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The Hong Kong Polytechnic University

Institute of Textiles and Clothing

The Supply Chain Advantage:

Development of a strategic business model for the Hong Kong clothing industry

Chi-Kuen HO

A thesis submitted in partial fulfilment of the requirements

for the Degree of Doctor of Philosophy

March 2005

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ABSTRACT

Hong Kong's leading role in exporting garments to the global market is currently challenged by the growing competition of low-cost producers, reduction of consumer shopping time, and growth of overseas buyers' bargaining power. Responding to these challenges, clothing companies in Hong Kong are seeking new sources of competitive advantage through improved management of supply chain. While supply chain management (SCM) is increasingly implemented in practice, the literature is still largely exploratory and descriptive, lacking dominant paradigms and unifying theories.

The purpose of this research is to enhance our understanding of the achievement of operations performance improvements and collective competitive advantage through SCM. Specifically, building upon a context-practices-performance framework and drawing on insights from a resource-based view of the firm, social network perspective on strategic alliances, relational view of inter-organizational competitive advantage, and SCM literature, an integrative theoretical model that hypothesized environmental, strategic and social antecedents, components, and performance consequences of SCM implementation was developed.

The theoretical model was examined in the setting of industrial market of clothing in Hong Kong. Data on 123 pairs of buyer-supplier relationships were collected from 63 clothing manufacturers in Hong Kong through a mail survey. Zero-order correlation analysis and multiple regression analysis were undertaken to test the theoretical model. Most of the hypotheses were confirmed in this study.

Findings showed that SCM in the clothing industry encompassed a set of mutually supporting practices that involved (1) sharing of product, purchasing, and sales and inventory information, and (2) integration of business processes between product development and pre-production, purchasing and production, and delivery and distribution. The findings also demonstrated that clothing buyers and their suppliers were motivated to create idiosyncratic investments and implement SCM when (1) they were facing a high level of demand uncertainty; (2) they perceived that each party had complementary, tacit and complex competitive capabilities; and (3) they had developed inter-organizational goodwill trust and competence trust. The reputations of clothing buyers and their suppliers in the industry facilitated the establishment of a good track record of transactions, development of relational norms, and initiation of frequent formal and informal social interactions, which in turn promoted inter-organizational goodwill trust and competence trust. In addition, operations performance improvements and collective competitive advantage could be achieved through successful SCM implementation.

This research helps clothing buyers and their suppliers in Hong Kong to understand the need, incentive, and opportunity to collaborate and implement SCM by recognizing the importance of demand uncertainty, partner firms' complementary competitive capabilities, and social resources embedded in the dyad and the industrial network. It also helps them to apply SCM practices successfully and as a result improve operations performance and achieve collective competitive advantage. Furthermore, this research supports a process-based view of SCM, and provides insights into the social embeddedness of inter-organization collaboration in a supply

chain. It also highlights the importance and the need to apply a context-practices-performance framework to examine SCM from a multidisciplinary perspective.

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Chapter 1 : Introduction

1.1 Background: The Hong Kong clothing industry

The clothing industry is increasingly characterized by the functional integration of spatially divided and distributed economic activities in the ongoing process of globalization (Dickerson 1999). In a typical clothing export supply chain, overseas buyers (e.g. importers, large department stores, speciality stores, top labels, catalogue buyers, and other chain retailers in North America and Europe) design, market and distribute products, whereas manufacturers in Hong Kong and other newly industrialized countries are responsible for sourcing fabrics, accessories and other materials, as well as production and delivery of garments to the buyers (Au and Ho 2002a).

The clothing industry has assumed a very important role in Hong Kong's export-oriented economy, as Hong Kong's total exports of clothing recorded HK$180.36 billion (in which domestic exports accounted for HK$63.88 billion and re-exports accounted for HK$116.48 billion) in 2003 (Census and Statistics Department 2003). The clothing industry is the leading earner in terms of domestic exports, taking up 52.5% of the total in 2003 (Census and Statistics Department 2003). However, Hong Kong have recently experienced a three-year consecutive reduction in domestic exports of clothing, as domestic exports fell from HK$77.42 billion in 2000 to HK$63.88 billion in 2003 (Census and Statistics Department, various years). Indeed, clothing manufacturers in Hong Kong are currently facing challenges in three ways: the growing competition of low-cost producers, reduction

of consumer shopping time, and growth of overseas buyers' bargaining power (Au and Ho 2002b).

Firstly, a noticeable trend of regionalization of production and sourcing is on the rise, as the role of Latin America and Central/Eastern Europe in the clothing supply to North America and Western Europe has become increasingly important. Harnessing the advantages of trade privilege within an economic bloc, close proximity to market, and low production costs, Mexico, Central America, and the Caribbean have achieved a tremendous growth in the export of clothing to the US over the past few years. In particular, Mexico has outperformed Hong Kong and become the second largest exporter after China since 1997. In fact, the share of Hong Kong's exports of clothing in the total imports into the US has dropped continuously from 12% in 1994 to 8.4% in 1997 and to 5.6% in 2003, while Mexico's share has surged from 4.9% in 1994 to its peak 13.5% in 1999 and reduced to 10.2% in 2003 (Census and Statistics Department, various years).

A similar trend is also observed in the European Union (EU) market, as the share of Hong Kong's exports of clothing to EU has dropped significantly from 8.8% in 1994 to 3.9% in 2003 (Census and Statistics Department, various years). Parallel to US clothing importers' increasing sourcing in Central/South America, European importers are also expected to increase sourcing in Central/Eastern Europe (Kurt Salmon Associates 1996). This is indicated by the fact that the share of Romania's exports of clothing to EU has surged significantly from 2.6% in 1994 to 6.9% in 2003, while outpacing Hong Kong and become the third supplier to EU after China and Turkey since 2001 (Census and Statistics Department, various years).

Secondly, there is a reduction in consumer shopping time, as more consumers become less satisfied with the traditional way of shopping, because they cannot

always get the right product at the right time and at the right place. In particular, considering that shopping has become a 'hassle', consumers in the US spent on average only 4.3 hours per month on shopping in 1995, and intended to reduce that time to strive for more time for other forms of enjoyment (Kurt Salmon Associates 1997). More recently, a study conducted at one of the largest shopping centers in the United Kingdom revealed that "busy lifestyles and longer working hours have led to the consumer's average shopping time being reduced from more than two hours to one hour 40 minutes" (Birmingham Post 2003, p.5). This change in consumer shopping behavior (i.e. reduction in shopping time) drives retailers to increase product variety and restock more speedily and frequently in order to meet demanding consumer requirements.

Thirdly, over the past decade various sectors of the US retail industry including department stores, mass merchants, off-price and speciality retailers have experienced a surge of consolidation. In fact, year 2003 has been considered to be the busiest year in a decade for merger and acquisition (M&A) activity in the apparel industry, as "the total disclosed value of deals in the apparel industry in the US and abroad rose 57.8 percent to $3.63 billion, while the number of mergers skyrocketed 88.6 percent to 132, according to Factset Mergerstat, a leading provider of US and international M&A information to the investment banking and corporate markets" (Lockwood 2004, p.16). Top management in the industry also expected that "there will be continued consolidation in the overall apparel industry, as the big titans like Liz Claiborne Inc., Kellwood Co. and VF compete to buy small companies and increase their market share" (The Columbian 2003, p.E4). Similar trend is also observed in the clothing retailing industry in Western Europe. Although the concentration of apparel sales and distribution channels of apparel are quite different

across Europe, a rapid consolidation, which reflects increasing market maturity, is on the rise, according to a recently published report—Apparel Retailing in Western Europe—by Retail Forward Inc. (Business Wire 2003).

The fierce competition of low-cost producers, the heightened expectations of value-conscious consumers associated with the 'quick shop' culture, and the growth of overseas buyers' bargaining power as a result of growing consolidation in today's global retail markets have collectively imposed great challenges for Hong Kong clothing manufacturers to maintain their competitiveness. Under this difficult environment, clothing manufacturers in Hong Kong are seeking new sources of competitive advantage through improved management of the clothing export supply chain (Au and Ho 2002a).

1.2 Overview and justification

Supply chain management (SCM) is not simply a new label for the management of logistics across organizations (Cooper et al. 1997). Rather, it represents a new model of managing the business and its relationships (LaLonde 1997, Lambert and Cooper 2000). In that, organizations have to prepare to operate in the era of 'network competition', where individual businesses no longer compete as solely stand-alone entities, but rather as supply chains (Christopher 2000, Lambert and Cooper 2000). Increasingly, this competitive paradigm of achieving total business excellence draws management's attention in different industries. As indicated in Harland et al.'s (1999) Delphi study, a panel of senior executives from the private and public sectors envisioned that over the next 20 years the survival and success of the network of supply are of critical importance to its constituent organizations. Similarly, purchasing and supply executives predicted issues of the

management of supply chain to become dominant in next ten years, as shown in Carter's et al. (2000) survey.

The supply chain, as a powerful metaphor, highlights the complex interplay of inter-organizational relationships in the value-adding processes, providing a new way of thinking about not only operational performance but also business strategy (Cox 1999). Increasingly, researchers have advocated achieving competitive advantage through improved SCM (Handfield and Nichols 1999), linking a firm's supply chain strategy to its overall business strategy (Lummus and Vokurka 1999), and arguing for a close connection between SCM and the creation of enhanced shareholder value (Christopher and Ryals 1999).

While the idea of competing through SCM sounds appealing, more research is expected to build the theoretical foundation for a better understanding of firm behavior and performance in the supply chain competition. In their meta-analysis of 117 dissertations in the field of purchasing undertaken from 1987 to 1995, Das and Handfield (1997) reported that purchasing research is still largely exploratory and descriptive, and lack of dominant paradigms and unifying theories. In particular, they found that very few attempts have been made to examine the relationship between purchasing and a firm's strategies and business environment, and called for an establishment of more comprehensive nomological research frameworks. More recently, in their review of 84 leading and cited papers on SCM, Croom et al. (2000) revealed that the literature is mainly empirical-descriptive, and argued for applying a multidisciplinary approach to the advancement of SCM theory.

Although empirical studies related to SCM are on the rise, conceptual work addressing the theoretical grounds of achieving competitive advantage through SCM is relatively scarce. Recently, Hines (1995) stresses the importance of establishing

strategic partnerships among clothing supply chain members in global markets. Olavarrieta and Ellinger (1997) explore the impact of strategic management on logistics, and propose the application of resource-based theory of the firm to examine the impact of distinctive logistics capability on competitive advantage, the role of logistics in strategic partnerships and outsourcing, and the interface of logistics with other functional areas. Similarly, Skjoett-Larsen (1999) discusses the management of supplier relationships and third-party logistics from the transaction cost approach, network perspective, and resource-based view. These studies represent initial, useful attempts to explore the strategic aspects of logistics and purchasing management; however, an adequate theoretical model that explicates the strategic nature of SCM has yet to develop.

In addition to this weakness of existing research, the influence of the context, in which supply chain members are embedded, on the implementation of SCM practices has received little attention in extant literature. A firm does not adopt organizational practices in a random fashion, nor does it implement organizational practices in a vacuum. Organizational practices are contextually embedded in a way that the context creates or constrains possibilities for their emergence and functioning. Context is the setting in which organizational practices are established and applied.

Increasingly, more research in operations management has been undertaken to study the contextual effects on organizational practices. For example, Benson et al. (1991), Ahire et al. (1995), and Ho et al. (1999) note the importance of studying contexts in explaining and predicting quality management practices. Studying how the development and functioning of SCM practices are contextually embedded, therefore, represents an important step to enhance our understanding of this emerging management approach.

1.3 Objectives and significance

The objective of this research is to develop and validate a strategic business model to provide insight into successful SCM implementation. Specifically, it aims to apply a context-practices-performance framework (Ho and Duffy 2000) to examine the antecedents, components, and performance consequences of implementing SCM for firms in the Hong Kong clothing industry.

Three key research questions that are examined in association with the model include:

1. What are the essential components of SCM implementation?
2. What is the impact of SCM implementation on operations performance improvements and collective competitive advantage?
3. What are the critical contextual factors that influence SCM implementation?

Drawing on insights from a resource-based view of the firm, social network perspective on strategic alliances, and relational view of inter-organizational competitive advantage, an integrative conceptual model of SCM is developed and examined in an industrial clothing supply setting of buyers and suppliers (clothing manufacturers). The constructs examined in the model are identified from prior research in strategic management, organization studies, marketing, and operations management. A survey research method is used to examine the model.

The theoretical framework developed and the research questions examined in this study are important from both an academic and a managerial perspective. On one hand, this study addresses the need for adopting a multidisciplinary approach to advance SCM theory. On the other hand, the research findings benefit clothing manufacturers and buyers in Hong Kong, as it sheds light on how firms can achieve collective competitive advantage through successful implementation of SCM.

Chapter 2 : Review of supply chain management literature

2.1 Overview

The notion of improving firm performance and achieving competitive advantage through SCM draws currently much attention of practitioners and researchers. Despite the growing interest and effort in studying SCM, our understanding on this subject matter does not improve significantly. Although some empirical studies have reported positive associations between SCM practices and firm performance, it is important to note the fact that there is little consistency about the basic definition and content of the SCM construct among these studies. Consequently, neither is there an agreement on its measurement. These differences make comparison and integration of research findings difficult. To make matters worse, the crux of the extant SCM literature's problems is not much about such inconsistency, but rather is about the inadequate attention and effort being put in theorizing SCM. As Croom et al. (2000) in their analysis of the literature reported, the literature is primarily empirical-descriptive, lacking theoretical work on SCM. Indeed, the need for directing more work toward theory building has been stressed by researchers as an important way to advance the field of operations management and its sub-fields (e.g. Amundson 1998, Handfield and Melnyk 1998).

In this Chapter, the SCM literature is reviewed with an aim to identify some major weaknesses in the prevalent approaches to the conceptualization, operationalization, and modeling of SCM. In addition, the potential causes

underlying these limitations are presented. Specifically, it demonstrates that (1) the SCM construct has been perceived narrowly from the perspective of a particular traditional function of a firm; (2) the construct validity is threatened due to inadequate preoperational explication of the content domain, among other operationalization problems; and (3) the dominant conceptual SCM models focus mainly on the practices-performance relationship, overlooking the context-practices relationship.

2.2 Divided functional approaches to SCM conceptualization

As Tan (2001) notes, some researchers have conceptualized SCM from the perspective of purchasing and supply functions, defining it as a set of decisions or activities of purchasing and supplier management, whereas others have considered it from the perspective of logistics and transportation functions, defining it as the management of materials, products and information flows from source to user (e.g. Thomas and Griffin 1996, Copacino 1997).

It appears that a considerable number of researchers have adopted the purchasing and supply management perspective in their empirical studies of SCM. For example, Tan et al. (1998b) suggest that a firm's practice of SCM is reflected by its degree of participation in ten inter-related areas of supply base management, supplier development, and customer-supplier integration, which involve the practice of establishing a quality assurance program for supplier's product and process, visiting supplier's facility regularly, sharing sensitive information with suppliers, etc. Narasimhan and Das (1999) consider SCM practices as a set of activities related to purchasing and supply base management, such as early supplier involvement in product and process design, supplier responsiveness to order volume and delivery

changes, and use of appropriate measurement/reward systems in purchasing. For Scannell et al. (2000, p.32), upstream SCM practices encompass supplier development ("policies, procedures, and practices for assessing and improving supplier capability and performance"), supplier partnering ("bringing the participants in the product life cycle into the process early, so suppliers and customers can provide inputs into the other's processes"), and Just in Time (JIT) purchasing ("requiring JIT deliveries from suppliers to support an overall JIT strategy"). Dong et al. (2001) refer supply chain integration as a set of decisions related to supplier management and coordination: using electronic data interchange (EDI), information sharing (e.g. demand forecasts and costs), sharing joint cost savings, and working with suppliers to improve the management of their (second tier) suppliers.

Although SCM practices entail activities related to purchasing and supplier management, defining SCM solely in terms of a firm's involvement in managing its supplier is a biased and narrow perception, as the firm interacts with other trading partners, in addition to suppliers, to achieve supply chain integration. Also, the importance of other supply chain members such as customers is by no means lower than that of suppliers. As Cooper et al. (1997) rightly argue, SCM is not a new label for integrated logistics management. Neither is it for integrated purchasing and supplier management. Examining SCM from a restrictive functional view provides at best a partial understanding, and may convey a sense of superiority of a particular function over others.

Some researchers nevertheless have taken a broader view on SCM, emphasizing management and integration of major linkages between a firm and its upstream and downstream trading partners. Frohlich and Westbrook (2001) conceive supply chain integration as a set of activities that manufacturers use to integrate their

operations with both suppliers and customers. The activities include access to planning systems, sharing production plans, joint EDI access/networks, knowledge of inventory mix/levels, packaging customization, delivery frequencies, common logistical equipment/containers, and common use of third-party logistics. Similarly, supplier integration, which is associated with decisions related to outsourcing and supplier capability assessment and management, as well as customer integration are two core elements of Narasimhan and Jayaram's (1998) 'decisions-oriented' framework of supply chain integration.

While addressing the operational linkages between a firm and its suppliers and customers represents a more balanced approach to SCM, simply presenting a list of activities performed by a firm to achieve operational integration is a simplistic approach to determine SCM practices, as it fails to identify the core concepts binding these activities. Nevertheless, attempts have been made by some researchers to specify SCM practices in terms of management of flow, quality, and design of materials and products. For example, Salvador et al. (2001) focus on a firm's interactions with its suppliers and customers for managing material flow (e.g. the practice of Kanban, EDI and JIT linkage) and for ensuring materials quality (e.g. information exchange on quality). In addition to the 'logistic' link, which consists of the practice of deliveries synchronization, integrated production planning, shared production forecasts (blanket orders), packaging congruence, and Kanban procurement approach, as well as the quality link, which involves information exchange on quality, free pass for deliveries, and supplier quality certification, De Toni and Nassimbeni (1999) also consider the design link, which encompasses information exchange on product, supplier involvement in product development, and

information exchange on development process, to be a major operational link established by buyers and suppliers to improve performance.

It appears that at first glance a coherent view on the SCM concept and its measures has yet to develop in the extant literature. More importantly, this inconsistency may attribute to two fundamental issues of construct validity: the degree to which the conceptual nature of SCM has been clearly defined, and the degree to which the SCM concept has been accurately operationalized.

2.3 Threats to construct validity of the SCM concept

Terms and constructs related to SCM have proliferated to the extent that it has become increasingly difficult to integrate as well as to map out the overall pattern of theoretical and empirical research in this area. Central to this problem is the inadequate specification of the constructs' content domain, coupled with the practice of associating multiple labels with the same construct. For example, Shin et al. (2000, p.318) coin the term *supply management orientation*, which is also called *supply chain management orientation* in the abstract, *supply management* in the main text, and *buyer-supplier management orientation* in the appendix of their paper, and refer it as "the management efforts or philosophy necessary for creating an operating environment where the buyer and supplier interact in a coordinated fashion". This construct indeed encompasses many elements. First, buyers and suppliers interact in many areas such as customer requirement identification, purchase/sales order processing, product development, demand forecast, inventory control, quality assurance, product delivery, and others. Second, an operating environment has many dimensions such as technological, cultural, social, and political components. As such, many management principles and practices, which altogether constitute a

management philosophy, can be identified for establishing a supportive operating environment that facilitates buyer-supplier interactions.

Given that the content domain of this construct is so broad, it is difficult, if not impossible, to develop an instrument that measures the construct adequately. In fact, Shin et al. (2000) have operationalized the construct narrowly in terms of four measurement items, which are very similar to the instrument of sourcing policies and design link employed by De Toni and Nassimbeni (1999) in a study of buyer-supplier operational practices (see Table 2.1 for a comparison).

Table 2.1 A comparison of similar instruments

Shin et al.'s (2000) instrument	De Toni and Nassimbeni's (1999) instrument
Supply management orientation	*Sourcing policies*
1. We strive to establish long-term relationship with suppliers.	1. Long term perspective
2. Quality is our number one criterion in selecting suppliers.	2. Importance of non-price selection criteria
3. We rely on a small number of high quality suppliers.	3. Supplier base reduction
4. Suppliers are actively involved in our new product development process.	4. Other items
	Design link
	1. Supplier involvement in product development
	2. Other items

A careful examination of Shin et al.'s (2000) study raises the issue of threats to construct validity, which stem from two major sources. First, their study has associated essentially the same construct with four different labels, creating unnecessary and avoidable confusion. If the term *supply management* represents an overview of the construct's content domain adequately, there is little point to associate the construct with another term *supply management orientation*, as it is expected that the word orientation signifies a different content domain (i.e. a different construct). This equally applies to the terms *supply chain management*

orientation and *buyer-supplier management orientation*. Second, the content domain reflected by the four measurement items is a partial representation of the content domain specified in the definition of the construct. As De Toni and Nassimbeni (1999) have conceptualized and shown, three items of Shin et al.'s (2000) instrument indicate the buyer's sourcing policies and one item indicates product development activity, which may at best represent part of management philosophy required for establishing an operating environment that facilitates buyer-supplier interactions. Unless a very narrow view of SCM is taken, a firm's sourcing policies could not capture all elements of SCM. If such a narrow perspective is adopted, there is little point to associate sourcing policies with additional terms such as SCM, or in Shin et al.'s (2000) words, supply chain management orientation.

Applying essentially the same set of measurement items to indicate multiple constructs also creates unnecessary and avoidable confusion. This problem is illustrated with reference to the following three closely related empirical studies. Tan et al. (1998b) applied an instrument, which examined a firm's involvement in ten inter-related areas of supply base management, supplier development and customer-supplier integration, to reflect the construct SCM, whereas Tan et al. (1999) used the same instrument to indicate another construct supply base management. Without addressing the relationship between the constructs supply base management and SCM, Tan et al. (1998a), on one hand, associated the same set of ten measurement items with supply base management practices in the main text, but, on the other hand, labeled them as a firm's practices for various areas of SCM in the appendix of their paper. As such, when considering these studies together, it becomes unclear at the conceptual level whether supply base management is subsumed under SCM, or they both refer to the same construct. Also, at the empirical level it has created ambiguity

concerning which construct the instrument is designed to indicate. If the content domains of these two constructs are the same, then either the term supply base management or SCM, which is associated with the same construct, must be redundant. If they are different constructs, using the same instrument to measure them is an illustration of inappropriate operationalization.

