mean is outside of the range of the data.

****

Data for visualizing conditional effect of X of Y:

cSCMD	Firm size	$\hat{Y}$
-.5906	-.8650	3.1639
.0000	-.8650	3.6561
.5906	-.8650	4.1482
-.5906	.0000	3.2030
.0000	.0000	3.5860
.5906	.0000	3.9690
-.5906	.8392	3.2408
.0000	.8392	3.5180
.5906	.8392	3.7952

******************** ANALYSIS NOTES AND WARNINGS ************************

Level of confidence for all confidence intervals in output: 95.00

NOTE: The following variables were mean centred prior to analysis: cSCMD , Firm size

NOTE: All std. errors for continuous outcome models are based on the HC3 estimator

------ END MATRIX -----

(D) Common method bias test

1. Standardized Regression Weights: (model without common latent factor)

			Estimate
Question3_7	<---	SCMI	.699
Question3_6	<---	SCMI	.703
Question3_5	<---	SCMI	.656
Question3_4	<---	SCMI	.567
Question3_3	<---	SCMI	.582
Question3_2	<---	SCMI	.577
Question3_1	<---	SCMI	.572
Question2_6	<---	SCMF	.746
Question2_5	<---	SCMF	.785
Question2_4	<---	SCMF	.615
Question2_3	<---	SCMF	.548
Question2_2	<---	SCMF	.685
Question2_1	<---	SCMF	.596
Question5_2_1	<---	FP	.781
Question5_2_2	<---	FP	.807
Question4_2_3	<---	SCMP	.822
Question4_2_4	<---	SCMP	.833
Question1_6	<---	SCMD	.614
Question1_5	<---	SCMD	.566
Question1_4	<---	SCMD	.710
Question1_3	<---	SCMD	.710
Question1_2	<---	SCMD	.566
Question1_1	<---	SCMD	.466
Question5_4_1	<---	FP	.687
Question1_7	<---	SCMD	.668
Question2_7	<---	SCMF	.761
Question4_1_2	<---	SCMP	.737
Question4_1_3	<---	SCMP	.847
Question4_1_4	<---	SCMP	.819
Question4_3_4	<---	SCMP	.789

			Estimate
Question4_3_3	<---	SCMP	.803
Question4_3_1	<---	SCMP	.865
Question4_3_2	<---	SCMP	.827
Question5_1_2	<---	FP	.643
Question5_3_1	<---	FP	.811
Question4_1_1	<---	SCMP	.788
Question4_2_2	<---	SCMP	.815
Question4_2_1	<---	SCMP	.825
Question5_4_3	<---	FP	.787
Question5_4_2	<---	FP	.795
Question5_1_1	<---	FP	.712

2. Standardized Regression Weights: (model with common latent factor)

			Estimate
Question3_7	<---	SCMI	.701
Question3_6	<---	SCMI	.703
Question3_5	<---	SCMI	.654
Question3_4	<---	SCMI	.567
Question3_3	<---	SCMI	.584
Question3_2	<---	SCMI	.576
Question3_1	<---	SCMI	.571
Question2_6	<---	SCMF	.747
Question2_5	<---	SCMF	.784
Question2_4	<---	SCMF	.620
Question2_3	<---	SCMF	.546
Question2_2	<---	SCMF	.683
Question2_1	<---	SCMF	.594
Question5_2_1	<---	FP	.783
Question5_2_2	<---	FP	.852
Question4_2_3	<---	SCMP	.792
Question4_2_4	<---	SCMP	.823
Question1_6	<---	SCMD	.637

			Estimate
Question1_5	<---	SCMD	.577
Question1_4	<---	SCMD	.701
Question1_3	<---	SCMD	.698
Question1_2	<---	SCMD	.555
Question1_1	<---	SCMD	.455
Question5_4_1	<---	FP	.663
Question1_7	<---	SCMD	.683
Question2_7	<---	SCMF	.763
Question4_1_2	<---	SCMP	.685
Question4_1_3	<---	SCMP	.813
Question4_1_4	<---	SCMP	.775
Question4_3_4	<---	SCMP	.806
Question4_3_3	<---	SCMP	.810
Question4_3_1	<---	SCMP	.884
Question4_3_2	<---	SCMP	.839
Question5_1_2	<---	FP	.579
Question5_3_1	<---	FP	.848
Question4_1_1	<---	SCMP	.751
Question4_2_2	<---	SCMP	.773
Question4_2_1	<---	SCMP	.773
Question5_4_3	<---	FP	.739
Question5_4_2	<---	FP	.768
Question5_1_1	<---	FP	.640
Question3_7	<---	CLF	.136
Question3_6	<---	CLF	.002
Question3_5	<---	CLF	-.020
Question3_4	<---	CLF	-.034
Question3_3	<---	CLF	-.068
Question3_2	<---	CLF	.088
Question3_1	<---	CLF	.080
Question2_7	<---	CLF	.048
Question2_6	<---	CLF	-.004
Question2_5	<---	CLF	-.017

			Estimate
Question2_4	<---	CLF	.098
Question2_3	<---	CLF	-.096
Question2_2	<---	CLF	-.106
Question2_1	<---	CLF	-.078
Question1_7	<---	CLF	.091
Question1_6	<---	CLF	.163
Question1_5	<---	CLF	.068
Question1_4	<---	CLF	-.110
Question1_3	<---	CLF	-.224
Question1_2	<---	CLF	-.162
Question1_1	<---	CLF	-.107
Question5_1_1	<---	CLF	-.497
Question5_1_2	<---	CLF	-.415
Question5_2_1	<---	CLF	-.053
Question5_2_2	<---	CLF	.071
Question5_3_1	<---	CLF	.041
Question5_4_1	<---	CLF	-.152
Question5_4_2	<---	CLF	-.164
Question5_4_3	<---	CLF	-.303
Question4_3_4	<---	CLF	-.018
Question4_3_3	<---	CLF	-.065
Question4_3_2	<---	CLF	-.053
Question4_3_1	<---	CLF	-.027
Question4_2_4	<---	CLF	-.136
Question4_2_3	<---	CLF	-.223
Question4_2_1	<---	CLF	-.328
Question4_2_2	<---	CLF	-.282
Question4_1_4	<---	CLF	-.287
Question4_1_3	<---	CLF	-.235
Question4_1_2	<---	CLF	-.313
Question4_1_1	<---	CLF	-.247

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