2.4 SCM modeling approaches

The impact of SCM has been examined empirically through testing SCM practices-performance models. Although all these models investigate the SCM practices-performance relationships, they differ in terms of research focus and analytic method. Among prior empirical studies of SCM models, four modeling approaches are identified (cf. Ho et al. 2001) (see Figure 2.1).

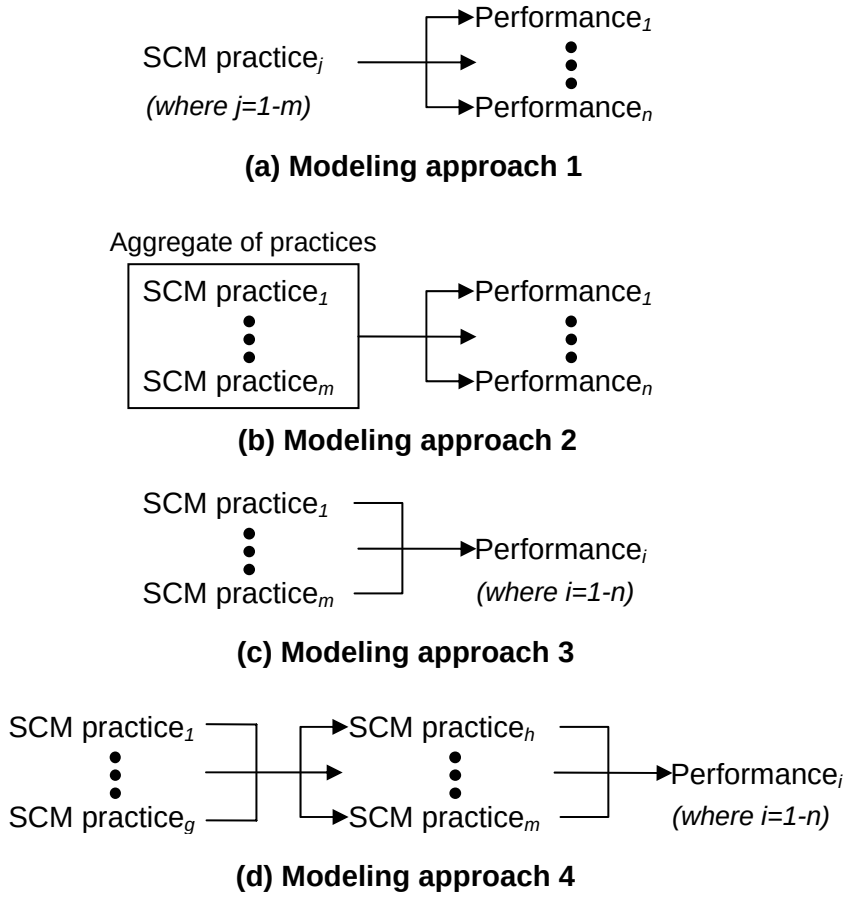

Figure 2.1 An overview of four SCM modeling approaches

The first modeling approach aims to examine the relationship between an individual SCM practice and a particular aspect of firm performance. That is, performance measure$_i$ = f (SCM practice$_j$), where i=1-n and j=1-m. As an example, Tan et al. (1998b) conducted a bivariate correlation analysis to examine the relationships between ten areas of SCM practices (operationalized as purchasing practices) and nine aspects of firm performance. Among 90 correlations, they found 50 significant positive associations between seven practices (e.g. the use of supplier knowledge and skills, supplier certification of products and processes, regular visit of supplier facilities, share of confidential information, and the use of commodity teams to set supplier goals) and nine performance measures (e.g. return on assets, growth in market share, in sales, and in return on assets). While this approach provides a general pattern of SCM practices-performance relationships, it does not address the interactions among SCM practices and their collective impact on performance.

The second approach focuses on the effect of not only the individual, but also the aggregated SCM practices on firm performance. In that, all practices are combined and formed an integrative factor influencing various aspects of performance. That is, performance measure$_i$ = f (aggregate of all SCM practices), where i=1-n. This approach is illustrated in Scannell et al.'s (2000) study of 57 first-tier suppliers to the Big Three U.S. automakers. They first examined the relationships between three SCM practices (the use of supplier development, supplier partnership, and JIT purchasing) and four aspects of performance (reflected by 12 measures of flexibility, innovation, quality, and cost) using bivariate correlation analysis. Among 36 correlations, they found 13 significant positive associations between three SCM practices and eight performance measures including flexibility (volume, mix, changeover, and modification), process innovation, conformance to specification,

cost reduction, and low production cost. They then further examined the collective effect of the practices on each aspect of performance using bivariate correlation analysis on the factor score of the factor upstream SCM strategy (consists of all three practices) and the scores of four factors of performance. Among the four sets of correlations, they found that upstream SCM strategy was significantly correlated with flexibility and cost performance, but was not significantly associated with innovation and quality performance. While this modeling approach provides additional information on the collective impact of SCM practices on firm performance, it does not consider the comparative utility of the practices.

The third approach seeks to study the relative strength of each SCM practice's impact on a particular aspect of firm performance. That is, performance measure$_i$ = f (SCM practice1, …, SCM practice$_m$), where i=1-n. Power et al. (2001), in their study of critical factors for successful agile organizations in managing their supply chains, identified seven 'soft' and 'hard' SCM practices. These practices were regressed against each of nine performance measures in two data sets: 66 'more agile' and 198 'less agile' manufacturing companies in Australia. The multiple regression results showed that five SCM practices, including computer-based technologies (e.g. the use of EDI), participative management style (e.g. elimination of barriers between individuals and/or departments), supplier relations (e.g. supplier's involvement in product design), resource management (warehousing and materials management), and technology utilization (e.g. manufacturing technologies are used to its maximum potential), had a descending degree of positive impact on the performance of customer satisfaction in the sample of 'more agile' companies. Using similar analytic technique, Tan et al. (1999), in their study of the impact of SCM, reported that the effect of supplier involvement (e.g. share confidential

information with suppliers) on a factor of performance (consists perceptual measures of return on asset, as well as of growth in sales, in market share, and in return on asset) was stronger that that of supplier evaluation (e.g. quality assurance program for supplier's products and processes).

The fourth modeling approach, perhaps the most sophisticated one, establishes a conceptual model that specifies the interrelationships of various SCM practices and their impacts on firm performance. Salvador et al. (2001) developed and examined a model of SCM that hypothesized that interactions with suppliers and with customers for managing material quality and material flow (altogether four independent variables) affect a firm's performance in punctuality of delivery and in operations speed directly (i.e. SCM interactions→time-related performance). Also, these interactions are expected to affect performance indirectly through internal practices for operations control and coordination (i.e. SCM interactions→Internal practices→time-related performance). The results of a mediated regression analysis of a sample of 164 plants showed that internal practices mediate the effect of SCM interactions for managing materials quality on performance completely. That is, these interactions affect time-related performance positively mainly because they allow for the implementation of new or improved internal practices. The results also indicated that SCM interactions for managing materials flow have both direct and indirect effects on the two aspects of time-related performance. While Salvador et al.'s (2001) modeling approach is helpful in addressing the questions of 'how' and 'why' SCM practices affect performance, the model they presented has a narrow focus on practices related to materials quality and flow and time-related performance.

2.5 Some important issues in developing a SCM theory

The development of theory on SCM begins with the establishment of a clear conception of its meaning. Review of the above empirical research with respect to the approach to conceptualize SCM, construct validity, and modeling approach indicates inadequate effort and emphasis being placed on theorizing SCM, as evidenced by the confusion over the conceptual nature of SCM, the ambiguity concerning the operationalization of SCM, and the diversity of approaches in modeling and examining its impact in practice. Although the SCM construct needs to be clearly defined before proceeding to the operationalization stage, it is not uncommon that some researchers skipped this very important and initial step, and associated a set of measurement items with the construct without explicitly or even without presenting its theoretical definition. Because the construct's content domain is unclear or even not given, it is difficult to assure and assess the degree to which the construct is measured by the associated indicators. As such, it is of paramount importance to address the problem of inadequate preoperational explication of the SCM construct (Cook and Campbell 1979), if a SCM theory is to be developed (Amundson 1998).

2.5.1 The construct of SCM

While the meaning of SCM is still under debate, SCM, in its broadest sense, is increasingly seen as a management philosophy (e.g. Leenders and Fearon 1997, Ross 1998, Tan et al. 1998b) that embodies a set of distinctive management principles, assumptions and practices (Dean and Bowen 1994). However, there are diverse views on the exact elements of this management approach in both theoretical and empirical literature. As mentioned previously, some prior empirical studies

tended to associate SCM with purchasing and supply management, considering sourcing policies, JIT purchasing, as well as the development, assessment, and coordination of suppliers as its core elements. Alternatively, looking at it from the logistics and transportation perspective, some researchers defined it as management of the entire flow of products along the supply chain. This is indicated in the following definitions.

> An integrative philosophy to manage the total flow of a distribution channel from suppliers through end users (Ellram and Cooper 1990, p.2).
>
> A total systems approach to managing the entire flow of information, materials, and services from raw-materials suppliers through factories and warehouses to the end customer (Chase et al. 1998, p.466).
>
> The management of flows between and among stages in a supply chain to maximize total profitability (Chopra and Meindl 2001, p.6).

This perspective of SCM builds on a contemporary understanding of logistics concept. As Cooper et al. (1997) argue, treating logistics (however broadly it is defined) and SCM as synonyms represents a narrow view of SCM, because logistics is just one of the many elements of SCM. This is reflected in the definition of logistics developed by the Council of Logistics Management in 1998.

> Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information flow from point-of-origin to point-of-consumption in order to meet customers' requirements (cited in Lambert and Cooper 2000, p.67).

As blurring the conceptual domain of logistics and SCM will only add confusion to research and practice, there is a need to examine the constituents of economic organization underneath the product level in order to identify what other key elements, in addition to logistics, would affect product flow in the supply chain. It is by incorporating these elements in the conceptualization of SCM that helps to

distinguish it from other related management approaches such as JIT, which refers broadly to a philosophy "where the entire supply channel is synchronized to respond to the requirements of operations or customers" (Ballou 1992, p.528).

Some researchers consider that a distinguishing feature of SCM is the achievement of seamless product flow through integration of members and physical entities in the supply chain, as the following SCM definitions indicate.

> The strategic integration of trading partners (Walton and Miller 1995, p.117).

> A set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize systemwide costs while satisfying service level requirements (Simchi-Levi et al. 2000, p.1).

While this view of SCM rightly emphasizes the importance of integration, it fails to delineate what exactly supply chain members need to integrate. This makes such definitions too general and runs the risk of proposing an all-embracing approach to supply chain integration. Two perspectives of SCM seem to have addressed this weakness: one suggests the need to integrate business activities, and the other to integrate business functions (see the following definitions).

> The coordination of activities, within and between vertically linked firms, for the purpose of serving end customers at a profit (Larson and Rogers 1998, p.2).

> The integration of the activities that procure materials, transform them into intermediate goods and final products, and deliver them to customers (Heizer and Render 2001, p.434).

> The systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer et al. 2001, p.22).

These two views indicate that SCM is more than a new label for integrated logistics management. It involves management of all activities or functions supporting the flow of products. Also, these activities or functions are undertaken within and across organization boundaries. Sharing these similar themes, the activity view could be subsumed into the function view, when related activities are grouped under the headings of their associated business functions, such as research and development, engineering, sales and marketing, manufacturing, distribution, and customer service. However, placing an overwhelming emphasis on individual functions may reinforce the bureaucratic nature of divided, hierarchical structure of an economic organization as well as the sequential movement of products across business functions. In order to achieve a better understanding of the dynamic interfaces between traditional functions, a process view of SCM is suggested (see the following definitions).

> The integration of business processes from end user through original suppliers that provides products, services and information that add value for customers (The International Center for Competitive Excellence, cited in Cooper et al. 1997, p.2).

> The coordination and configuration of the process that is necessary to make products available in a timely, reproducible, and satisfactory (i.e. conforming to customer requirements) condition (Forker et al. 1997, p.1683).

> The integration of business processes among channel members with the goal of better performance for the entire channel system (Alvarado and Kotzab 2001, p.184).

> The synchronization of a firm's processes and those of its suppliers to match the flow of materials, services, and information with customer demand (Krajewski and Ritzman 2001, p.498).

> The collaborative effort of multiple channel members to design, implement, and manage seamless value-added processes to meet the real needs of the end customer (Fawcett and Magnan 2001, p.18).

The process view is more inclusive than the activity and the function perspectives, as a key business process, such as order management, encompasses a sequence of activities that (1) draw on multiple functional skills and knowledge within an organization, and (2) span organizational boundaries, extending into suppliers and customers (Davenport 1993). As such, it may not be helpful to incorporate both business functions/activities and processes in the definition of SCM (for example, Sarkis and Talluri (2001, p.359) define SCM as "the management of activities and processes associated with the flow and transformation of goods from raw materials through the end user and to disposal or back into the systems".), as such a conceptualization does not give additional insight.

In addition to integration of business processes, value creation for customers is another core component of the process view of SCM. Added value may be materialized in various areas of supply chain performance improvement, including resources utilization (e.g. reductions in manufacturing and distribution costs and inventory), output (e.g. higher customer satisfaction, order fill rate, and product quality), and flexibility (e.g. higher responsiveness to demand variations) (Beamon 1999).

2.5.2 Toward a process-based view of SCM

While there is a growing interest in promoting a process-based view of SCM (Hammer 2001), any SCM concept developed from such a perspective has to address two definitional issues. The first issue is the dimensions and intensities of process integration. Some researchers (e.g. Lambert et al. 1998) observe that previous literature tends to implicitly or explicitly suggest an all-embracing approach to integrate all areas of supply chain, including inter-organizational business processes

and relationships, from original suppliers to end user. Bask and Juga (2001, p.150) assert that this holistic approach to SCM integration "sounds impressive but says little", and emphasize the need to establish partially or selectively integrated supply chains in addressing the need to achieve innovation and flexibility in a dynamic business environment. The adoption of a selective integration approach to manage the supply chain in practice is indicated in Lambert and Cooper's (2000, p.80) findings that there was no evidence supporting a total integration of all business processes in the entire supply chain, and that the companies studied "had only integrated some selected key process links, and were likewise only monitoring some other selected links". Fawcett and Magnan (2001, p.27) in an empirical study also reported that integration from suppliers' supplier to customers' customer was perceived by managers to be "very rare—more of a theoretical ideal than a reality", and that few companies had engaged in such extensive integration.

The second issue is the consideration of stakeholders' interests in value creation. While there is little doubt that creation of value for customers is the main objective of all supply chain members, the interests of not only customers, but also other stakeholders, such as suppliers, government agencies, and community members, should be considered in SCM, because an organization's decisions and operations affect and are affected by various parties within and outside its boundary. For example, supply chain members should design and implement business processes in response to stakeholders' concerns of (1) the impact of design, acquisition, production, distribution, use, reuse, and disposal of the products on natural environment (Carter and Carter 1998, Narasimhan and Carter 1998, Zsidisin and Siferd 2001), and of (2) the practice of unethical activities (Carter 2000).

Although these two issues have not been incorporated in the majority of previous attempts to develop SCM concept, the following definition adopted by The Global Supply Chain Forum seems to have addressed these limitations.

> The integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders (The Global Supply Chain Forum, cited in Lambert et al. 1998, p.1).

This SCM definition explicitly highlights the management and integration of key business processes, which implies the adoption of a selectively approach to supply chain integration. By emphasizing the creation of value for both customers and other stakeholders, it acknowledges the existence of multiple, different interests and objectives among constituencies of business environment, including the powerless and the exploited. This definition provides an initial point for developing SCM research from various paradigmatic and philosophical standpoints, as New (1997) has advocated.

In addition, this process perspective of SCM is enriched if it also emphasizes the collaborative relationships of supply chain members, as indicated in Christopher's (1998, p.18) view of SCM: "the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole". Handfield and Nichols (1999) as well as Fawcett and Magnan (2001) in their conceptualization of SCM also stress the role of improved relationships of supply chain members in achieving integration.

Taking all these issues and focuses together, SCM can be considered as:

> A philosophy of management that involves the management and integration of a set of key business processes (spanning from end users to original suppliers) that provides products, services, and information, adding value for customers and other stakeholders through collaborative efforts of supply chain members.

Based on this definition, three core elements of SCM can be identified: value creation, integration of key business processes, and inter-organizational collaboration.

Firstly, creation of value for the consumers (LaLonde 1998) and other stakeholders is central to SCM. The value adding processes of a supply chain take place within a single system (Lummus and Vokurka 1999), in which all parties involved contribute their efforts and commitment. This view is based on the assumption that a supply chain is a network of interdependent, yet autonomous organizations, which individually and collectively create value. Added value may be materialized in various areas of supply chain performance improvement including cost, quality, flexibility, and delivery.

Secondly, creation of value requires the management and integration of key business processes across a supply chain (Cooper et al. 1997, LaLonde 1997, Lummus and Vokurka 1999). This principle builds on the assumption that value is created through a set of inter-linked business processes, which are managed by different parties in a supply chain. Business process integration involves joint actions/practices of supply chain members that aim to create best product flows through continuous information flows. As Lambert and Cooper (2000) suggest, key business processes include customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, procurement, product development and commercialization, and returns. Integrating activities of these key business process that span firm boundaries requires the implementation of a set of SCM practices, such as the practice of deliveries synchronization, integrated production planning, shared production forecasts, joint EDI access/networks, packaging congruence, and Kanban procurement approach, jointly by supply chain members at the operational level.

However, supply chain members do not implement these practices to the same degree. Rather, they will apply the practices that match the demand characteristics of products they supply. According to Fisher (1997), the demand of functional products with long product life cycles is stable and predictable, whereas that of innovative products with short product life cycles is unstable and unpredictable. To address demand uncertainty in volatile markets, trading partners need to establish an agile supply chain, in which inventory and process lead times are slashed through real-time information sharing throughout the chain (Mason-Jones and Towill 1999). This approach is indicated in a recent survey research that members of innovative-product supply chains seek higher integration through applying information practices in production planning and control, quality management, and service and after-sales support to a greater extent than members of functional-product supply chains do (Ramdas and Spekman 2000).

Thirdly, integration of key business processes in a supply chain is best achieved through collaboration of business partners (Christopher 1998). The principle of collaborative commerce is based on the assumption of synergy—properly managed the whole can be greater than the sum of its parts. It further assumes that interdependent organizations seek to work closely to achieve greater gain when they see each other as partners. Collaboration of supply chain members can be understood as a form of cooperative inter-organizational relationships, which are "socially contrived mechanisms for collective action" (Ring and Van de Ven 1994, p.96). Depending upon the basis through which inter-organizational economic behavior develops, inter-organization cooperation can be achieved through either collaboration or compliance. Specifically, trust provides a basis for achieving

collaboration, while power serves as a mechanism for achieving compliance (Hardy and Phillips 1998, Hardy et al. 1998).

Collaboration between organizations stems from the building of a trusting relationship, which is generated "as the partner deliberately tried to establish goodwill towards each other and refrain from opportunistic behavior at each other's expenses" (Hardy et al. 1998, p.71). Further, collaboration is characterized by the partners' voluntary basis of reciprocal engagement, and "operates on a model of shared power" (Gray 1989, p.119), in which the partners have "sufficient power to prevent other organizations from imposing solutions on them or other affected parties" (Hardy and Phillips 1998, p.224). In contrary, compliance is characterized by inequities in power, and non-voluntary participation, where weaker parties have no choice but to cooperate under the dominance of powerful parties (Hardy and Phillips 1998). The terms and conditions of cooperative relationships are mutually determined in collaboration, but they are dictated and enforced by the dominant parties in compliance.

In essence, the philosophy of SCM suggests that organizations in the supply chain collaborate to create value for customers and other stakeholders by integrating and managing key inter-firm business processes. Based on the relationships between these three core elements of SCM specified in this definition, conceptual models that encompass the antecedents and consequences of SCM practices could be developed.

2.5.3 Modeling approach

As presented previously, the extant empirical studies of SCM models, regardless how sophisticated analytic techniques have been applied, focus predominantly on the SCM practices-performance relationship, and pay little

attention to the context under which SCM practices are implemented. Context is the setting in which organizational practices are established and applied. Organizational practices are contextually embedded in a way that the possibilities for their emergence and functioning are created or constrained by the context. Although the process-based definition of SCM indicates that supply chain members' collaborative relationships, which are important contextual factors, are crucial for achieving process integration, little studies focus on this context-practices relationship. Nevertheless, some studies have examined the context-performance relationship. For, example, Monczka et al. (1998) in their study of success factors in strategic supplier alliances examined a model that predicted five specific performance dimensions (improvements in price and quality of purchased material, order cycle time, new product development time, and access to new technologies) by a set of factors including attributes of alliances' relationships, among others. The results of multiple regression analysis showed that the factor of trust and coordination was a strong significant predictor of all performance dimensions (except cycle time).

Although Monczka et al.'s (1998) model specified a direct effect of attributes of alliances' relationships on performance, which was supported by their findings, it is expected that the impact of these attributes on performance could be mediated through the implementation of a set of SCM practices. That is, collaborative relationships between supply chain members promote the adoption of SCM practices, which in turn improve performance. As such, there is a need to expand and integrate prior research that focus either on the context-performance relationship or on the practices-performance relationship. Specifically, further SCM models need to build on a context-practices-performance framework (Ho and Duffy 2000), modeling not only SCM practices and their impacts on performance, but also the contextual effects

of environmental, strategic and social factors on the functioning of SCM practices (see Figure 2.2).

Figure 2.2 A context-practices-performance framework of SCM (based on Ho and Duffy 2000)

There is also a need to build on theories developed in other fields, in addition to operations management, to develop SCM models, which echoes Amundson's (1998) recent discussion on the future directions of theory-driven empirical research in operations management. The interactions between SCM and other theoretical domains are particularly important in examining the context-practices relationship. Specifically, it is beneficial for researchers to draw on insights from organization studies literature in studying the impact of some socio-cultural contextual factors on the application of SCM practices, as solid theoretical grounds that substantiate the context-practices relationship can be established. The call for paying more attention to organization studies literature is not new, as this has been stressed by prior studies on a related management approach—total quality management (TQM) (Benson et al. 1991, Ahire et al. 1995, Ho et al. 1999). It is also beneficial to draw on insights from prior research findings that indicate positive impacts of contextual factors, such as organization culture and trust, on the practice of TQM (e.g. Ho and Duffy 2000). This is because these findings provide some directions and justifications for identification of key contextual factors and their measures, although SCM focuses more on the inter-organizational issues, whereas TQM emphasizes more on the intra-organizational issues.

2.6 Summary

This Chapter has reviewed some studies in extant SCM literature, and found several major weaknesses in the conceptualization, operationalization, and modeling of SCM. In particular, the SCM construct is perceived narrowly as an extension of integrated purchasing and supply management or integrated logistics and transportation management. Even worse is the practice of associating a set of measurement items with the SCM construct without presenting a clear description of the content domain, or even without defining the construct. Exacerbating this problem is the practice of associating essentially the same construct with multiple labels, or using essentially the same set of instruments to measure different constructs, coupled with the one-sided focus of current conceptual SCM models on the practices-performance relationship.

All these limitations stem mainly from the insufficient attention paid to theorizing SCM, especially the inadequate explication of the core elements and the boundaries of the SCM construct. As the core elements of a construct are poorly specified, different interpretations of its exact meaning are made possible. Consequently, it becomes very difficult to establish a valid instrument to reflect the construct. In a similar vein, as the relationships between the core elements are not clearly specified, incomplete or even conflicting conceptual models may result.

In order to advance theory development of SCM, it is crucial for researchers to pay more attention to the initial step of the theory-building process. That is, to define and specify the content domain of the SCM construct clearly before progressing to operationalization and modeling its antecedents and consequences. The process-based view of SCM presented in this Chapter can benefit researchers by providing a starting point for understanding and examining the subject matter. In

addition, by adopting the context-practices-performance framework, researchers are encouraged to consider not only the impact of SCM practices, but also the potential contextual factors influencing the implementation of SCM. Perhaps more rewarding is the cross-fertilization of theories and research of SCM and those of related fields such as organization studies, because such synthesis can strengthen the theoretical grounds of conceptual and empirical studies of SCM.

Chapter 3 : The theoretical framework and model

In this Chapter, a theoretical model, which integrates multiple theoretical perspectives and adopts a context-practices-performance framework and a process-based view of SCM (presented in Chapter Two), is developed to examine the antecedents, components, and performance consequences of SCM implementation. This Chapter is divided into the following Sections. An overview of the proposed theoretical SCM model for the clothing industry is presented in Section 3.1, which is followed by the description of the components of the model and hypotheses. Section 3.2 presents the constructs of SCM practices and idiosyncratic investments and their interrelationships, as well as the development of Hypotheses 1a-d. In Section 3.3, the contextual influence of environmental, strategic and social factors on SCM implementation, and the development of Hypotheses 2-6 are presented. The impact of SCM practices on operations performance improvement and collective competitive advantage, and the development of Hypotheses 7a-b are described in Section 3.4. The Chapter concludes with a summary of the theoretical model and hypotheses in Section 3.5.

3.1 A theoretical SCM model for the clothing industry

The current initiative to implement SCM in the Hong Kong clothing industry (Au and Ho 2002a) can be traced back to the development of Quick Response (QR) strategy in the US textile and clothing industry in the mid-1980s (Lummus and Vokurka 1999). As a way to combat low-cost producers in countries like China and Mexico, QR strategy has been applied by US clothing manufacturers to regain their

competitive advantage. This strategy aims to provide an organization the ability to meet the demand of a highly diverse range of products in the exact quantity and quality, and at the right time, place, and price as required by customers (Lowson et al. 1999). QR appears to be a viable approach to match clothing supply to dynamic market demand in today's global clothing marketplace, where the design and styling in almost every clothing category have grown significantly; the boom in retail space has outpaced the growth in consumer expenditures; and the pressure to offer lower prices to consumers is on the rise (Abernathy et al. 1999). Indeed, the application of QR practices has diffused from the US to other regions such as the UK (Hunter et al. 2002, Birtwistle et al. 2003) and Taiwan (Hsueh 2000).

Although the movement toward SCM in the clothing industry has its root in QR, review of QR literature indicates several different views on the concept of QR and SCM. At one end, both concepts are treated as synonyms (Byrne and Young 1995), whereas at the other end, QR is strongly differentiated from SCM. This view is clearly indicated by Lowson et al. (1999) and Hunter et al. (2002), who claim that the concept of SCM is rhetoric and somewhat superficial. These researchers have trivialized a rich concept of 'SCM' and considered it simply as 'managing the supply chain'. They have also associated strategic and operational issues that are relevant to the entire supply chain solely to the QR domain. Unfortunately, without the support of in-depth review and analysis of recent advancement of SCM research, in particular in the field of operations management (see a recent review by Chen and Paulraj 2004), their reasons for downplaying an emerging stream of SCM literature seem to be unfounded (see a critique by Nair 2001).

In between these two ends, some researchers have occupied the middle ground, stressing the complementary relation between QR and SCM. For example,

Kincade et al. (2001, p.303) in a study of US clothing manufacturers examined "the use of Quick Response (QR) technology for supply chain management", and considered that a sophisticated level of QR implementation reflects the mature stage of SCM. More explicit than that, Lee and Kincade (2003, p.34) in a SCM study of the US clothing industry noted that "The apparel industry has practiced the philosophy of SCM as part of the strategy of quick response (QR)", and considered some key QR practices (e.g. computer-to-computer communication, EDI, and frequent, small lot order and delivery) to be SCM activities.

Among these three views on QR and SCM, the complementary perspective appears to be most useful for studying SCM in the clothing industry. That is, on one hand, to consider SCM as a philosophy that encompasses a set of management principles (i.e. value creation for customers; management and integration of key inter-organizational business processes; and collaboration of partner firms in a supply chain) for managing the clothing supply chain at the strategic level. This calls for attention to a number of strategic issues including the evaluation of environmental impact on the application of SCM, identification of potential partners to implement SCM; assessment of the possibility of forming collaborative arrangement with the potential partners; and investment of assets dedicated to the partners for business process integration.

On the other hand, the complementary view considers the implementation of SCM practices (which encompass core QR technologies) as a means to apply the guiding principles of SCM for performance improvement at the operational level. Important issues to be examined include the identification of key business processes for integration; the core operational practices to be implemented for such integration; and the impact of these practices on operations performance.

While prior QR research has provided insights into the study of SCM practices, there is a need to expand the focus on operational issues within the domain of QR, in order to provide a better understanding of SCM in the clothing industry. To this end, a theoretical SCM model that examines the antecedents, components, and performance consequences from multiple theoretical perspectives is developed (see Figure 3.1 for an overview of the theoretical model).

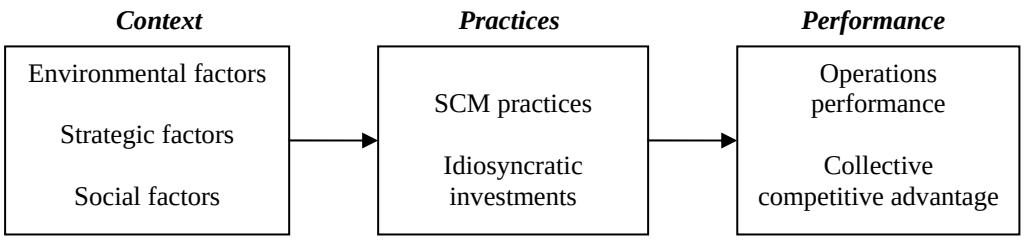

Figure 3.1 Overview of the theoretical SCM model

The approach adopted to develop this SCM model represents a novel and sophisticated way to study SCM and offers insights in several ways. Firstly, by applying the context-practices-performance framework to examine SCM, the proposed theoretical model on one hand has addressed the weaknesses of prior SCM studies that focus solely on the relationship between SCM practices and performance (e.g. Tan et al. 1998b, Tan et al. 1999, Scannell et al. 2000, Power et al. 2001, Salvador et al. 2001), through the incorporation of key contextual factors that promote the application of SCM practices. On the other hand, the theoretical model has also extended prior studies that focus solely on the relationship between contextual factors and performance of a supply chain (e.g. Monczka et al. 1998) by incorporating SCM practices as a set of factors that mediate the effect of context on performance. As such, the proposed theoretical model has addressed the limitations of these two prior modeling approaches by proposing an integrative view on the

examination of the contextual effect, nature, and consequences of SCM implementation.

Secondly, the advocacy of a process-based view of SCM by the theoretical model transcends the divided functional approaches to SCM conceptualization in the extant literature (Tan 2001), and avoids biased identification of SCM practices that focus on either purchasing and supply function or logistics and transport function. More importantly, the process-based view provides a more systematic way to examine the nature, interrelationships, and impact of different yet highly related SCM practices. This extends prior studies of QR in the clothing industry, which predominately operationalize QR strategy as a set of technologies and combine various QR technologies as a whole in the examination of its effect (e.g. Kincade 1995, Ko and Kincade 1997, 1998, Ko et al. 2000, Kincade et al. 2001).

Thirdly, by incorporating environmental, strategic and social factors as antecedents of SCM, the theoretical model has expanded the narrow scope of prior approaches to conceptualize SCM antecedents that focus primarily on social and organizational factors (e.g. Mentzer et al. 2001) or environmental factors (e.g. Fisher 1997), in an effort to address the complex nature of contextual impact on SCM. In addition, through the integration of the theoretical perspectives of bullwhip effect (Lee et al. 1997), resource-based theory of strategic alliances (Das and Teng 2000), relational view of competitive advantage (Dyer and Singh 1998), and social network perspective on strategic alliances (Gulati 1995) in formulating contextual effect, the theoretical model is able to achieve a more comprehensive explanation for the issues being examined than a single theoretical approach does. At the same time, the model has echoed the call to apply a multidisciplinary approach to develop SCM theory (Croom et al. 2000). Indeed, the incorporation of multiple antecedents in the

theoretical model has expanded the limited scope of some simulation studies of QR operating practices and benefits in the clothing industry (e.g. Lowson et al. 1999, Hunter et al. 2002). Details of the theoretical SCM model are presented in the following Sections.

3.2 SCM practices and idiosyncratic investments (Hypotheses 1a-d)

The process-based view of SCM (presented in Chapter Two) posits that management of the supply chain requires allied firms to implement a set of SCM practices. Specifically, it involves integration of key business processes, which span product development and pre-production, purchasing and production, and delivery and distribution, through the application of information technology (IT) and commitment of bilateral idiosyncratic investments. Consistent with the current view on the role IT on SCM (e.g. Spekman et al. 1998, Strader et al. 1999, Lee and Whang 2000, Humphreys et al. 2001, Shah et al. 2002), inter-organizational information systems are modeled as an enabler of SCM, which facilitates allied firms to collect, analyze and share information, so that integration of business processes can be undertaken.

Based on literature review, case and survey studies of the Hong Kong clothing industry (Au and Ho 2000, 2002a), a set of SCM practices that involve process integration and information sharing in the clothing export supply chain are identified. Building on the process-based view of SCM, four hypotheses (1a-d) are developed to examine the relationships among process integration, information sharing, and idiosyncratic investments made by the buyers and suppliers. A model of Hypotheses 1a-d is shown in Figure 3.2.

H1a: There are positive associations between integration of product development and pre-production, purchasing and production, and delivery and distribution processes.

H1b: There are positive associations between sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means (EDI or web-based applications).

H1c: There are positive associations between process integration (product development and pre-production, purchasing and production, and delivery and distribution processes) and information sharing (product information, purchasing information, and sales and inventory information sharing).

H1d: There are positive associations between SCM practices and idiosyncratic investments committed by a buyer and a supplier.

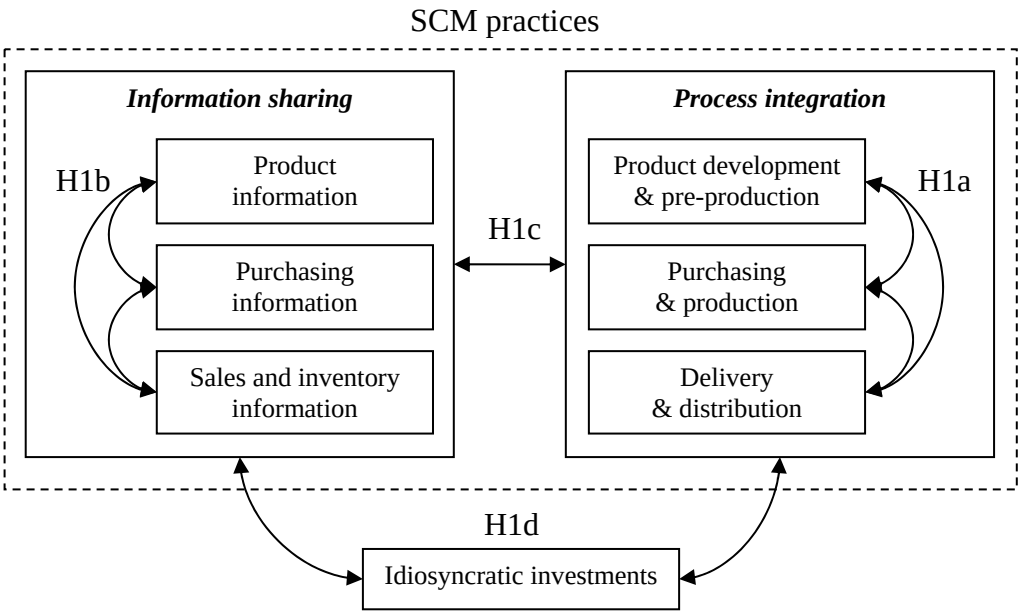

Figure 3.2 A model of Hypotheses 1a-d

3.2.1 Integration of product development and pre-production processes

Integration of a buyer's product development and a supplier's pre-production processes, which involves the practice of supplier involvement in product development, is thought to be an important element of SCM. The importance of this practice is reflected by the fact that several SCM studies have considered this factor

as a component of their conceptual models and provided empirical support for its positive impact on operations performance (e.g. Narasimhan and Das 1999, Shin et al. 2000, Power et al. 2001, Tracey and Tan 2001).

The benefits of involving suppliers in a buyer's product development process include the potential of harnessing suppliers' technological competence, reducing the time to market, improving the quality and lowering the global cost of the product, and increasing the level of motivation of suppliers for their higher responsibility in product design (De Toni and Nassimbeni 2001). Past research has shown that manufacturers and their suppliers, particularly those in the automotive industry, have successfully applied this practice to improve performance (Clark 1989, Clark and Fujimoto 1991, Turnbull et al. 1992).

Although the product structure and components of clothes are considered to be less complex than that of automobiles, the potential benefits realized from early supplier involvement in product development cannot be undermined in the clothing industry. Despite the fact that typical offshore clothing manufacturers are specialized in contract/specification manufacturing, and do not involve in original design concept generation, they can collaborate with buyers to develop products during the prototyping stage (i.e. the development of production samples) in different ways to improve supply-chain performance.

Firstly, they can provide information and suggestions to clothing designers on the use of standard components and accessories (e.g. buttons and zippers), from which several benefits can be realized: materials sourcing lead time is shorter as standard items are more readily available in the market and thus less searching is involved; product and inventory costs are lower as additional premium is incurred for

tailor-made items; and production holdups due to limited or unreliable supply of special items are reduced (Fisher et al. 1994).

Secondly, clothing manufacturers can provide information and suggestions to designers on simplification of product design, which involves reduction of product structure complexity and removal of unnecessary features or components (e.g. reducing color shades while satisfying essential aesthetic requirements). As such, without reducing the variety perceived by the end-users, production complexity and costs are reduced and production lead time and product quality are improved (Forza and Vinelli 1996, De Toni and Nassimbeni 2001).

Thirdly, manufacturers can assist designers to develop product specifications in a way that the specifications are "expressed clearly and comprehensively; are sufficiently precise and rigorous; provide enough information for inspection and quality test purposes; and do not include unnecessary and nonessential features" (De Toni and Nassimbeni 2001, p.173). As a result, a good basis for materials sourcing and production process planning can be established.

Fourthly, manufacturers can contribute to product development by preparing samples timely and reliably. The speed and quality of sample making is important in shortening the design-prototype-test cycle in the process of developing new products, so that more samples are made available to designers to evaluate different design, identify potential problems, and select the best design (De Toni and Nassimbeni 2001). Thus, the time and quality of new product development can be improved.

Given the substantial influence of product design on the planning and execution of subsequent business processes (e.g. purchasing and production) undertaken by various supply chain members, the need for early supplier involvement in product development is greatly warranted. In addition, the potential

benefits provide strong incentive for the members to apply this practice. It is expected that the application of this SCM practice jointly by clothing buyers and manufacturers in product development can improve operations performance and thus provide a competitive advantage for the parties involved.

3.2.2 Integration of purchasing and production processes

Integration of a buyer's purchasing and a supplier's production processes is an essential element of SCM that helps to reduce order variability and improve operations performance. Frequent, small-lot purchasing and production are deployed in the integration. According to the literature on JIT (Waters-Fuller 1995) and QR (Hunter 1990), an increase in the frequency of supplies and a reduction in the quantity per shipment are important practices to reduce the need to accurately predict demand well in advance of sales, but yet enable quick response to uncertain demand with reduced buffer stocks.

Specifically, the provision of actual sales, sales forecasts, and inventory data by clothing retailers to manufacturers is crucial to achieve successful integration, because manufacturers can improve demand forecasting and production scheduling if an accurate demand pattern is made available to them. Together with the application of advanced manufacturing technologies and practices, clothing manufacturers can reduce order-to-delivery lead times significantly and support frequent and small-lot supplies. As such, the synchronization of contracting orders and scheduling production with actual sales at retail stores can be accomplished with less buffer stocks.

Integration of purchasing and production processes also involves the contracting of blanket purchase orders, which is an important practice to reduce

purchasing and production lead times. To undertake this practice, clothing buyers based upon actual sales and sales forecasts develop projected aggregate demand of garments and delivery schedule. With this information, buyers place blanket orders to suppliers. Although complete product specifications are not finalized at this point, clothing manufacturers start to lock-up production capacity for fulfilling the orders, whereas other upstream suppliers such as yarn suppliers and fabric suppliers reserve undyed yarn, pre-position greige fabrics, and schedule capacity for weaving and dyeing. With this early commitment in production, the orders can be completed in a shorter time. This practice of contracting blanket purchase orders has been applied by companies such as Li & Fung Limited, which is a premier global consumer products export trading company with head office in Hong Kong (Magretta 1998).

In addition, the degree to which a buyer's purchase ordering system is linked directly to a supplier's production planning system and the degree to which the buyer's consideration of the supplier's production capacity and schedule in developing purchase order plan also affect the synchronization of contracting orders and scheduling production (De Toni and Nassimbeni 2000).

The contribution of integrating purchasing and production processes to effective SCM has been indicated in some recent studies. As the practice of frequent, small-lot purchasing reflects the logic of JIT purchasing (De Toni and Nassimbeni 2000), it is not surprising to find that JIT purchasing has been considered to be an element of SCM in some empirical studies (e.g. Scannell et al. 2000, Power et al.2001). The practice of providing supply chain members with access to planning systems and sharing production plans has been shown to be some key supply chain integration tactics in the global manufacturing industries of fabricated metal products, machinery and equipment (Frohlich and Westbrook 2001). For the textile and

clothing industry, SCM initiative can be traced to the development of QR strategy (Lummus and Vokurka 1999), which is the application of JIT operations philosophy and advanced IT in managing information and material flow (Sullivan and Kang 1999). Indeed, prior QR studies have examined the application of QR technologies for effective SCM in the clothing industry (e.g. Kincade et al. 2001, Lee and Kincade 2003).

3.2.3 Integration of delivery and distribution processes

Integration of a supplier's delivery and a buyer's distribution processes is an important element of SCM, as these processes have to be coordinated so that efficient product flow can be achieved. Two arrangements that support such integration have been applied in practice increasingly: cross-docking and direct-store shipment (Abernathy et al. 1999, Simchi-Levi et al. 2003). In cross-docking system, manufacturers ship orders for different stores to distribution centers where merchandises are inspected, sorted by destination store, repacked and dispatched. The distribution centers serve mainly as inventory coordination areas and not inventory storage areas, as merchandises flow through the centers quickly. In direct-store shipment, manufacturers deliver merchandises directly to retail stores, without the use of distribution centers. Delivery lead time and inventory cost are saved, as the time for merchandises remain in storage before they are consumed is reduced significantly in both arrangements.

The application of advanced IT and sharing of purchasing information are essential to the integration of a supplier's delivery and a buyer's distribution processes in the clothing industry, as this has been demonstrated in QR literature (Lowson et al. 1999, Hunter et al. 2002). Specifically, bar-coding of merchandises

enables efficient tracking of product flow in the supply chain. Precise product identification is made possible when merchandises are attached with barcodes that comply with Uniform Product Code (UPC), as each Stock Keeping Unit (SKU) is assigned with a unique and unequivocal item number (Fiorito et al. 1998).

Bar-coding supports computerized scan and pack function at clothing factories for delivery of store-ready merchandises. By utilizing scanners and appropriate information systems, the packing activities in factories can be electronically documented. For every order, each individual item must be scanned into the system when it is packed for comparison to the pre-defined picking instruction. As orders will not be confirmed for shipment unless all items packed are scanned and checked, higher accuracy of the carton contents can be achieved and thus less shipping errors will be involved. After the order is confirmed, advance shipment notice can be automatically generated and sent to buyers through the system in electronic format. To realize these benefits, clothing suppliers are required to implement pre-ticketing of merchandise, that is, to print bar-coded tickets and hang tags as well as to ticket merchandises before shipment, whereas clothing buyers need to provide accurate ticketing information to suppliers in electronic format when placing orders. In addition, the practice of minimal inspections of incoming goods or free pass for deliveries is crucial to achieve efficient product flow (De Toni and Nassimbeni 2000).

As a summary, integration of product development and pre-production, purchasing and production, and delivery and distribution processes involve the application of the practices shown in Table 3.1.

Table 3.1 A summary of the practices of process integration

Product development and pre-production integration	Purchasing and production integration	Delivery and distribution integration
Supplier involvement in product development • Use standard components and accessories • Simplify product design • Develop clear and comprehensive product specifications	• Frequent and small-lot purchases • Place blanket purchase orders • Inform changes in purchase order and production schedule • Match development of ordering plan and production schedule	• Pre-ticketing of products • Standardized bar-coding of products • Scan and pack system for delivery of store-ready products • Frequent and small-lot shipments • Cross-docking or direct-to-store shipments • Minimal inspection or free pass for deliveries

3.2.4 Sharing information through electronic means

Sharing important information between clothing buyers and suppliers in a timely manner is essential to enable the integration of business processes across firm boundaries. Specifically, sharing information about product design, purchasing, and sales and inventory through electronic means is vital to support integration of product development and pre-production, purchasing and production, and delivery and distribution processes in a clothing supply chain.

The practice of supplier involvement in product development requires a high degree of communication between the buyer and supplier (De Toni and Nassimbeni 2000). Specifically, the quality of product information exchanged is of great concern, because acting on inaccurate, incomplete, or inconsistent product design and specifications will jeopardize the execution of a series of interconnected tasks in the pre-production stage, including quotation preparation, cost estimation and analysis, bills of material development, construction details development, materials sourcing, and product samples preparation.

Product Data Management (PDM) systems, which are database driven information systems that are used to “control information, files, documents, work

processes required to design, build, support, distribute, and maintain products" (Liu and Xu 2001, p.252), are useful in managing information flow between the supply chain members involved in the design and pre-production processes. By utilizing web-based PDM systems, clothing buyers can (1) organize and integrate product information, such as sketches, drawings, and specifications of fabric, trim, accessories, and measurement, from the various software applications used in the product development cycle in a systematic manner, and (2) provide suppliers with an instant, read-only access to the required information from the same data source via the Internet (Hill 1999, DesMarteau et al. 2000). In this way, early supplier involvement in product development is greatly supported.

As the product information exchanged is of high quality, an accurate translation of the original design into production samples in the first place could be achieved. In addition, more benefits can be realized when PDM systems are deployed as a bridge linking buyers' Computer-Aided-Design (CAD) systems and suppliers' Computer-Aided-Manufacturing (CAM) systems. As the product data supplied by buyers are readily compatible with suppliers' CAM systems, the need for data re-entry is avoided. Thus, computerized marker making, grading, and pattern making as well as cutting operations can be undertaken quickly. In this way, through the exchange of digitized product information between clothing buyers and suppliers, the processes that span from new design concept generation to production-ready samples preparation can be better coordinated, and thus new product development can be speeded up.

This growing trend of using advanced IT to facilitate product development in order to reduce time to market has been indicated in some recent studies. For example, Forza et al. (2000, p.235) in a survey of Italian textile and clothing

companies showed a “tendency towards greater integration of CAD with systems adopted to manage product data (bills of materials, standard costs, production cycles, brochures, etc.)”. Au and Ho (2002a) in a case study of Hong Kong clothing industry also reported the growing application of web-based PDM system to integrate clothing buyers’ product development process and suppliers’ pre-production process.

It is expected that sharing important product information between clothing buyers and manufacturers through inter-organizational information systems is critical to the establishment of an infrastructure that promotes and enables collaborative product development.

In addition to product information, sharing purchasing and sales and inventory information through electronic means is also important to support process integration. EDI, which is a particular type of inter-organizational information system that “involves the exchange of structured information (typically business documents) between companies, from computer to computer and in a standard format” (O’Callaghan 1998, p.179), has been increasingly applied to enable process integration. The application of EDI in sharing critical information between trading partners has been examined in empirical SCM studies (e.g. Dong et al. 2001, Frohlich and Westbrook 2001, Salvador et al. 2001) and QR studies (e.g. Kincade 1995, Lowson et al. 1999, Hunter et al. 2002).

Electronic transmission of purchasing information, including purchase orders, order acknowledgements, advance shipment notices, and packing information, in EDI format has enabled the automation of routine activities, avoiding data re-entry as well as reducing manual checking and corrections in processing business documents. Higher data accuracy, fewer errors, and shorter administrative lead times can be achieved, as a result of reduced human interventions.

With the aid of scanning devices at the point of sale (POS) in stores, collection and transmission of sale and inventory data of bar-coded merchandises can be undertaken quickly and instantaneously (Abernathy et al. 2000). As the collection, analysis and utilization of information on product mix and SKU volumes are greatly facilitated, retailers can make a more informed judgment on forecasting demand and planning purchase orders, whereas with the provision of sale and inventory data by the retailers through EDI, suppliers can develop production schedule more accurately and fulfill the orders more efficiently. In this way, sharing information through EDI supports the functioning of JIT purchasing and delivery. That is to synchronize contracting orders and scheduling production to address uncertain demand. In practice, the application of EDI with suppliers and customers is growing in the textile and clothing industry of Hong Kong (Au and Ho 2000) and Italy (Forza et al. 2000), among others, for better management of the supply chain.

In addition to EDI, Internet technology emerges to be a new tool to support process integration. Recently, open and complementary standards governing the implementation of web-based electronic business have evolved quickly. In particular, the development of XML (Extensible Markup Language)-based e-business frameworks for horizontal (cross-industry) and vertical (industry-specific) applications has been the prime focus of various global-wide industry standard groups and consortia, such as UN/CEFACT (United Nations Center for Trade Facilitation and Electronic Business) and OASIS (Organization for the Advancement of Structural Information Standards). These frameworks, such as ebXML, RosettaNet, and BizTalk, specify standards for such components as business processes, information to be exchanged, trading partner agreement, and messaging (transport, routing and packaging of messages). Despite the fact that different

standardization initiatives continue to develop, most of them have adopted an open and complementary philosophy to build a unified, universal approach to e-business standardization.

Increasingly, web-based technologies building on these emerging standards, such as XML-based EDI systems, have been applied to automate information exchange between trading partners in various industries (Lu et al. 2001, Shin and Leem 2002, Yen et al. 2002). In particular, in the Hong Kong textile and clothing industry leading companies in collaboration with semi-governmental bodies and universities have developed and applied web-based applications to digitize and exchange business messages as well as to migrate business processes, such as sourcing, order placement and delivery, onto the Internet (Au and Ho 2002a, Au and Ho 2002b, Yen and Ng 2002, Yen and Ng 2003). A summary of sharing information on product, purchasing, and sales and inventory is shown in Table 3.2.

Table 3.2 A summary of the practices of information sharing

Product information	Purchasing information	Sales and inventory information
• Exchange product design information, product specifications, and information for product development through web or e-mail	• Exchange purchase orders, packing instructions, advance shipment notices, and invoices through EDI or web	• Exchange Point-of-sale data, sales forecasts, and inventory data through EDI or web

In summary, it is proposed that SCM implementation encompasses the integration of product development and pre-production, purchasing and production, and delivery and distribution processes, which are enabled by sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means (e.g. EDI, web, and e-mail). As such, the following hypotheses are proposed.

H1a: There are positive associations between integration of product development and pre-production, purchasing and production, and delivery and distribution processes.

H1b: There are positive associations between sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means (EDI or web-based applications).

H1c: There are positive associations between process integration (product development and pre-production, purchasing and production, and delivery and distribution processes) and information sharing (product information, purchasing information, and sales and inventory information sharing).

3.2.5 SCM practices and idiosyncratic investments

Implementation of SCM practices involves investments committed by buyers and suppliers in various areas, such as new information systems and communication networks, barcode printing and scanning devices, packing equipment, and training, which enable the integration of key business processes across firm boundaries. Such investments are considered to be idiosyncratic because the investments are tailor-made for a particular pair of exchange partners, which facilitate and support transactions between them, and have little value elsewhere (Williamson 1985). Idiosyncratic investments can take on various forms. For example, a manufacturer may make (1) site-specific investments to establish production plants that are located close to its major buyers; (2) transaction-specific capital investments to tailor production processes to its major buyers' requirements; and/or (3) transaction-specific know-how investments to establish a team of salespersons dedicated to serving its major buyers. In order to integrated inter-organizational business processes successfully, bilateral investments in specialized equipment and facilities, skilled human resources, and developing and implementing specialized operating

processes that are dedicated to transactions between partner firms would be essential (Anderson and Weitz 1992 and Ganesan 1994). This leads to the following hypothesis.

> *H1d: There are positive associations between SCM practices and idiosyncratic investments committed by a buyer and a supplier.*

3.3 Antecedents of SCM implementation and idiosyncratic investments

The influence of the context in which firms embedded on the application of SCM practices and bilateral idiosyncratic investments can be examined from the environmental, strategic and social aspects. Although prior research has suggested that environmental uncertainty (Jap 1999, Mentzer et al. 2000, Ramdas and Spekman 2000), the need for strategic complementary resources (Jap 1999), and social capital (Harland 1999) including inter-organizational trust (Lee and Billington 1992, Spekman et al. 1998, Mentzer et al. 2001) and relational norms are important antecedents of SCM implementation, an integrative model that studies the effect of these factors on SCM is yet to developed.

To address this research gap, the theoretical model proposes that individual firms in isolation fail to respond effectively to demand uncertainty resulted from rapidly changing consumer requirements and short product life cycle. The uncertainty in the supply chain creates pressure for firms to form an alliance and exploit each other's competitive capabilities in order to respond to changing demand quickly and outperform competitors. Although the synergistic effect of harnessing complementary competitive capabilities can be realized through the deployment of IT to integrate key business processes that span firm boundaries, this approach to manage the supply chain is not equally applicable to all firms. This is because not all firms share equal opportunities to collaborate. The key lies in the availability of

social capital that firms can deploy to form partnership so as to combine each other's competitive capabilities. This leads to the following model of Hypotheses 2-4 (Figure 3.3).

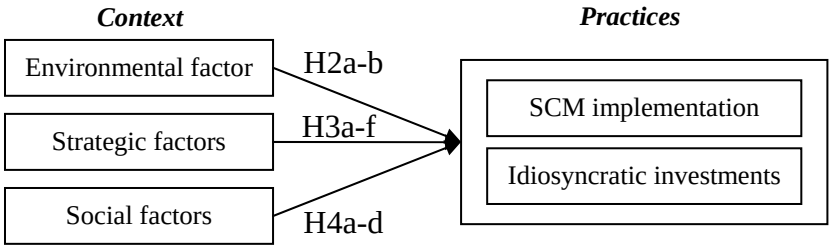

Figure 3.3 A model of Hypotheses 2-4

3.3.1 The influence of task environment on SCM implementation and idiosyncratic investments (Hypotheses 2a-b)

As shown in Figure 3.4, the theoretical model hypothesizes that demand uncertainty of the product influences SCM implementation and idiosyncratic investments.

H2a: There is a positive association between SCM implementation and demand uncertainty (indicated by the fashion level and seasonality of the product).

H2b: There is a positive association between idiosyncratic investments and demand uncertainty (indicated by the fashion level and seasonality of the product).

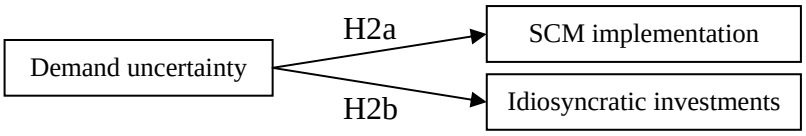

Figure 3.4 A model of Hypotheses 2a-b

The task environment in which firms operate has an impact on the implementation of SCM. Specifically, demand uncertainty of the product influences

the design and application of SCM practices (Fisher 1997). Matching supply and demand is a challenging task in an uncertain environment where consumer demand fluctuates significantly and product life cycle is short. This is because an accurate demand forecast for new items is difficult to achieve with little historical data, markdown of obsolete inventory may involve substantial loss, and shortage may cost significantly in potential revenue. Indeed, this challenge is observed in the global clothing marketplace where value-conscious consumers are demanding more in-stock items with greater variety and novelty at lower prices (Abernathy et al. 1999, Dickerson 1999, Lowson et al. 1999). To satisfy consumer requirements, retailers have to increase offerings of innovative products in a short time and raise service level (i.e. to reduce probability of stock-out). Consequently, manufacturers need to reduce order processing and production lead times and increase delivery accuracy in order to fulfill retailers' frequent, small-lot orders. In turn, raw material suppliers have to satisfy manufacturers' requirement in a similar fashion.

In practice, these inter-organizational collaboration and coordination are difficult to achieve, as the objectives that different supply chain members want to achieve are conflicting (Lee and Billington 1992, Simchi-Levi et al. 2003). For the purpose of efficient planning and operation, most raw material suppliers want manufacturers to place orders with little variation in the mix of required materials and with stable and large production volume requirements, so that economies of scale can be achieved. Similarly, as manufacturers want to achieve low production costs through high productivity, they seek to fulfill orders with known and stable demand pattern, so that long production runs with little changeovers can be implemented. However, manufacturers' desire for production efficiency is in direct conflict with retailers' demand for short lead times and flexibility in product mix and

volume, as consumers want great product variety and high service level. In this way, manufacturers have to become more flexible in delivery to meet retailers' requirements and changing demands. In turn, raw material suppliers' objective of implementing large-batch production now becomes in conflict with manufacturers' desire for flexibility in supply of material mix and volume.

When supply chain members are operating with conflicting objectives independently, poor system-wide performance is expected. In particular, large-batch ordering creates the bullwhip effect, that is, the variance of orders amplifies as one moves upstream (Lee et al. 1997). Despite the fact that the actual demand of a product could be fairly stable, the demand pattern that manufacturers observe can become distorted and highly variable, if retailers place a large order, which is followed by several periods of no orders and followed by another large order, and so on. Consequently, raw material suppliers see even higher variance of orders when manufacturers act on erratic demand pattern and place large-batch orders infrequently. The problem resulted from high order variance is that manufacturers need to carry more safety stock than retailers or to maintain higher capacity than the retailers in order to meet the same service level as the retailers, because variance of orders placed by the retailers is higher than variance of consumer demand (Simchi-Levi et al. 2003). In this way, inefficiency in the form of excess capacity or inventory and in terms of cost and time amplify and accumulate along the supply chain. This problem becomes more acute if there is a high variance in actual product demand.

In addition, long order-to-delivery lead time, which may be resulted from long production runs to optimize capacity utilization or from inefficient administrative and manufacturing processes, increases variance of orders. As the estimation of order volume depends partly upon projected demand in the period of

order placement and receipt of products, a small change in the estimate of demand variance leads to a significant change in order variance if the lead time is long (Simchi-Levi et al. 2003). Long lead time also widens the forecast horizon, which makes demand forecast less accurate. Consequently, similar to the problem of large-batch ordering, a distorted and highly variable order pattern resulted from long lead time leads to supply chain inefficiency.

Another factor contributes to the increase in variability in the supply chain is the practice of forecasting demand that is based mainly upon order information. In a traditional buyer-supplier relationship, suppliers can only infer future demand pattern and complete production planning solely based upon the order information passed by retailers, who have kept actual sales data from suppliers' access. Since the information of orders does not reflect the actual sales pattern only, but also buyers' decisions and judgments, suppliers' inference of future demand is likely to be distorted and therefore their planning is misguided (Lee and Whang 2000).

It is apparent that when each supply chain member makes ordering and production decisions without consideration of their impact on other parties, additional uncertainties in demand forecasting and order fulfillment processes are induced, and therefore total system-wide performance is hampered. Indeed, the need for better management of the supply chain and inter-organizational collaboration becomes more pronounced when the actual product demand is highly uncertain.

In order to achieve global optimization and minimize the effect of uncertainty in the supply chain, coordination and integration of key business processes that span organizational boundaries are crucial. At the operational level, this involves the implementation of a set of SCM practices and extensive sharing and utilization of information among partners. In this light, advanced information and communication

technologies, which has greatly facilitated the collection, analysis and distribution of information as well as improved inter-organizational connectivity, becomes an important enabler of effective SCM.

In the retailer (buyer)-manufacturer (supplier) stage of a clothing supply chain, coordination of activities in the area of product development and pre-production, purchasing and production, and delivery and distribution processes, which is enabled by various inter-organizational information systems, is essential to minimize supply chain variability and improve responsiveness and flexibility. This is particularly the case for firms that supply products with high novelty and fashion contents and short life cycles, which are characterized by highly unpredictable demand (Lee 2002).

Past empirical research has shown that the need for effective SCM is heightened in an uncertain market. Ramdas and Spekman (2000) in a survey study found that high performers among innovative-product supply chains are more likely to engage in SCM to enhance revenues than are high performers among functional-product supply chains. Kincade et al. (2001) in a study of clothing industry showed that the implementation of QR technologies could contribute to improved management of supply chain for firms providing products that have high fashion content and seasonal demand. As such, the following hypotheses are suggested.

H2a: There is a positive association between SCM implementation and demand uncertainty (indicated by the fashion level and seasonality of the product).

H2b: There is a positive association between idiosyncratic investments and demand uncertainty (indicated by the fashion level and seasonality of the product).

3.3.2 The influence of strategic and social factors on SCM implementation and idiosyncratic investments

Although firms operating in a dynamic environment may recognize the need for effective SCM, it is not the case that the opportunities to apply this management approach successfully are equally available to all firms. Such differences in the propensity of forming inter-organizational linkages or more specifically integrating business processes across allied firms in a supply chain can be explained jointly by two factors: *inducement*, which relates a firm's incentive to form linkages to its need for critical external resources, and *opportunity*, which indicates that a firm's opportunity to form linkages depends upon its attractiveness to other firms (Ahuja 2000). Based on this duality of collaboration, it is expected that both strategic factors, which reflect a firm's perceived quality of its partners' competitive capabilities, and social factors, which reflect the availability of social resources for a firm and its partners to form collaborative arrangement, affect the implementation of SCM practices and bilateral idiosyncratic investments. This suggests the following model of Hypotheses 3a-f and 4a-d (Figure 3.5).

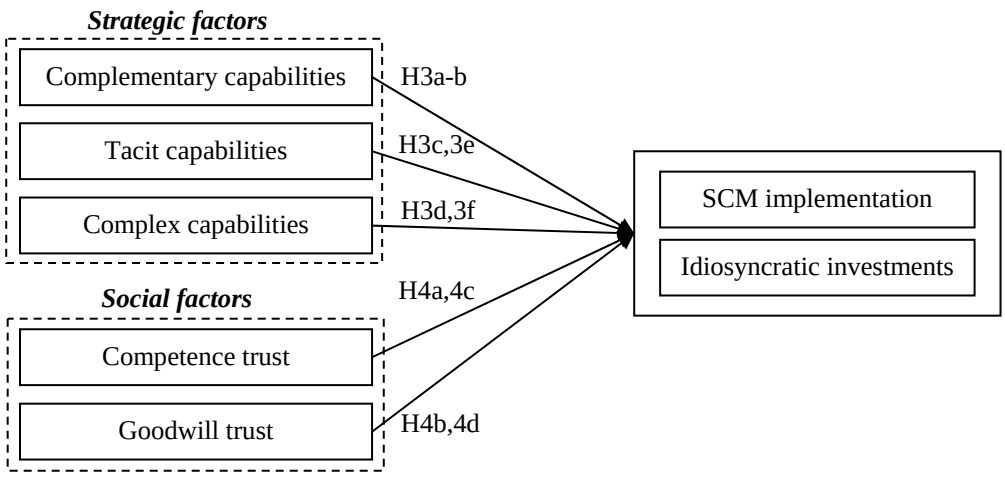

Figure 3.5 A model of Hypotheses 3a-f and 4a-d

3.3.2.1 A resource-based view of strategic factors (Hypotheses 3a-b)

As shown in Figure 3.6, the theoretical model hypothesizes that complementary competitive capabilities influence SCM implementation and idiosyncratic investments.

> *H3a: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive SCM practices are implemented by them.*

> *H3b: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive idiosyncratic investments are committed by them.*

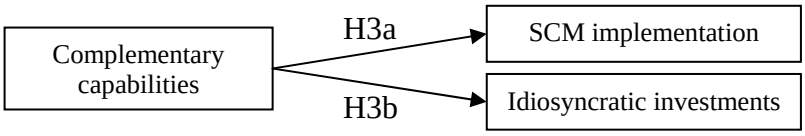

Figure 3.6 A model of Hypotheses 3a-b

According to the resource-based view, a firm is considered as a bundle of resources that are tangible and intangible assets tied semi-permanently to the firm (Wernerfelt 1984). In the broadest sense, all of the financial, physical, human, and organizational assets, which are deployed by a firm to develop, manufacture, and deliver products or services to its customers, can be referred to as its resources and capabilities (Barney 1995). As Grant (1991) notes, resources are inputs into the process of production of goods and services to satisfy human wants, while a capability is the capacity for a set of resources to perform some tasks or activities. This distinction between resources and capabilities is pointed out more specifically by Amit and Schoemaker (1993, p.35, italics original) that:

> *Capabilities*, in contrast, refer to a firm's capacity to deploy *Resources*, usually in combination, using organizational processes, to effect a desired end. They are information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's *Resources*.

In other words, a firm's capabilities are created through the coordination and integration of internal business processes, in which firm-specific resources are utilized to perform some activities for value creation. To understand the strategic nature of the deployment of a firm's resources, two perspectives of capabilities, which reflect internal and external dimensions of competition, need to be distinguished: competencies and competitive capabilities (Koufteros et al. 2002).

As operations strategy literature suggests, firms seek to compete on four different but related dimensions including cost, quality, flexibility, and delivery. Choice of these competitive priorities has been considered as a critical initial step in the process of developing and implementing operations strategy, as the achievement of a competitive advantage depends on the translation of a firm's key competitive priorities into *competences*, which are inwardly focused skills, through developing a set of supportive decisions and practices regarding the structure (e.g. plant capacity, facilities, and technologies) and infrastructure (e.g. workforce, quality, and production planning) of operations (Leong et al. 1990, Boyer 1998).

To achieve competitiveness, a firm needs to exploit its *competitive capabilities* that have an external or customer focus (Corbett and Van Wassenhove 1993) and that enable the firm to better meet customer expectations than do its competitors (Teece and Pisano 1994, Teece et al. 1997). In this sense, competencies (e.g. machine flexibility) have external value only when they enable the firm to build a set of competitive capabilities (e.g. flexible product innovation) to provide products and services customers desire (Koufteros et al. 2002).

Building on the competitive priorities, four dimensions of competitive capabilities can be identified: (1) flexible product innovation—a firm's ability of introducing new products and features in the marketplace, (2) quality—a firm's ability of offering product quality that meets customer expectations, (3) delivery dependability—a firm's ability of meeting customer delivery requirements, and (4) competitive price—a firm's ability of competing based on low prices (Koufteros et al. 2002).

While the major thesis of resource-based view concerning the deployment of strategic firm-specific resources for achieving competitive advantage is insightful, such focus on internal resources utilization needs to expand if it is to contribute to our understanding of the collaborative advantage of strategic alliances. This is because resource-based view overlooks "the important fact that the (dis)advantages of an individual firm are often linked to the (dis)advantages of the network of relationships in which the firm is embedded" (Dyer and Singh 1998, p.660). As the development and application of strategic resources occur not only at multiple levels inside the firm, but also in the network of relationships in which the firm is embedded, the search for competitive advantage should focus on the resources resided within and beyond firm boundaries (Birkinshaw 2000).

This limitation is addressed by the resource-based theory of strategic alliances (Das and Teng 2000), which posits that firms actively seek economic gains from maximizing value through combining and utilizing critical resources. Owing to the fact that certain needed complementary resources (i.e. resources that are dissimilar and contribute to the goals of the alliance) are controlled by other firms, and that these resources are often imperfectly imitable, imperfectly substitutable, and imperfectly mobile (i.e. they have low tradeability in factor markets), establishing

strategic alliances is a viable strategy for a firm to aggregate, share, or exchange these resources with other firms for achieving competitive advantages and values that are otherwise unavailable to the individual firm.

The importance of integrating critical complementary resources through strategic alliances is stressed in the relational view of competitive advantage, which argues that (1) arm's-length market relationship cannot generate inter-organizational competitive advantage because such exchange relationship is neither rare nor inimitable, thereby fails to enable the two parties to create profits higher than what other seller-buyer combinations can create; and (2) the integration of distinctive resources supplied by alliance partners generates a synergistic effect (i.e. these resources become more valuable, rare, and difficult-to-imitate when combined), through which alliance partners can collectively generate profits higher than the sum of those can be created by the individual resources of each partner (Dyer and Singh 1998).

As the competitive advantage of strategic alliances builds initially upon the integration of a right mix of resources possessed by partner firms, it becomes that the recognition of the value of potential partners' resources and consequently the identification of potential partners are very important in the alliance formation stage. Although this suggests that the leverage of complementary resources is an important rationale for forming strategic alliances (Das and Teng 2000), more often it is the need for complementary competitive capabilities, rather than the need for a particular type of resource, that provides the incentive for linkage formation. For example, in a typical export clothing supply chain, fashion retailers in North America or Europe who do not own manufacturing facilities desire to form alliances with offshore manufacturers who are able to utilize a set of advanced manufacturing technologies

and practices in a superior way so that orders with special or innovative features can be fulfilled quickly. And it is not simply the possession of complementary manufacturing resources (e.g. machines and workers) that draws the retailers' attention. As such, the need for complementary competitive capabilities could be a crucial consideration in searching for alliance partners in the clothing industry.

In this sense, if a pair of trading partners perceive each other's competitive capabilities to be complementary, that is their competitive capabilities are distinctive and contribute to the achievement of shared competitive priorities (product innovation flexibility, price, quality, and delivery), both of them will have strong incentive to form an alliance, and therefore it is more likely that they will implement SCM practices and make bilateral idiosyncratic investments in order to exploit each other's competitive capabilities. This leads to the following hypotheses.

H3a: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive SCM practices are implemented by them.

H3b: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive idiosyncratic investments are committed by them.

3.3.2.2 A knowledge-based view of strategic factors (Hypotheses 3c-f)

As shown in Figure 3.7, the theoretical model hypothesizes that tacit competitive capabilities and complex competitive capabilities influence SCM implementation and idiosyncratic investments.

H3c: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive SCM practices are implemented by them.

H3d: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive SCM practices are implemented by them.

H3e: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive idiosyncratic investments are made by them.

H3f: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive idiosyncratic investments are made by them.

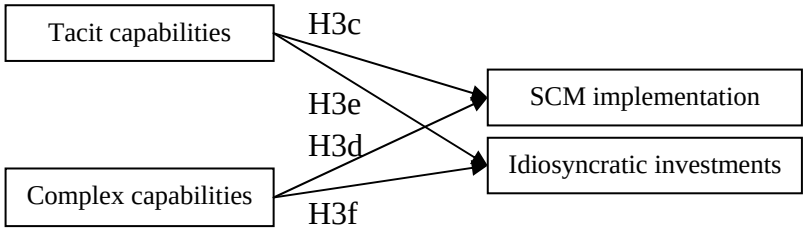

Figure 3.7 A model of Hypotheses 3c-f

Forming strategic alliances to utilize complementary competitive capabilities does not automatically lead to the achievement of collective competitive advantage, if competitors can easily develop or access such competitive capabilities. The strategic potential of a competitive capability depends partly upon the nature of its constituent resources. According to the resource-based view, the imitability characteristic of a firm's resources, this is, the degree to which competitors have difficulties in imitating the resources either through duplication or substitution, contributes to the provision of competitive advantages (Barney 1991, 1995).

As Miller and Shamsie (1996) note, the value of a firm's resources is contingent upon market conditions. Based on the notion of barriers to imitability, they suggest that a firm's resources can be categorized as property-based or knowledge-based. Property-based resources are a firm's legal assets such as

exclusive rights to use a valuable technology, prime distribution channels, production facilities, and human resources owned by firms. As property-based resources are protected by various property rights, such as patents, contracts, or deeds of ownership, competitors cannot imitate these resources legally even though they may have the knowledge to duplicate the resources. Knowledge-based resources are a firm's intangible skills and know-how, such as design, technical, and creative skills, which are difficult to be imitated by competitors due to knowledge barriers—that is, competitors do not have sufficient knowledge to duplicate a firm's skills.

In the view of Miller and Shamsie (1996), since the benefits derived from the deployment of property-based resources are specific to a process or product, these resources are most valuable in stable or predictable settings for which they were developed. However, their value will diminish if the market no longer values these resources. As such, property-based resources are in greater danger of obsolescence in a changing and uncertain environment. On the contrary, knowledge-based resources are relatively less specific, and some of them (e.g. skills to create better or innovative products) are designed to cope with environmental changes. Thus, knowledge-based resources are more valuable in a dynamic environment. However, they are of less value in predictable settings, as knowledge and its deployment change more slowly in stable settings, and thus open for potential competitive imitation. Also, as the development and retention of these resources incur high costs, this may not be justified in stable conditions, which do not require such extensive knowledge and skills.

Although integration of knowledge-based resources across firms through collaborative arrangements appears to be an important strategy for value creation in dynamic environments, it is not the case that all types of knowledge-based resources

contribute to competitive advantage equally. Knowledge of a firm exists at two levels: (1) individual knowledge, which resides in an individual's brain and bodily skills, and can be deployed independently to accomplish tasks and solve problems, and (2) collective knowledge, which is distributed and shared by organizational members, and stored in an organization's rules, procedures, routines, and social norms to facilitate business activities (Lam 2000). At each level, two forms of knowledge can be identified: explicit and tacit (Polanyi 1962). They are different in the modes of expression: explicit knowledge is (1) objective, abstract and independent of the knower, (2) can be generated through logical deduction and acquired by formal study, and hence (3) can be codified and transferred across time and space, whereas tacit knowledge is (1) personal, subjective and intimately tied up with the knower's experience, (2) can only be acquired through practical experience in the relevant context, and hence (3) is difficult to be codified and transferred independently of the knowing subjects (Spender 1996a, Lam 2000, Ambrosini and Bowman 2001).

Considering the individual and collective as well as the explicit and tacit nature of knowledge together, four types of knowledge can be identified: embrained knowledge (individual-explicit), embodied knowledge (individual-tacit), encoded knowledge (collective-explicit), and embedded knowledge (collective-tacit) (Lam 2000). Since these knowledge types exist in different levels, and differ in ease of communication and transfer, their abilities to create strategic advantages vary accordingly. As Spender (1996b, p.52) argues, embedded knowledge is "the most secure and strategically significant kind of organizational knowledge". This can be explained by the fact that the intrinsic nature and properties of embedded knowledge create causal ambiguity in competitive advantage, and thus limits imitation (Reed and DeFillippi 1990). This type of knowledge-based causal ambiguity can be

considered as characteristic ambiguity—ambiguity inherent to the resource itself (King and Zeithaml 2001), which erects barriers to imitation because competitors are unable to comprehend the resources that are the source of competitive advantage (Reed and DeFillippi 1990).

Characteristic ambiguity of resources is a key factor to be considered when assessing the value of a partner firm's complementary resources, as higher barriers to imitation are created when the complementary resources have more causally ambiguous characteristics. In this light, if the complementary resources are inherently ambiguous, the competencies developed from the combination of these resources will become even more ambiguous and less imitable. As Reed and DeFillippi (1990) suggest, tacitness and complexity of firm-specific resources can individually or in combination create ambiguity in competencies.

The ambiguity associated with tacitness stems from the low codifiability of tacit knowledge (Winter 1987), which refers to the inability of a firm "to structure knowledge into a set of identifiable rules and relationships that can be easily communicated" (Kogut and Zander 1992, p.387). The value of a partner firm's complementary resources is higher if the resources are based on tacit knowledge, which is difficult for competitors to encode and articulate in symbolic forms (e.g. drawings, manuals, and formula) for imitation. Complexity refers to the number of interdependent technologies, organization routines, and individual- or team-based skills embrace by a particular knowledge or competency (Reed and DeFillippi 1990). Imitation is limited when competitors fail to comprehend the way in which the firm combines different human and technological resources to create a complex competency.

Given that tacitness and complexity in firm-specific skills and know-how can create causal ambiguity in competency-based advantage, and hence limits competitive imitation (Reed and DeFillippi 1990), if a firm's competitive capabilities are perceived as complementary and causally ambiguous, it is likely that others will be interested in forming alliances with it. However, the identification of complementary competitive capabilities *per se* does not directly lead to competitive advantage. The strategic potential of complementary competitive capabilities is materialized when they are combined by alliance partners via idiosyncratic integrative capabilities, which are developed jointly by the partners and thus are unique to the alliance (Jap 1999, Lambe et al. 2002). These integrative capabilities are created through the deployment of advanced coordination principles and IT to integrate key business processes across organization boundaries of alliance partners. In other words, they are developed through the implementation of SCM practices.

As such, if trading partners perceive each other's competitive capabilities to be tacit and complex, there is a higher chance that they seeks to form strategic alliance, and consequently it is more likely that they will collaborate to implement SCM practices and make bilateral idiosyncratic investments in order to leverage each other's competitive capabilities. This leads to the following hypotheses.

H3c: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive SCM practices are implemented by them.

H3d: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive SCM practices are implemented by them.

H3e: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive idiosyncratic investments are made by them.

H3f: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive idiosyncratic investments are made by them.

3.3.3 A social network view of social factors (Hypotheses 4a-e)

Although a firm can access and utilize complementary competitive capabilities through forming strategic alliances, it is *not* the case that all firms can apply this strategy successfully. This is partly attributable to the fact that firms do not share equal opportunities to collaborate (Ahuja 2000). An important factor influencing such opportunities is the social capital available for potential partner firms to utilize for leveraging each other's complementary competitive capabilities.

The social network perspective on strategic alliances, which stresses that the behavior and performance of alliances are influenced by the social network of relationships in which allied firms are situated (Gulati 1998), is particularly useful for understanding of contextual influence on SCM implementation. This perspective builds on Granovetter's (1985) notion of social embeddedness of firm behavior, which argues that "economic actions are influenced by the social context in which they are embedded and that actions can be influenced by the position of actors in social networks" (Gulati 1998, p.295).

Social structure and social resources are two central elements that underlie the influence of social context on firm behavior and performance, according to the social capital literature (Burt 2000). While there seems to be less disputes over conceptualizing a social structure to be "a network of actors who are in some way connected via a set of relationships" (Gabbay and Leenders 1999, p.1), the components of social capital varies from one studies to another (Torsvik 2000). As Nahapiet and Ghoshal (1998) and Gabbay and Leenders (1999) note, some authors

take a narrow view of social capital and conceive it to be either the structure of the relationship networks (e.g. Baker 1990), or the resources an actor can access through such networks, whereas others such as Bourdieu (1986), Coleman (1988), and Putnam (1993) take a broader view and stretch the concept to include both social structure and social resources, as indicated in the following definitions of social capital.

> The aggregate of the actual or potential resources which are linked to the possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition. (Bourdieu 1986, p.248)

> A variety of different entities, with two elements in common: they all consist of some aspect of social structure and they facilitate certain actions of actors—whether personal or corporate actors—within that structure. (Coleman 1988, p.S98)

> Features of social organization, such as trust, norms, and networks, that can improve the efficiency of society by facilitating coordinated action. (Putnam 1993, p.167)

Central to these definitions are the notions that (1) social capital is a set of resources associated with social relationships, which makes it different from other forms of capital, such as human capital, which is a quality of individuals, (2) social capital encompasses both the social network and the resources that can be accessed and mobilized through the network of relationships, and (3) these valuable resources provide certain individuals or groups with a competitive advantage in pursuing their goals, because of their location in social network (Burt 2000).

It appears that a consensus has yet to reach among the researchers who applied the concept of social capital to the study of organizations. Gabbay and Leenders (1999, p.3) maintain that social structure is not an element of social capital, and that corporate social capital should be referred to “the set of resources, tangible

or virtual, that accrue to a corporate player through the player's social relationships, facilitating the attainment of goals". In contrast, considering both social network and social resources mobilized through that network as social capital, Nahapiet and Ghoshal (1998) propose a multidimensional view of social capital, in which the overall pattern of ties between actors is considered to be the structural dimension, and social resources are categorized into relational and cognitive dimensions. Despite these conceptual differences, it is important to consider "*both* the different network structures that facilitate (or impede) access to social resources *and* the nature of the social resources embedded in the network" (Seibert et al. 2001, p.221, emphasis original) in examining the utility of social capital (Lin 2000).

Building on the multidimensional view of social capital advanced by Nahapiet and Ghoshal (1998) and the approaches adopted by Tsai and Ghoshal (1998) and Seibert et al. (2001) in modeling the influence of social capital, a theoretical model that comprises social network structure, social resources, SCM implementation, and idiosyncratic investments is proposed. This model argues that (1) the application of SCM practices and commitment of bilateral idiosyncratic investments are affected by the social resources that allied partners of a supply chain can access and use (see Figure 3.8 for the model of Hypotheses 4a-e), and (2) the development of these social resources is, in turn, affected by the relationships of allied firms at the dyadic level and the structural position these firms occupy at the network level.

H4a: There is a positive association between inter-organizational competence trust and implementation of SCM practices.

H4b: There is a positive association between inter-organizational goodwill trust and implementation of SCM practices.

H4c: There is a positive association between inter-organizational competence trust and commitment of idiosyncratic investments.

H4d: There is a positive association between inter-organizational goodwill trust and commitment of idiosyncratic investments.

H4e: Idiosyncratic investments provide explanatory power in SCM implementation over and above that attributable to the six contextual factors.

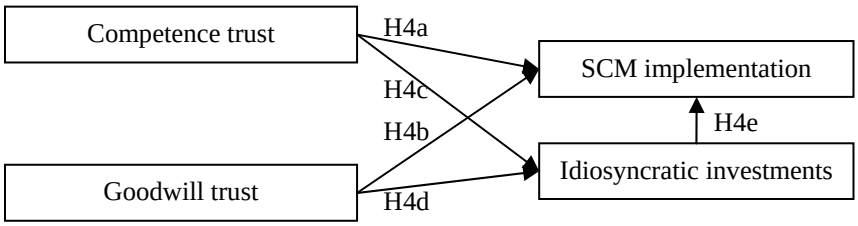

Figure 3.8 A model of Hypotheses 4a-e

3.3.3.1 Inter-organizational trust and collaboration in a supply chain

Inter-organizational trust, which is a key element of the relational dimension of social capital (Nahapiet and Ghoshal 1998), is an essential enabler of collaboration between buyer-supplier dyads, as this social resource helps to reduce risk and promote value creation in strategic alliances. Trust has been studied by researchers in different disciplines, ranging from psychology/micro-organizational behavior to strategy/economics. Although various definitions of trust have been suggested, Rousseau et al. (1998, p. 395) note that a consistent, cross-discipline view of trust is emerging:

> Trust is a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another.

Central to this conceptualization of trust are three assumptions that underlie the necessary conditions for trust to arise (Lane 1998, Rousseau et al. 1998). First, a degree of interdependence between the parties involved in an exchange relationship

is assumed as the achievement of one party's interests relies on another. Second, exchange relationships are characterized by certain degree of risk or uncertainty. Risk, expressed as the perceived probability of loss, arises because the parties involved are uncertain about the intentions and behavior of others. The parties become vulnerable when they are willing to take risk in facing opportunism in exchange relationships (Mayer et al. 1995). Third, it is further assumed that the parties expect or believe that others will not exploit their vulnerabilities in the exchange relationships (Lane 1998).

Although trust enables cooperative behavior (Gambetta 1988) and involves risk taking, trust is neither a behavior, nor a choice, but a psychological condition that can lead to or stem from such actions (Rousseau et al. 1998). Trust also differs from trustworthiness, as Barney and Hansen (1994, p.176) put that:

> An exchange partner is trustworthy when it is worth of the trust of others. An exchange party worthy of the trust is one that will not exploit other's exchange vulnerabilities . . . Trust is an attribute of a relationship between exchange partners, trustworthiness is an attribute of individual exchange partners.

Trust between organizations (Sako 1992) can be examined at multiple levels (Currall and Inkpen, 2000). Trust between organizations operates at both individual and organizational levels, where interpersonal trust refers to the degree of a boundary-spanning agent's trust in his/her counterpart in the partner firm, and inter-organizational trust refers to the degree of trust placed in the partner firm by the members of a focal firm (Zaheer et al. 1998). Central to these two constructs is the notion that it is an individual and individuals as members of an organization, rather than the organizations themselves, who trust. Therefore, inter-organizational trust reflects a collectively-held trust orientation developed by organizational members toward the partner firm, and not the extent to which a firm trusts the partner firm

(Zaheer et al., 1998). Maintaining individuals as the origin of trust is important as it avoids reification of the organizations.

3.3.3.2 Forms of inter-organizational trust

Trust is increasingly seen as a multidimensional concept, and two major forms of trust including competence trust and goodwill trust are important in the context of buyer-supplier alliances or partnerships (Sako 1992, Humphrey 1998, McCutcheon and Stuart 2000, Das and Teng 2001). Competence trust refers to "the expectation of technically competent role performance", whereas goodwill trust refers to "the expectation that some others in our social relationships have moral obligations and responsibility to demonstrate a special concern for other's interests above their own" (Barber 1983, p.14).

Individuals and organizations rely not only on technically competent performance, but also on direct moral responsibility for their welfare, when they deal with each other (Barber 1983). In this sense, a firm's trust in its partners concerns the partners' capabilities to accomplish tasks according to agreements, and the partners' intentions to do so (Nooteboom 1996). These two forms of trust (ability to perform and intention to perform) have also been described as credibility and benevolence, respectively in marketing literature (Ganesan 1994). As Doney and Cannon (1997, p.36) note:

> A buying firm facing some degree of risk in a purchasing situation turns to a supplier or salesperson that the buyer believes is able to perform effectively and reliably (credible) and is interested in the customer's best interests (benevolent).

3.3.3.3 Trust, risk, and collaboration in strategic alliances

Strategic alliance is inherent a risky strategy, and associated with two independent types of perceived risk (Das and Teng 1996). First, given the potential

of partner's opportunistic behavior, there is risk of unsatisfactory inter-organizational collaboration or *relational risk*, which refers to the probability and consequences that partner firms do not commit themselves fully to an alliance. Examples of opportunistic behavior are "withholding or distorting information, shirking or failing to fulfill promises or obligations, appropriation of the partner firm's technology or key personnel, late payments, and delivery of substandard products" (Parkhe 1993, p.828). Second, *performance risk*, which is the probability and consequences that an alliance may fail even when partner firms collaborate fully, arises from a lack of competence of the partner firms in addition to factors such as the volatility of the market, intensified competition, changing government regulations and policies, and sheer bad luck (Das and Teng 2001).

In order to apply the strategy of alliances successfully, potential partner firms have to manage and reduce both relational risk and performance risk. Fostering inter-organizational trust has been considered as an effective means to mitigate partner firms' perception of risks (Das and Teng 2001), which in turn builds their confidence in collaboration, that is, their perceived degree of certainty that their partners will refrain from acting opportunistically and pursue mutually compatible interests is higher (Das and Teng 1998).

Goodwill trust reduces a partner firm's perception of relational risk, whereas competence trust reduces perceived performance risk in an alliance (Das and Teng 2001). As goodwill trust signifies partner firms' desire and intentions to commit to the shared objectives and to act for the alliance effectively, the partner firms will be less concerned with the risk of unsatisfactory inter-organizational collaboration. Similarly, since competence trust provides partner firms confidence that their counterparts have the required capabilities to perform tasks in the alliance, the

partner firms will be less concerned with the risk of performance. As such, it is expected that inter-organizational goodwill trust and competence trust reduce partners' perceived relational risk and performance risk in an alliance, respectively, which in turn increase the chance for a buyer and a supplier to collaborate to implement SCM practices and make bilateral idiosyncratic investments. This leads to the following hypotheses:

H4a: There is a positive association between inter-organizational competence trust and implementation of SCM practices.

H4b: There is a positive association between inter-organizational goodwill trust and implementation of SCM practices.

H4c: There is a positive association between inter-organizational competence trust and commitment of idiosyncratic investments.

H4d: There is a positive association between inter-organizational goodwill trust and commitment of idiosyncratic investments.

3.3.4 Contextual factors, idiosyncratic investments, and SCM implementation (Hypothesis 4e)

Although the six antecedents including demand uncertainty, complementary, tacit and complex competitive capabilities, and inter-organizational goodwill and competence trust are hypothesized to exert contextual influence on the application of SCM practices, it is expected that, other thing being equal, if trading partners have invested a significant amount of idiosyncratic assets, they are more likely to utilize the committed resources to their full extent, thus implementing SCM practices more extensively. As such, bilateral idiosyncratic investments are expected to provide explanatory power over and above that attributable to the six antecedents. This leads to the following hypothesis.

H4e: Idiosyncratic investments provide explanatory power in SCM implementation over and above that attributable to the six contextual factors.

3.3.5 Bases of inter-organizational trust (Hypotheses 5a-d)

There are different bases upon which members of a firm develop positive expectations of its partner's intentions or behavior. As Lewis and Weigert (1985, p.972) note, "trusting behavior may be motivated by strong positive affect for the object of trust (emotional trust) or by 'good rational reasons', why the object of trust merits trust (cognitive trust), or more usually, some combination of both". Increasingly, the conceptual distinction between affect-based and cognition-based trust has been examined and demonstrated in empirical studies of various work settings, such as a manager's trust in a peer at work (McAllister 1995), trust between work units in organizations (Cummings and Bromiley 1996), trust within virtual teams (Kanawattanachai and Yoo 2002), and trust between international joint venture partners (Fryxell et al. 2002).

Past research suggests that cognition-based trust represents a rational calculative view of trust, whereas affect-based trust represents a social relational view of trust (Zaheer and Venkatraman 1995, Tyler and Kramer 1996, Rousseau et al. 1998). Based on these two views, it is expected that successful historical transactions, relational norms, and social interactions between buyers and suppliers engender inter-organizational trust. Figure 3.9 shows a model of Hypotheses 5a-d.

H5a: There is a positive association between inter-organizational competence trust and successful historical transactions.

H5b: There is a positive association between inter-organizational goodwill trust and relational norms shared by a buyer and a supplier.

H5c: Relational norms shared by a buyer and a supplier are less influential than successful historical transactions in predicting inter-organizational competence trust.

H5d: There is a positive association between inter-organizational goodwill trust and bilateral interactions (the frequency of interactions between members of a buyer and a supplier).

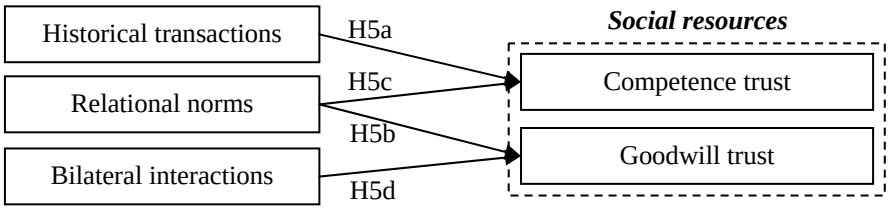

Figure 3.9 A model of Hypotheses 5a-d

3.3.5.1 Successful historical transactions and competence trust (Hypothesis 5a)

Barney and Hansen (1994) argue that trust—albeit in a semi-strong form—can emerge under the conditions where significant exchange vulnerabilities exist, if exchange parties are protected through effective governance mechanisms, such as the market for reputations, which impose economic and social costs on opportunistic behavior. Reputation, as a term preferred in economics, has been described as prestige in sociology, image in marketing, goodwill in accountancy and law (Shenkar and Yuchtman-Yaar 1997). While different theoretical aspects of reputation have been addressed by researchers in various disciplines over time (Baden-Fuller et al. 2000), the game-theoretic perspective provides a useful explanation on the role of reputation in developing cognitive-based competence trust.

The game-theoretic perspective suggests that reputation (1) represents a characteristic or attribute ascribed to an actor (e.g. an individual, a firm, or an industry) by others on the basis of the actor's past actions, and (2) forms a prediction about likely future behavior of the actor (Wilson 1985). As Raub and Weesie (1990, p.629) note:

> If the actor anticipates that his current behavior will affect not only the immediate consequences he will face in the actual situation but also the later behavior of his partner(s) and thus his own future consequences, then he has an incentive for a trade-off between the short-run effects of present decisions and their long-run effects on reputation.

Given that the business of a firm depends considerably upon its reputation as a trustworthy party, rational exchange partners are deterred from exploiting others' vulnerabilities when the opportunity costs associated with a damaged reputation, which arise from the exclusion from future economic exchanges with existing and potential partners, are greater than the benefits of opportunistic behavior (Barney and Hansen 1994). Therefore, "if actors encounter each other repeatedly in a risky situation, reputation is likely to be an important concern, both in terms of establishing a particular reputation for oneself as well as making some judgment about the reputation of one's potential exchange partners" (Kollock 1994, p.320). In summary, the calculative view of trust specifies that it is the economic rationality that provides the exchange parties mutual confidence that their vulnerabilities will not be exploited because it is in the self-interest of exchange partners not to behave opportunistically, if the costs of cheating are greater than the benefits derived from it (Hill 1990).

An important cognitive process through which members of a firm judge the reputation of a trading partner is dyadic learning, that is, members of a firm develop competence trust in a trading partner based on perceived positive reputation of the partner, which is resulted from collecting and assessing positive information about the partner's behavior from their own past experiences (Buskens and Weesie 2000).

Dyadic learning manifests itself as a continuing monitoring of trading partners' actions as well as collecting credible information that signifies the other's

positive intentions to perform beneficial actions and claims of trustworthiness through various means (e.g. by certification or by word of mouth), which are essential in developing calculus-based trust (Rousseau et al. 1998). Thus, for both buyers and suppliers, sending information about one's reputation as a competent firm to the partner and collecting information about the partner's reputation help to elicit mutual competence trust.

In practice, a supplier can indicate its competence by maintaining a good track record in achieving the agreed performance targets (McAllister 1995). In particular, in the clothing industry the supplier's compliance with international standard on protecting human rights in workplaces (e.g. SA 8000) and on quality management system (e.g. ISO 9000) also indicates its competence. For the buyer, maintaining a good track record of on-time payment of orders with the supplier is an important indication of its positive intention to perform beneficial actions (Humphrey and Schmitz 1998). As such, positive information about the partner's trustworthy behavior in past transactions provides each party confidence that its partner can be trusted now.

This rational-calculative perspective differs from the social-relational perspective in that the trust orientation of members of a firm developed toward a partner firm is not based on personal relationships, but rather on a set of institutionalized inter-organizational processes or routines that transcend the influence of individuals, and create a stable and reliable context for exchange (Zaheer et al. 1998). It is expected that inter-organizational competence trust emerges under conditions of continuous repeated exchange (Gulati 1995) due to the consistency and predictability of the buyer's purchasing and order payment routines

and supplier's production and delivery routines. This leads to the following hypothesis.

> *H5a: There is a positive association between inter-organizational competence trust and successful historical transactions.*

3.3.5.2 A social-relational view of goodwill trust

The social-relational view of trust, which is based on knowledge of the other party's internal norms and values, has been argued to be strong form trust that "emerges in the face of significant exchange vulnerabilities, independent of whether or not elaborate social and economic governance mechanisms exist, because opportunistic behavior would violate values, principles, and standards of behavior that have been internalized by parties to an exchange" (Barney and Hansen 1994, p.179). In other words, exchange partners are trustworthy not because their trustworthy actions are guided by the optimized outcome of economic calculation and governed by various social or economic governance devices, but rather because such actions are consistent with the beliefs, norms and values they shared.

The social-relational view of trust reflects the essence of identification-based trust, which emerges when the partners know and identify with the other's desires and intentions, such that they are committed to the same objectives and can act for each other effectively, which in turn give them confidence that their interests will be fully protected and that no monitoring of the other's behavior is necessary (Lewicki and Bunker 1996, Sheppard and Tuchinsky 1996). As compared with calculus-based trust, relational trust "involves a broader array of resource exchange (including socioemotional support, as well as concrete resources) and entails a greater level of faith in the intentions of the other party" (Rousseau et al. 1998, p.400). At this stage, trust is not necessarily broken by inconsistent behavior if exchange partners can

adequately explain or understand the other's behavior, and therefore exchanges are more resilient (Lewicki and Bunker 1996).

3.3.5.3 Relational norms and goodwill trust (Hypothesis 5b)

Social norms are shared expectations about behavior by a group of decision makers (Heide and John 1992). They guide and regulate the standards of trade and conduct, prescribing acceptable behavior in economic exchanges (Gundlach et al. 1995). As Kaufmann and Stern (1988, p.535) note, norms "exist in all exchange behavior, from very discrete transactions to highly relational exchange". Discrete transaction has a "distinct beginning, short duration, and sharp ending by performance", and in contrary relational exchange "traces to previous agreements" and "is longer in duration, reflecting an ongoing process" (Dwyer et al. 1987, p.13). Accordingly, discrete exchange norms are characterized by expectations about an individualistic or competitive interaction between exchange partners, whereas relational norms encompass expectations that stress the value of the relationship itself and prescribe behaviors of exchange parties toward collective rather than individual goals (Noordewier et al. 1990, Heide and John 1992). Relational norms, acting as a self-regulating governance mechanism, are important for parties that seek to establish stable, long-term exchange relationships (Gundlach et al. 1995).

Relational norms of exchange are multidimensional in nature, as past theoretical and empirical studies have indicated (e.g. Macneil 1980, Dwyer et al. 1987, Kaufmann and Stern 1988, Kaufmann and Dant 1992). Four relational norms are seen to be important in governing ongoing interactions among partner firms in a supply chain (Macneil 1980, Kaufmann and Stern 1988, Heide and John 1992, Gundlach et al. 1995). *Role integrity* refers to exchange parties' mutual expectations for their roles that are seen as complex and expand beyond simple buy and sell

arrangement, covering various issues not directly associated with any particular transaction. *Solidarity* refers to the expectation that exchange parties place a high value on their relationships and act in a way that benefits each other. *Harmonization of conflict* refers to the expectation that exchange parties achieve mutually satisfying resolution when conflicts or disagreements occur. *Flexibility* is the expectation that exchange parties are willing to make adaptations (e.g. modify the original contractual terms) in the light of changed circumstances.

These different dimensions of relational norms collectively provide a basis for exchange parties to establish goodwill trust, as a firm is confident that its partners will not exploit its vulnerability because it has knowledge of its partners' internal norms (Korczynski 2000), and because these norms prescribe its partners to act in a mutually beneficial manner. This sharing of relational norms indicates the possibility of transfer of trust from the individual to organizational level. That is, trust in a person can be transferred to trust in other members of the group that the person belongs to. In fact, trust transfer can occur in a way when an individual transfers his/her trust in a member of the partner firm to other members of the partner firm with whom he/she has no direct history or experience, if a high level of similarity among members of the partner firm is perceived (McEvily et al. 2003). Here, relational norms serve as an important common point of reference in assessing the similarity among members of the partner firm. That is, a high level of perceived value congruence between the individual and the members of the partner firm could lead to transfer of his/her trust in a member to other members of the partner firm. Indeed, this applies not only to a particular individual, but also to all members of both partner firms. Thus, through the process of trust transfer, sharing of relational norms between trading partners elicits mutual inter-organizational goodwill trust.

Past empirical studies have indicated a positive association between relational norms and trust in different industrial settings, including a firm and its foreign distributor or licensee (Aulakh et al. 1996), an importing distributor firm and its overseas manufacturer (Skarmeas and Katsikeas 2001), as well as a beer distributor and its major supplier (Simpson and Mayo 1997). However, since these studies have not distinguished competence trust and goodwill trust, a definitive conclusion on the relationship between relational norms and goodwill trust is yet to draw. Thus, the following hypothesis is suggested:

> *H5b: There is a positive association between inter-organizational goodwill trust and relational norms shared by a buyer and a supplier.*

3.3.5.4 Relational norms and competence trust (Hypothesis 5c)

Past research has shown that affect-based trust cannot develop unless some level of cognition-based trust exists, as development of affect-based trust requires a greater investment of time and emotion than is cognition-based trust (Rempel et al. 1985, McAllister 1995). That is, when trading partners have maintained a good track record for performing competently over time, and thus eliciting some level of cognition-based trust, they become more willing to invest further in their relationships. In that they tend to expect both should perform mutually beneficial actions, thus developing relational norms, and attribute such actions performed by the partner to its care and concern, thus developing affect-based trust. As such, relational norms not only contribute to inter-organizational goodwill trust, but also relate positively to inter-organizational competence trust. However, it is considered that as compared to successful historical transactions, relational norms serve as a secondary predictor of competence trust. This is because competence trust can be developed even though a high of relational norms is yet to establish, if there is

sufficient positive information about partner's performance in past transactions. As Johnson-George and Swap (1982, p.1316) note, cognition-based trust is considered to be "more superficial and less special" than affect-based trust. This leads to the following hypothesis.

> *H5c: Relational norms shared by a buyer and a supplier are less influential than successful historical transactions in predicting inter-organizational competence trust.*

3.3.5.5 Bilateral interactions and goodwill trust (Hypothesis 5d)

Provision and collection of positive social information about the intentions of trading partners are essential to the development of goodwill trust, as affect-based trust reflects an individual's attributions concerning the motives for partners' behavior (Lewis and Weigert 1985). Past research has shown that frequent interaction provides opportunities for partners to gather sufficient social data so as to enhance their confidence of attributions (McAllister 1995). This indicates goodwill trust takes time to develop and accumulates gradually over time (Sako 1992).

In addition to formal routine business contact directly related to transactions, informal and social meetings provide an important way for trading partners to exchange social information. As Liu and Brookfield (2000) in a study of Taiwan machine tool industry showed, informal and social events, such as the traditional year-end dinner, are more common than the formal ones for the Chinese trading partners to build friendly relations and exchange information. These social face-to-face interactions provide an important means for individuals to understand and predict each other's behavior and moral character. When members of trading partners frequently initiate formal and more importantly informal work-related interactions, they proactively seek to enhance mutual understanding and want to become more familiar and identify with each other, thus promoting inter-

organizational goodwill trust. As such, it is expected that goodwill trust engenders as formal and informal interactions between a buyer and supplier increase. This leads to the following hypothesis.

> *H5d: There is a positive association between inter-organizational goodwill trust and bilateral interactions (the frequency of interactions between members of a buyer and a supplier).*

3.3.5.6 Reputations in the industry and inter-organizational trust (Hypotheses 6a-b)

As the social network perspective of strategic alliances (Gulati 1995) suggests, the development of social sources depends not only on the relationship between a buyer-supplier dyad, but also on the position they occupy in the network they are embedded. A model that considers dyadic factors (i.e. historical transaction, relational norms, and bilateral interactions) as mediators of the effect of a key network factor (the reputations of buyers and suppliers in the industry) on inter-organizational trust is developed. Figure 3.10 shows a model of Hypotheses 6a-b.

> *H6a: The positive association between inter-organizational competence trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by successful historical transactions and relational norms.*

> *H6b: The positive association between inter-organizational goodwill trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by relational norms and the frequency of interactions between members of the buyer and the supplier.*

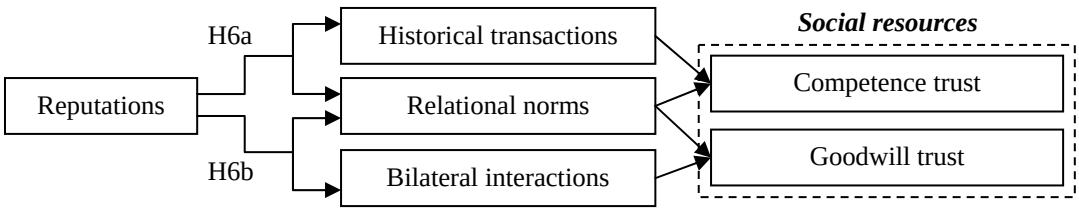

Figure 3.10 A model of Hypotheses 6a-b

The development of inter-organizational trust is affected factors that operate at both dyadic and network levels. Specifically, these two levels represent the social contexts that have been described as an isolated dyad—two actors disconnected from others, and an embedded dyad—two actors connected to third parties, respectively (Burt and Knez 1996). These two levels also correspond to relational embeddedness—actors' dyadic (pairwise) relations, and structural embeddedness—the structure of the overall network of relations, respectively (Granovetter 1992). Members of a firm can base trust on learning with reference to its own past transactions with a partner (i.e. dyadic learning) on one hand, and with reference to third parties who are connected to the firm and transmit information about the partner's behavior (i.e. network learning) on the other hand (Buskens and Weesie 2000).

With third parties connected to a pair of trading partners, the action taken by the partners affects not only future exchanges between them, but also their future exchanges with third parties. An actor who is found to act opportunistically would be excluded from future exchanges with the partner who has been taken advantage, as well as possibly with his/her other partners who become aware of the actor's damaged reputation and expect that their vulnerability could be exploited in future exchanges. As such, the potential costs associated with a damaged reputation would be higher under the condition where exchange partners are embedded in a highly interconnected network through which information on an actor's behavior in one of his/her relations spreads quickly to his/her other partners, as compared with exchanges undertaken within a sparse network.

As Walker et al. (1997, p.111) note:

> If all firms in an industry had relationships with each other, interfirm information flows would lead quickly to established norms of cooperation. In such a dense network, information on deviant behavior would be readily disseminated and the behavior sanctioned.

This network effect is demonstrated in Raub and Weesie's (1990) experimental study, which showed that when the degree of embeddedness of exchanges increases (decreases), the speed of information diffusion and therefore reputation effect increase (decrease) in the network of social relations.

Through network learning members of a firm in a dense network are able to triangulate among multiple sources so as to combine and assess the information obtained from different parties about their past experiences with the firm's partner, thus gaining a richer understanding of its partner. Indeed, accumulation of positive experiences reflects a firm's reputation for performing competently and for being concerned about partners. It becomes possible that members of a firm may trust their partner even though a long and close business relationship is yet to develop, if that partner is perceived to be well known and hold a good reputation in the industry.

However, it is exaggerated to posit that information about a firm's behavior collected through network learning is the most important determinant of inter-organizational trust. In fact, although positive third-party information about a partner helps members of a firm to establish an initial favorable perception about the partner and build up their confidence in the partner's behavior, such information cannot substitute the information obtained directly from the firm's own past experience with its partner in judging the partner's trustworthiness. As such, it is expected that if a buyer and a supplier are well known in the industry for their credibility, both of them are likely to perform competently in successive transactions so that their perceived

trustworthiness can be verified by each party and continue to enhance in the dyad and the industry shortly.

Similarly, if a buyer and a supplier are well known in the industry for their benevolence, both of them are likely to initiate formal and informal work-related interactions so that positive social data can be collected through dyadic learning to verify and thus enhance their perceived trustworthiness in the dyad and the industry quickly. In addition, they are more readily and likely to develop relational norms if both of them have a reputation for being concern about partners in the industry.

In summary, it is expected that a buyer's and a supplier's perceptions concerning the diffusion of each other's good reputation in the industry influence the development of inter-organizational competence trust and goodwill trust indirectly through the development of successful transactions, relational norms, and formal and informal interactions between the partners. This leads to the following hypotheses.

H6a: The positive association between inter-organizational competence trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by successful historical transactions and relational norms.

H6b: The positive association between inter-organizational goodwill trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by relational norms and the frequency of interactions between members of the buyer and the supplier.

3.4 The consequences of SCM (Hypotheses 7a-b)

It is expected that implementation of SCM practices contributes to operations performance improvement, which in turn confers collective competitive advantage for both buyers and suppliers. Figure 3.11 shows the model of Hypotheses 7a-b.

H7a: There is a positive association between SCM practices and operations performance improvement.

H7b: There is a positive association between operations performance and collective competitive advantage.

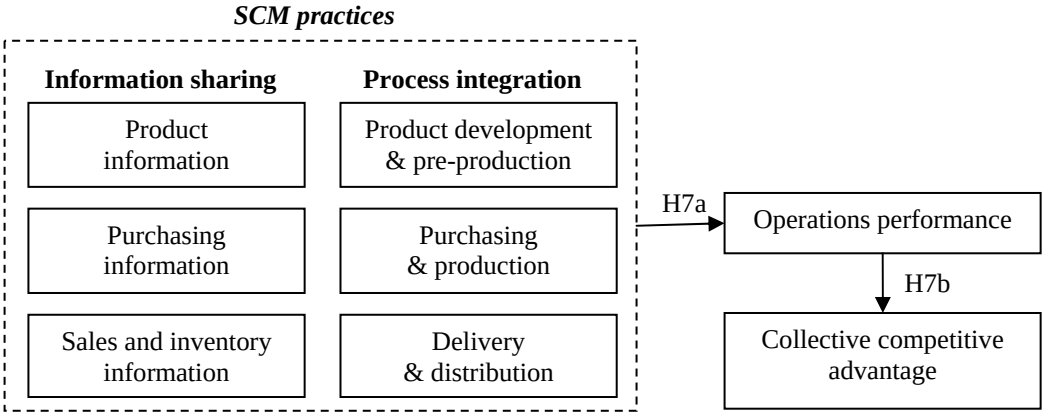

Figure 3.11 A model of Hypotheses 7a-b

3.4.1 Operations performance improvement (Hypothesis 7a)

Review of the SCM literature shows that several classification frameworks of supply chain performance have been suggested. As Beamon (1998) notes, a simple approach to categorize supply chain performance measures is to consider them as either qualitative-based measures, which may not be directly described numerically (e.g. customer satisfaction) or quantitative-based measures, which may be directly described numerically (e.g. measures based on cost). Stressing the importance of a supply chain system to achieve simultaneously a high level of efficiency, a high level of customer service, and the ability to respond effectively to a changing environment, Beamon (1999) proposes a measurement system that focuses on these three interrelated organizational strategic goals, and suggests performance measures of resources (e.g. distribution costs, manufacturing costs, inventory, and return on investment), output (e.g. fill rate, on-time deliveries, backorder/stockout, customer response time, and manufacturing lead time), and flexibility (e.g. volume flexibility, delivery flexibility, mix flexibility, and new product flexibility) to indicate to what extent such goals are accomplished, respectively. Addressing the need for a balanced

approach to measure supply chain performance, Gunasekaran et al. (2001) categorize both financial and non-financial performance measures at strategic, tactical, and operational levels of management, and relate these measures to the four links of an integrated supply chain (plan, source, production, and delivery), leading to customer service and satisfaction.

Although these performance frameworks, which build on strategic goals or management levels, represent a useful approach to categorize performance measures, their link to competitive priorities that supply chain members seek to pursue collectively needs to be strengthened. It appears that several major dimensions of competition, including cost/price, quality, flexibility, delivery (Leong et al. 1990, Boyer 1998) and speed (White 1996), have provided guidance for researchers to examine the effect of SCM practices on operations performance in terms of cost reduction and revenue improvement in recent empirical SCM studies.

An important performance indicator of cost reduction is the inventory level of finished products (Ramdas and Spekman 2000). Given that finished products have the highest value added as compared with raw materials and semi-finished items, massive markdown of out-of-fashion or out-of-season leftover can cause a huge financial loss. This is particular the case for innovative products that have short life cycle. Equally important is the performance of revenue improvement, which can be indicated by whether a firm offers its products to customers at a competitive price, and by product quality, which reflects the degree to which the product can fulfill customer expectations (Koufteros et al. 2002).

In addition to the commonly used performance measures of cost/price and product quality, flexibility emerges to be an important aspect of revenue improvement. Stressing that measures of supply chain performance should address

customer demand, Kincade et al. (2001) consider increased product offerings to be an important performance indicator for the clothing industry. In other words, this flexible product innovation is reflected by the degree to which a firm introduces new products and features in the market to meet customer demand (Koufteros et al. 2002).

Delivery speed and speed in getting new products to market are two major dimensions of time-based competition (White 1996). These two aspects of time performance indicate the degree to which a firm reduces order-to-delivery cycle time and product development time, respectively. An important aspect of delivery performance is the fulfillment of delivery promises (Boyer and Lewis 2002), which indicates the degree to which a firm improves shipment accuracy (Ramdas and Spekman 2000). Achieving superior performance in these areas is important to increase revenue, as the firm can launch innovative products faster than competitors to fulfill new demand. Also, having the right mix and quantity of products delivered to stores can avoid the issue of backorder and reduce wastes in the form of finished products, which means a high level of efficiency in terms of cost and time can be achieved.

While performance measures oriented toward customer demand deserve close attention, some internal measures related to administration are equally important. Specifically related to the adoption of advanced IT in process integration is the performance of labor productivity and quality of information transmission. Increasingly, availability of information *per se* fails to confer competitive edge, whereas quality of information does (Huang et al. 1999). Productivity is hampered when operations are undertaken based on poor quality information (Wang and Strong 1996). With the application of inter-organizational information system such as EDI, faster transmission of trade information could be achieved and the accuracy of trade

information could be improved as a result of elimination of data re-entry (Philip and Pedersen 1997). Thus, administrative efficiency can be improved.

Based on the above discussion, it is expected that the implementation of SCM improves operations performance in the areas of cost/price, quality, flexibility, delivery, speed, and administrative efficiency. The focus placed on operations performance, rather than on business-level performance (e.g. market share, sales, and return on investment), is warranted because operations performance is more directly attributable to operational programs and practices than is business-level performance (Miller and Roth 1994). This leads to the following hypothesis.

H7a: There is a positive association between SCM practices and operations performance improvement.

3.4.2 Collective competitive advantage (Hypothesis 7b)

The implementation of SCM practices jointly by buyers and suppliers is expected to improve operations performance, which in turn contributes to competitive advantages that are specific to the partners. According to transaction cost analysis, transaction-specific investments, which have little or no value outside a particular exchange relationship, are essential to the achievement of productivity gains because they are more efficient and effective than general-purpose investments (Williamson 1985). In addition, due to the specificity to inter-organizational relation, competitors may face time, cost and knowledge barriers to invest in similar transaction-specific assets in order to duplicate the alliance's integrative capability. As such, alliance partners are able to gain collective competitive advantages via lower system-wide costs, higher quality, faster response and innovative products, if they both invest in inter-organizational relation-specific assets which are used to combine difficult-to-imitate complementary competitive capabilities for value

creation (Dyer and Singh 1998, Jap 1999, Lambe et al. 2002). This leads to the following hypothesis.

H7b: There is a positive association between operations performance and collective competitive advantage.

3.5 Summary

Building on the context-practices-performance framework, a theoretical model that encompasses antecedents, components, and performance consequences of SCM is developed. From this theoretical SCM model (see Figure 3.12), seven sets of hypotheses are derived. A summary of hypotheses is presented in Table 3.3.

Table 3.3 A summary of hypotheses

Hypothesis	Relationship	Focus
1a	Positive associations between integration of product development and pre-production, purchasing and production, and delivery and distribution processes.	SCM practices
1b	Positive associations between sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means.	SCM practices
1c	Positive associations between process integration and information sharing.	SCM practices
1d	Positive associations between SCM practices and idiosyncratic investments.	SCM practices
2a	Positive association between SCM implementation and demand uncertainty.	Environmental influence
2b	Positive association between idiosyncratic investments and demand uncertainty.	Environmental influence

Table 3.3 (cont.) A summary of hypotheses

Hypothesis	Relationship	Focus
3a	Positive association between complementary competitive capabilities and SCM implementation.	Influence of strategic factors
3b	Positive association between complementary competitive capabilities and idiosyncratic investments.	Influence of strategic factors
3c	Positive association between tacit competitive capabilities and SCM implementation.	Influence of strategic factors
3d	Positive association between complex competitive capabilities and SCM implementation.	Influence of strategic factors
3e	Positive association between tacit competitive capabilities and idiosyncratic investments.	Influence of strategic factors
3f	Positive association between complex competitive capabilities and idiosyncratic investments.	Influence of strategic factors
4a	Positive association between inter-organizational competence trust and SCM implementation.	Influence of social factors
4b	Positive association between inter-organizational goodwill trust and SCM implementation.	Influence of social factors
4c	Positive association between inter-organizational competence trust and idiosyncratic investments.	Influence of social factors
4d	Positive association between inter-organizational goodwill trust and idiosyncratic investments.	Influence of social factors
4e	Idiosyncratic investments provide explanatory power in SCM implementation over and above that attributable to the six contextual factors.	Contextual influence
5a	Positive association between inter-organizational competence trust and successful historical transactions.	Antecedents of social factors
5b	Positive association between inter-organizational goodwill trust and relational norms.	Antecedents of social factors
5c	Relational norms are less influential than successful historical transactions in predicting inter-organizational competence trust.	Antecedents of social factors
5d	Positive association between inter-organizational goodwill trust and bilateral interactions.	Antecedents of social factors
6a	Positive association between inter-organizational competence trust and reputations is mediated by successful historical transactions and relational norms.	Antecedents of social factors
6b	Positive association between inter-organizational goodwill trust and reputations is mediated by relational norms and bilateral interactions.	Antecedents of social factors
7a	Positive association between SCM practices and operations performance improvement.	Performance
7b	Positive association between operations performance and collective competitive advantage.	Performance

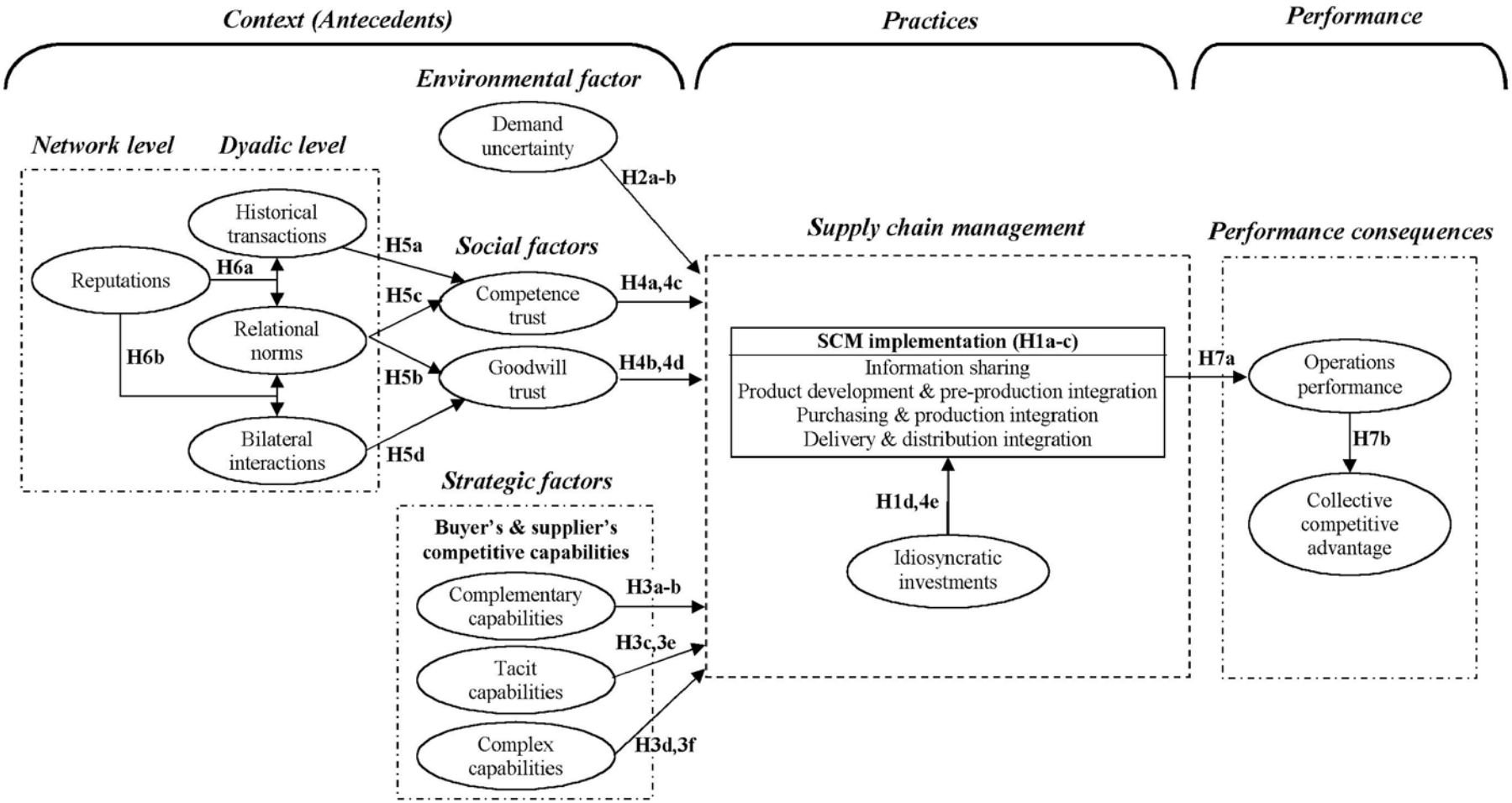

Figure 3.12 The theoretical model of SCM

Hypotheses 1a-d are related to the components of SCM. Implementation of SCM is realized through the application of a set of SCM practices that involve integration of product development and pre-production, purchasing and production, and delivery and distribution processes, as well as sharing of product, purchasing, and sale and inventory information between buyers and suppliers. Application of these practices also requires idiosyncratic investments in transaction-specific assets made by the buyers and suppliers. All of the SCM practices and bilateral idiosyncratic investments are thought to have positive associations.

Hypotheses 2-4 are related to the antecedents of SCM. Three groups of contextual factors including an environmental factor (demand uncertainty), three strategic factors (complementary, tactic, and complex competitive capabilities), and two social factors (inter-organizational competence and goodwill trust) are expected to be positively associated with the implementation of SCM practices and commitment of idiosyncratic investments by the buyers and suppliers.

Hypotheses 5-6 are related to the antecedents of inter-organizational competence and goodwill trust. At the dyadic level, three factors including successful historical transactions, relational norms, and bilateral interactions between the buyers and suppliers are expected to be positively associated with inter-organizational competence and goodwill trust. At the network level, the influence of the reputations of buyers and suppliers in the industry on inter-organizational competence and goodwill trust is mediated by historical transactions, relational norms, and bilateral interactions. Finally, Hypotheses 7a-b are related to the performance consequences of SCM. The application of SCM practices is expected to be positively associated with operations performance, which in turn provides the buyers and suppliers with collective competitive advantage.

Chapter 4 : Research methodology

In this Chapter, details of research design including sample selection, sample size and statistical power, target respondents, method of data collection, informant competence, measures of the model, and methods of analysis are presented.

4.1 Sample selection

The focus of this research was placed on the SCM implementation of clothing companies in Hong Kong. The clothing industry was selected due to its importance in Hong Kong economy and the intensity of globalization and competition in the industry. According to the industrial statistics in 2003 (Census and Statistics Department 2003), this industry is the largest manufacturing employer in Hong Kong, with 1,157 establishments involving in wearing apparel manufacturing and hiring 22,479 workers. More importantly, Hong Kong is a major hub in South East Asia, providing full package sourcing services for Western buyers. In 2003, there were 96,834 establishments involving in import-export trades in Hong Kong and hiring 490,700 workers. Many large foreign retailers and buyers such as The Gap, J C Penny, Liz Claiborne, Polo Ralph Lauren, Donna Karan, Jones, May Department Stores, Next, and Woolworth have established their own buying offices in Hong Kong for sourcing garments. In fact, this industry is the leading earner in terms of domestic exports, taking up 52.5% of the total domestic exports in 2003.

Manufacturing companies supplying outer garments (including woven and knitwear) in Hong Kong were selected because they were potential candidates implementing SCM, as revealed in Au and Ho's (2002a) study on the application of SCM practices in the Hong Kong clothing industry.

4.2 Sample size and statistical power

The conventional values of 0.05 for significant level (α) and 0.20 for β (a power of 0.80) were adopted in planning the sample size. *A priori* power analysis of correlation and multiple regression was undertaken because these two analyses were applied to test the hypotheses. The results of *a priori* power analysis of correlation indicated that a sample size of 64 is required in order to attain a power level of 0.8, given that an alpha value of 0.05 and a medium effect size index r of 0.3 (Cohen 1988) were selected. In addition, the results of *a priori* power analysis of multiple regression showed that sample size of 79 was required in order to attain a power level of 0.8, given that an alpha value of 0.05, an effect size index f^2 of 0.176 (corresponds to R^2 of 0.15 and close to Cohen's (1988) convention of medium effect size of 0.15), and 5 predictors were chosen. These results together showed that sample size of 79 or above was considered to be adequate in order to achieve a power level of 0.8 and medium effective size in correlation analysis and multiple regression analysis according to Cohen's (1988) conventions.

4.3 Target respondents

Individuals who worked for clothing manufacturing companies in Hong Kong and were responsible for handling sourcing orders placed by clothing buyers were the target respondents. These informants, who were sales managers, product managers, or holding other similar titles, were selected, because they work closely with their clothing buyers to complete activities in the business processes that range from product development to order delivery. Consistent with prior SCM studies, individuals working at the middle level of the organizational hierarchy were selected (cf. Shin et al. 2000), because they tend to have extensive knowledge about the

industry in general and about the companies they work for in particular, as well as possess extensive experience in dealing with their trading partners. They also have knowledge of management policies and access to operational and performance data. Thus, these informants were potential candidates from whom the required information on their relationship with the buyers and the SCM practices they had undertaken jointly with the buyers was obtained.

4.4 Data collection

The sampling frame adopted was the 24th edition of Directory of Hong Kong Industries 2001/2002 published by Hong Kong Productivity Council. This directory has been applied by other empirical studies of Hong Kong clothing industry (e.g. Moon 1999). To better reflect the characteristic of the population, a stratified random sampling method was used to draw a sample, according to the distribution of Hong Kong's domestic exports of clothing by category (Standard International Trade Classification-SITC division 84). The proportion of Hong Kong's domestic exports of woven wear (SITC 841 and 842) and knitwear (SITC 843 and 844) in dollar value was in the ratio of 70% vs. 30%, and such a pattern was found to be consistent over the period of 1999 to 2003 (Census and Statistics Department, various years) (see Table 4.1). This difference was also observed in the Directory of Hong Kong Industries 2001/2002, which listed 329 manufacturers supplying woven outer garments and 206 manufacturers supplying knitted outer garments, representing the ratio of 61.5% vs. 38.5%. Indeed, the supply of outerwear has the largest share of Hong Kong's domestic exports of clothing, accounting for 88.8% and 89.2% of the total in 2002 and 2003, respectively (Census and Statistics Department 2003).

Table 4.1 Share of Hong Kong's domestic exports of woven wear and knitwear by SITC division 84

Year	SITC842 Women's/ girls' woven wear	SITC841 Men's/ boys' woven wear	Total woven wear	Woven wear's share (%)	SITC844 Women's/ girls' knitwear	SITC843 Men's/ boys' knitwear	Total knitwear	Knitwear's Share (%)
1999	19174.8	14886.1	34060.9	71.7	10277.1	3198.7	13475.8	28.3
2000	19688.0	14908.1	34596.1	72.3	9989.8	3284.6	13274.4	27.7
2001	19133.3	12541.5	31674.8	71.4	10209.9	2454.6	12664.5	28.6
2002	19465.4	10517.2	29982.6	72.0	9369.3	2303.0	11672.3	28.0
2003	19335.1	10776.6	30111.7	73.6	8561.1	2259.2	10820.3	26.4

Note: All figures of domestic exports are in HK dollars (Million)

Using the ratio of 70% vs. 30%, 140 manufacturers were drawn from the woven outerwear list and 60 manufacturers were drawn from the knitted outerwear list of the directory randomly, which together represented a sample of 200 companies. Data collection for the survey was done by a self-administrated mailed questionnaire. Similar to other SCM studies (e.g. Kincade et al. 2001), the procedure included mailing a cover letter and a questionnaire, a follow-up fax, and a second mailing. Follow-up faxes were used as a final reminder to request late respondents to complete and return the questionnaires. All respondents were assured of the confidentiality of their data. See Appendix for the cover letter and questionnaire.

Regarding the selection of the buyer-supplier relationship to focus on, caution was exercised to avoid potential restriction in range problems and to obtain variation in the responses (Anderson and Narus 1990). To this end, based on Humphrey and Ashforth's (2000) approach, the research design called for each supplier to develop a list of its top and bottom clothing buyers in Hong Kong, select two buyers from the list, and complete two sets of same questions in the questionnaire with reference to these buyers. The suppliers were told that "Buyers in the *Top* group are those that your company has better than average to excellent relationships with, whereas those buyers with whom your company has poor to average relations belong to the *Bottom*

group". The suppliers were told that they could list all of their buyers into either top or bottom group and selected two top or bottom buyers, if they felt that was more accurate. This can avoid forcing respondents into classifying buyers into two different groups.

4.5 Informant competence

Informant competence indicates the degree to which informants are adequately qualified to report on the issues under investigation (Kumar et al. 1993). Although formal evaluation of informant competence is seldom applied in prior SCM empirical research, it is considered that such a test is necessary if the informants' adequacy is to be assured. Following Kumar et al.'s (1993) suggestions, informant competence was evaluated by both global and specific measures (see Table 4.2).

Table 4.2 Measure of informant competence

Code	*Question*
IC1	My experience in working with this buyer: *Scale for IC1: <3 years; <5 years; <10 years; ≥10 years*
IC2	My level of information and knowledge concerning the characteristics of this buyer.
IC3	My level of information and knowledge concerning the relationship between our company and this buyer.
IC4	My level of information and knowledge concerning the tasks performed jointly by our company and this buyer. *Scale for IC2-4: 1= Very inadequate; 7= Very adequate*

A global item (IC1) assessed informants' working experience (number of years) in dealing with their clothing buyers. In addition, three specific items (IC2-4) with seven-point Likert response format assessed the level of information and knowledge that the informants had about the characteristics of their buyers, relationships with their buyers, and the tasks performed jointly by their firms and the buyers. Any informant indicating less than a three on the Likert-type scale (1=very inadequate, 7=very adequate) for all three specific items were removed (Anselmi

2000). These specific measures indicated more precisely the informant's ability on each major issue of interest (Kumar et al. 1993). One global and three specific measures together reflected the informants' capacity to respond to the survey.

4.6 Measures of the model

Well established measures that have been used in the literature were adopted whenever appropriate, as this can further the process of scale validation (Boyer et al. 1997), whereas new measures were developed for this study if necessary. A summary of the measures of the model (with 78 items in total) is shown in Table 4.3.

Table 4.3 A summary of measures of the model

Construct	*Code*	*Number of items*	*Reference*
Demand uncertainty	DU1-2	2	Ko and Kincade (1998)
Complementary competitive capabilities	CPL1-4	4	A new measure developed based on Jap (1999), Koufteros et al. (2002)
Tacit competitive capabilities	TC1-3	3	Subramaniam and Venkatraman (2001)
Complex competitive capabilities	CPX1-3	3	Simonin (1999), Subramaniam and Venkatraman (2001)
Competence trust	CT1-8	8	Ganesan (1994), Cummings and Bromiley (1996), Spreitzer and Mishra (1999)
Goodwill trust	GT1-4	4	Ganesan (1994), Cummings and Bromiley (1996), Doney and Cannon (1997)
Relational norms	N1-4	4	Lin and Germain (1999)
Historical transactions	HIS1-4	4	A new measure developed based on McAllister (1995), Humphrey and Schmitz (1998)
Bilateral interactions	INT1-3	3	McAllister (1995)
Reputations	RP1-4	4	Anderson and Weitz (1992)
Idiosyncratic investments	INV1-3	3	Anderson and Weitz (1992), Ganesan (1994)

Table 4.3 (cont.) A summary of measures of the model

Construct	*Code*	*Number of items*	*Reference*
SCM practices			
Product development and pre-production integration	SCM1-4	4	These six measures of SCM practices were newly developed based on Ko and Kincade (1997), De Toni and Nassimbeni (1999), Lowson et al. (1999), De Toni and Nassimbeni (2000), De Toni and Nassimbeni (2001), Giunipero et al. (2001)
Sharing of product information	SCM5-7	3	
Delivery and distribution integration	SCM8-13	6	
Purchasing and production integration	SCM14-17	4	
Sharing of purchasing information	SCM18-21	4	
Sharing of sales and inventory information	SCM22-24	3	
Operations performance improvement	OP1-9	9	A new measure developed based on Krause et al. (2000), Ramdas and Spekman (2000), Boyer and Lewis (2002), Koufteros et al. (2002)
Collective competitive advantage	ADV1-3	3	Jap (1999)

4.6.1 Demand uncertainty

Demand uncertainty was indicated by fashion level and seasonal aspects of the product, as these two characteristics are measures of product innovation and product life cycle in clothing industry (Kincade et al. 2001). Fashion level and seasonality of the product were measured by two items (DU1-2) that were used by Ko and Kincade (1998) (see Table 4.4 for the questions). Response format was changed from a four-point to a seven-point Likert scale (1=highly basic and 7=highly fashionable for fashion level; and 1=highly staple and 7=highly seasonal for seasonality), so as to maintain the consistency of response format throughout the questionnaire. The higher the score, the more demand uncertainty of the product was. Ko and Kincade's (1998) instrument was used because their items focused specifically on the clothing industry, as compared with other general measures of

environmental dynamism (e.g. Jap 1999). This instrument has also been applied in other empirical studies (e.g. Kincade et al. 2001).

Table 4.4 Measure of demand uncertainty

Code	*Question*
DU1	The fashion level of the main product that this buyer sourced from our company is: *Scale: 1= Highly basic; 7= Highly fashionable*
DU2	The demand of this main product occurred throughout the year is: *Scale: 1= Highly staple; 7= Highly seasonal*

4.6.2 Competitive capabilities

Perceived complementary competitive capabilities of partners were measured by four items CPL1-4 (see Table 4.5) that were developed with reference to Jap (1999) and Koufteros et al. (2002). A seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree) was used. The items of this measure indicated the extent to which a buyer and a supplier possess competitive capabilities that are helpful to achieve shared goals in improving flexible product innovation, quality, delivery, and costs/prices. These four areas were addressed because they focused on customers and external dimensions of competition, and reflected the prime competitive priorities that both buyers and suppliers seek to pursue, as suggested in operations strategy literature. The higher the score, the more competitive capabilities were perceived to be complementary by a buyer and a supplier.

Table 4.5 Measure of complementary competitive capabilities

Code	*Question*
CPL1	Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in increasing new product style features.
CPL2	Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in improving product quality.
CPL3	Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in providing fast and on-time deliveries.
CPL4	Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in reducing costs/prices. *Scale for CPL1-4: 1=Strongly disagree; 7=Strongly agree*

Perceived complexity of partners' complementary competitive capabilities was measured by an instrument that had three items (see Table 4.6). One item (CPX1) was taken from Simonin (1999) and the other (CPX2) from Subramaniam and Venkatraman (2001), whereas the third item (CPX3) was developed based on the process-oriented SCM construct applied in this study. These items indicated the buyer's and the supplier's perceptions of the degree to which their complementary competitive capabilities were the product of many interconnected and interdependent techniques, routines, individuals, resources, and processes that span various functional units and organizational boundaries. Multiple-item measure, rather than a single-item measure (which has been applied in prior empirical studies), was used in order to improve the reliability of the measure. These items were measured on a seven-point Likert-type response format (1=strongly disagree, 7=strongly agree). A high score indicated a high level of the buyer's and the supplier's perceived complexity of their complementary competitive capabilities.

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Table 4.6 Measure of complex competitive capabilities

Code	*Question*
CPX1	The complementary competitive capabilities of our company and this buyer are complex.
CPX2	The complementary competitive capabilities of our company and this buyer are the product of many interdependent techniques, routines, individuals, and resources.
CPX3	The complementary competitive capabilities of our company and this buyer are the integration of many interconnected processes that span various functional units and organizational boundaries. *Scale for CPX1-3: 1=Strongly disagree; 7=Strongly agree*

The perceived tacitness of complementary competitive capabilities was measured by three items (TC1-3) that were taken from Subramaniam and Venkatraman (2001) (see Table 4.7). These items indicated the buyer's and the supplier's perceptions of the degree to which their complementary competitive capabilities can be communicated and understood easily through written documents. A seven-point Likert-type response format (1=strongly disagree, 7=strongly agree) was applied to this measure. The higher the score, the more difficult the buyer's and the supplier's complementary competitive capabilities are to be communicated and understood through written documents, thus indicating a high level of perceived tacitness.

Table 4.7 Measure of tacit competitive capabilities

Code	*Question*
TC1	The complementary competitive capabilities of our company and this buyer are difficult to be documented comprehensively in manuals or reports.
TC2	The complementary competitive capabilities of our company and this buyer are difficult to be understood comprehensively from written documents.
TC3	The complementary competitive capabilities of our company and this buyer are difficult to be communicated precisely through written documents. *Scale for TC1-3: 1=Strongly disagree; 7=Strongly agree*

4.6.3 Competence trust and goodwill trust

Inter-organizational competence trust, which is cognition-based, was measured by Cummings and Bromiley's (1996) Organizational Trust Inventory—Short Form. Six items (CT1-6) that reflected the cognition component of trust were

taken from their measure to indicate three dimensions of trust including the buyer's and the supplier's beliefs that both of them (1) keep commitments, (2) negotiate honestly, and (3) avoid taking excessive advantage. The referent of trust was members of partner firms. These three dimensions of trust are comparable to that of other measures of trust. For example, these three dimensions correspond to the reliability, openness, and concern dimensions of Spreitzer and Mishra's (1999) trust instrument. These dimensions are also addressed in Ganesan's (1994) trust (credibility) measure.

However, Cummings and Bromiley's (1996) measure is considered to be more specific, because the cognition state of trust is addressed by the questions (items) that are phrased in terms of cognition (Members of our company and this buyer *think* that both of us …). In addition to these three dimensions, the ability dimension of trust, which has been addressed by Ganesan (1994) and Spreitzer and Mishra (1999), was added. This dimension of competence trust indicates the degree to which a buyer and a supplier think that both of them possess the required capabilities to perform their tasks effectively and reliably as well as the required knowledge about the products. Thus, by applying the same cognitive phrase and response format of the other six items, two items (CT7-8) were developed based on Ganesan (1994) and Spreitzer and Mishra (1999) to reflect this dimension. Therefore, an eight-item measure was used to indicate inter-organizational competence trust (see Table 4.8). The items of this measure were measured on a seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). The higher the score, the higher the level of inter-organizational competence trust.

Table 4.8 Measure of inter-organizational competence trust

Code	*Question*
CT1	Members of our company and this buyer think that both of us tell the truth in negotiations.
CT2	Members of our company and this buyer think that both of us negotiate agreements fairly.
CT3	Members of our company and this buyer think that both of us keep each other's promises.
CT4	Members of our company and this buyer think that both of us are reliable.
CT5	Members of our company and this buyer think that both of us do not take advantage of each other's weaknesses.
CT6	Members of our company and this buyer think that both of us do not take advantage of ambiguous situations.
CT7	Members of our company and this buyer think that both of us are competent in performing each other's tasks.
CT8	Members of our company and this buyer think that both of us are knowledgeable about the products each party supplies or sells. *Scale for CT1-8: 1=Strongly disagree; 7=Strongly agree*

Inter-organizational goodwill trust, which is affection-based, was measured by four items (GT1-4) that were based on Ganesan's (1994) trust (benevolence) instrument and Doney and Cannon's (1997) trust instrument (see Table 4.9). Again, following Cummings and Bromiley's (1996) approach, the questions (items) were phrased in terms of affect (Members of our company and this buyer *feel* that both of us …) in order to address the affective state of trust. The referent of trust was members of partner firms. The items were measured on a seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). The higher the score, the higher the level of inter-organizational goodwill trust.

Table 4.9 Measure of inter-organizational goodwill trust

Code	*Question*
GT1	Members of our company and this buyer feel that both of us keep each other's best interests in mind.
GT2	Members of our company and this buyer think that both of us are concerned with each other's needs.
GT3	Members of our company and this buyer think that both of us deal with each other kindly.
GT4	Members of our company and this buyer think that both of us are like friends. *Scale for GT1-4: 1=Strongly disagree; 7=Strongly agree*

4.6.4 Relational norms

Relational norms were measured by four items (N1-4) that were based on Lin and Germain's (1999) instrument with a seven-point Likert-type response format (1=strongly disagree, 7=strongly agree) (see Table 4.10).

Table 4.10 Measure of relational norms

Code	*Question*
N1	Our company and this buyer both expect that we stay together in the face of adversity/challenge.
N2	Our company and this buyer both expect that our relationship is flexible in accommodating one another if special problems/needs arise.
N3	Our company and this buyer both expect that our relationship extends across complex responsibilities and multiple tasks beyond simple buy-and-sell transactions.
N4	Our company and this buyer both expect that we find a fair combination of gains and losses for both parties when there is a disagreement over an important issue.
	Scale for N1-4: 1=Strongly disagree; 7=Strongly agree

These four items indicated several dimensions of relational norms including solidarity, flexibility, role integrity, and harmonization of conflict (Gundlach et al. 1995). The higher the score, the higher level of relational norms were shared by a buyer and a supplier. As norms are patterns of accepted and expected behavior shared by members of partner firms (Heide and John 1992), normative phrase was used in all questions (Our company and this buyer both *expect* …) to operationalize the normative nature of this construct.

4.6.5 Historical transactions

Historical transactions were measured by four items (HIS1-4) that were developed based on McAllister (1995) and Humphrey and Schmitz (1998), with a seven-point Likert-type response format (1=strongly disagree, 7=strongly agree) (see Table 4.11). Three items indicated the degree to which the supplier has a good track record in achieving the agreed performance targets, and established safe and healthy

working conditions in factories and quality management system that comply with international standard. One item indicated the degree to which the buyer has a good track record in maintaining on-time payment of orders with the supplier. The higher the score, the more successful historical transactions were considered by a buyer and a supplier.

Table 4.11 Measure of historical transactions

Code	*Question*
HIS1	Our company has a good track record in achieving the agreed performance targets.
HIS2	This buyer has a good track record in maintaining on-time payment of orders with us.
HIS3	Our company has established safe and healthy working conditions in factories that comply with international standard.
HIS4	Our company has satisfied requirement of quality management system that complies with international standard (e.g. ISO 9000).
	Scale for HIS1-4: 1=Strongly disagree; 7=Strongly agree

4.6.6 Bilateral interactions

Interaction between members of partner firms was measured by three items (INT1-3) that were developed based on McAllister (1995), with a seven-point Likert-type response format (1=strongly disagree, 7=strongly agree) (see Table 4.12). The items indicated the frequency of formal and informal work-related interactions initiated by the members of a buyer and a supplier. The higher the score, the more frequent bilateral interactions was indicated.

Table 4.12 Measure of bilateral interactions

Code	*Question*
INT1	Members of our firm and this buyer frequently initiate formal work-related interaction.
INT2	Members of our firm and this buyer frequently initiate informal work-related interaction.
INT3	Members of our firm and this buyer frequently initiate social work-related interaction.
	Scale for INT1-3: 1=Strongly disagree; 7=Strongly agree

4.6.7 Reputations

The perceived diffusion of the buyer's reputation and the supplier's reputation in the industry was measured by four items (RP1-4) that were developed

based on Anderson and Weitz (1992), with a seven-point Likert-type response format (1=strongly disagree, 7=strongly agree) (see Table 4.13). The items indicated the degree to which a firm has a reputation for being concerned about partners and for performing competently in the industry. Two items measured the buyer's reputation, and the other two items measured the supplier's reputation. The higher the score, the more well known a buyer and a supplier were for their good reputations in the industry.

Table 4.13 Measure of reputations

Code	*Question*
RP1	It is well known in the industry that we have a reputation for being concerned about partners.
RP2	It is well known in the industry that we have a reputation for performing competently.
RP3	It is well known in the industry that this buyer has a reputation for being concerned about partners.
RP4	It is well known in the industry that this buyer has a reputation for performing competently. *Scale for RP1-4: 1=Strongly disagree; 7=Strongly agree*

4.6.8 Idiosyncratic investments

Bilateral idiosyncratic investments were measured by three items (INV1-3) that were developed based on the instrument used by Anderson and Weitz (1992) and Ganesan (1994) (see Table 4.14). The items indicated the degree to which both a buyer and a supplier had invested in specialized equipment and facilities, skilled human resources, and developing and implementing specialized operating processes that were dedicated to their transactions. All items were measured on a seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). The higher the score, the more specific the bilateral investments were dedicated to their transactions.

Table 4.14 Measure of idiosyncratic investments

Code	*Question*
INV1	We and this buyer both have invested significantly in specialized equipment and facilities that are dedicated to our transactions.
INV2	We and this buyer both have invested significantly in skilled human resources that are tailored to our transactions.
INV3	We and this buyer both have invested significantly in developing and implementing specialized operating processes that are specific to our transactions. *Scale for INV1-3: 1=Strongly disagree; 7=Strongly agree*

4.6.9 SCM practices

Integration of product development and pre-production processes was measured by four items (SCM1-4) that indicated the key areas where suppliers serving as contract clothing manufacturers can contribute early in the product development stage (see Table 4.15). Based on the study of De Toni and Nassimbeni (2001) on suppliers' co-design effort, four important practices related to functional design as well as product structural design and engineering were identified. The items reflected the degree to which a supplier contributed to the development of a buyer's product specifications; simplification of product design; usage of standard components and accessories; and preparation of samples timely and reliably. All items were measured on a seven-point Likert-type response format ranging from 1 (none) to 7 (extensive). The higher the score, the more extensive the supplier involved in product development.

Table 4.15 Measure of integration of product development and pre-production processes

Code	*Question*
SCM1	We participate in product development with this buyer in providing advice for the use and choice of standard components and accessories.
SCM2	We participate in product development with this buyer in contributing towards simplifying product design.
SCM3	We participate in product development with this buyer in providing support in developing product specifications.
SCM4	We participate in product development with this buyer in preparing samples promptly and reliably. *Scale for SCM1-4: 1=None; 7=Extensive*

Integration of purchasing and production processes was measured by four items (SCM14-17) that were developed based on recent empirical studies of JIT purchasing (De Toni and Nassimbeni 1999, De Toni and Nassimbeni 2000) and QR (Ko and Kincade 1997, Lowson et al. 1999, Giunipero et al. 2001) (see Table 4.16).

Table 4.16 Measure of integration of purchasing and production processes

Code	*Question*
SCM14	Blanket purchase orders (orders without complete product specifications) are placed by this buyer.
SCM15	Changes in this buyer's purchase order and our production plan are passed on to each other at once.
SCM16	The development of this buyer's ordering plan and our production schedule are closely integrated.
SCM17	Frequent and small-lot purchases are implemented with this buyer. *Scale for SCM14-17: 1=None; 7=Extensive*

These items reflected (1) the degree to which blanket orders were placed to the supplier; (2) the speed to which changes in the buyer's purchase order and the supplier's production plan are informed; (3) the extent to which development of the buyer's ordering plan and the supplier's production schedule are integrated; and (4) the degree to which frequent, small-lot purchase was implemented. All items were measured on a seven-point Likert-type response format ranging from 1 (none) to 7 (extensive). The higher the score, the more extensive purchasing and production processes were integrated.

Integration of delivery and distribution processes was measured by six items (SCM8-13) that were developed based on prior JIT purchasing and QR studies (see Table 4.17). The items indicated the extent to which pre-ticketing and bar-coding of products; scan and pack system; frequent and small-lot shipment; cross-docking or direct-store shipment; and minimal inspection are implemented. All items were measured on a seven-point Likert-type response format ranging from 1 (none) to 7

(extensive). A high score indicated a high level of integration between delivery and distribution processes.

Table 4.17 Measure of integration of delivery and distribution processes

Code	*Question*
SCM8	We and this buyer have implemented pre-ticketing of products.
SCM9	We and this buyer have implemented standardized bar-coding of products.
SCM10	We and this buyer have implemented scan and pack system for delivery of store-ready products.
SCM11	We and this buyer have implemented frequent and small-lot shipments.
SCM12	We and this buyer have implemented cross-docking or direct-to-store shipments.
SCM13	We and this buyer have implemented minimal inspection/free pass for deliveries. *Scale for SCM8-13: 1=None; 7=Extensive*

Information sharing between a buyer and a supplier was indicated by three measures (SCM5-7; SCM18-21; SCM22-24) that were developed largely based on QR studies (see Table 4.18). Different from prior empirical QR studies, the focus on EDI as the major IT tool was enlarged. That is, the application of web-based technologies was added in order to reflect its growing usage and importance. Specifically, the application of web-based product data management and e-mail, which have not been examined extensively in past studies, was incorporated. The items of these measures indicated the extent to which information was shared in three areas.

First, two items (SCM5-6) were developed to indicate the extent to which product design and specifications (in electronic format) were shared through web or e-mail, whereas one item (SCM7) assessed the degree to which important information that helps to solve problems in product development was shared quickly between a buyer and a supplier.

Second, four items (SCM18-21) indicated the extent to which business documents including purchase order, packing instruction, invoice, and advance shipping notice were exchanged through EDI or web.

Third, three items (SCM22-24) indicated the extent to which POS data, sales forecasts, and inventory data were shared through EDI or web. All items were measured on a seven-point Likert-type response format ranging from 1 (none) to 7 (extensive). The higher the score, the more extensive information sharing between a buyer and a supplier was.

Table 4.18 Measure of information sharing

Code	*Question*
SCM5	We and this buyer exchange product design (in the form of Computer Aided Design (CAD) files, scanned images, or digital photos) through web or e-mail.
SCM6	We and this buyer exchange product specifications through web-based Product Data Management (PDM) information system or e-mail.
SCM7	We and this buyer exchange important information that helps to solve problems in product development quickly.
SCM18	We and this buyer exchange purchase orders through Electronic Data Interchange (EDI) or web.
SCM19	We and this buyer exchange packing instructions through EDI or web.
SCM20	We and this buyer exchange advanced shipping notices through EDI or web.
SCM21	We and this buyer exchange invoices through EDI or web.
SCM22	We and this buyer exchange Point-of-Sale (POS) data through EDI or web.
SCM23	We and this buyer exchange sales forecasts through EDI or web.
SCM24	We and this buyer exchange inventory data through EDI or web.
	Scale for SCM5-7,18-24: 1=None; 7=Extensive

4.6.10 Operations performance improvement

Operations performance improvement in the areas of cost/price, quality, flexibility, delivery, speed, and administrative efficiency were measured by nine items (OP1-9) that were developed based on the study of Krause et al. (2000), Ramdas and Spekman (2000), Boyer and Lewis (2002), and Koufteros et al. (2002) (see Table 4.19).

Table 4.19 Measure of operations performance

Code	*Question*
OP1	Over the past 2 to 3 years, our company in collaboration with this buyer has reduced inventory of finished products.
OP2	Over the past 2 to 3 years, our company in collaboration with this buyer has offered products with competitive price to customers.
OP3	Over the past 2 to 3 years, our company in collaboration with this buyer has offered quality products that fulfill customer expectations.
OP4	Over the past 2 to 3 years, our company in collaboration with this buyer has offered products with increased number of new style features that customers desire.
OP5	Over the past 2 to 3 years, our company in collaboration with this buyer has reduced new product development time.
OP6	Over the past 2 to 3 years, our company in collaboration with this buyer has reduced order-to-delivery cycle time.
OP7	Over the past 2 to 3 years, our company in collaboration with this buyer has increased shipment accuracy.
OP8	Over the past 2 to 3 years, our company in collaboration with this buyer has improved efficiency and accuracy of information transmission.
OP9	Over the past 2 to 3 years, our company in collaboration with this buyer has increased labor productivity. *Scale for OP1-9: 1=Strongly disagree; 7=Strongly agree*

These items indicated the degree to which over the past 2 to 3 years, the supplier in collaboration with the buyer has reduced inventory of finished products; offered products with competitive price to customers; offered product quality that fulfills customer expectations; offered products with increased number of new style features to customers; reduced new product development time and order-to-delivery cycle time; increased shipment accuracy; improved efficiency and accuracy of information transmission; and increased labor productivity. A 2-3 year period has been considered in the empirical literature to be useful and sufficient to assess the performance improvement of implementing new management/ manufacturing practices or technologies (e.g. Tan et al. 1998a, Shin et al. 2000, Kotabe et al. 2003, Rosenzweig et al. 2003). Perceptual measures of performance have been considered as reliable indicators and commonly applied in the empirical SCM literature (e.g. Scannell et al. 2000, Narasimhan and Das 2001), given that prior studies have demonstrated statistically significant correlations between perceptual and

corresponding objective measures of performance (e.g. Jayaram et al. 2000). All items were measured on a seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). A high score indicated a high level of operations performance improvement.

4.6.11 Collective competitive advantage

Collective competitive advantage was measured by three items (ADV1-3) that were based on Jap's (1999) instrument (see Table 4.20). The items indicated the extent to which both a buyer and a supplier had gained strategically important outcomes. All items were measured on a seven-point Likert-type response format ranging from 1 (strongly disagree) to 7 (strongly agree). A high score indicated a high level of collective competitive advantage had been realized.

Table 4.20 Measure of collective competitive advantage

Code	*Question*
ADV1	We and this buyer have gained strategic advantages collectively over our competitors.
ADV2	We and this buyer have gained benefits that enable us to compete more effectively as a supply-chain alliance in the marketplace.
ADV3	We and this buyer both have gained strategically important outcomes jointly. *Scale for ADV1-3: 1=Strongly disagree; 7=Strongly agree*

4.7 Analysis

This Section describes the analyses undertaken to examine the hypotheses. A set of preliminary analyses on the data were conducted before testing hypotheses. Outliner was identified if the standard score of a variable exceeded the normal range of -2.5 and +2.5 (Hair et al. 1995). Assessment of normality was undertaken through the Normal probability plot and statistical test of skewness of all variables. The linearity of relationship between two variables was examined through a scatterplot.

The items developed to measure each variable were factor-analyzed separately by principal component analysis to determine the dimensionality of the proposed factor structure. Varimax rotation was applied to examine the factor structure of SCM practices, as several different but related factors were expected to reflect the construct of SCM implementation. Individual factors were identified by those items with loadings (the correlation of each item and the factor) exceeding the commonly adopted cut-off value of 0.5, and with eigenvalue of their corresponding factor greater than the minimum criterion value of 1.0 (Hair et al. 1995). Convergent validity was established if all items loaded appropriately on their expected factors.

The items developed to measure independent and dependent variables were factor-analyzed together by principal component analysis to determine the discriminant validity of related measures. Individual factors were identified based on item loadings exceeding the value of 0.5, and eigenvalue greater than the minimum criterion value of 1.0. Discriminant validity was established if all items loaded appropriately on their expected factors.

Cronbach's α (Cronbach 1951) was used as the coefficient of reliability for testing the internal consistency of the items in each construct validated by the factor analysis. A reasonable level of reliability was achieved if Cronbach's α of the measure exceeded the threshold value of 0.7, as suggested by Nunnally (1978).

Hypotheses were tested after the psychometric properties of the measures were established. Hypotheses were examined by zero-order correlation analysis and multiple regression analysis. The following three key assumptions of multiple regression analysis were examined. The assumptions of (1) linearity and (2) homoscedasticity (equal variance dispersion) for independent and dependent variables were examined by graphical analysis of standardized residuals, whereas (3)

normality of the residuals was examined by Normal probability plot. Equal weighting was applied to items of all variables, variables that form a composite variable, and variables within each analysis. A significant level of 0.05 was specified to interpret the analysis results, and thus confirmation and rejection of the hypotheses were determined.

4.8 Summary

This Chapter describes the research methodology that was used to examine the proposed theoretical model empirically. Owing to the importance of clothing industry to Hong Kong's economy and the potential of applying SCM practices in this industry, the theoretical model was tested in the industrial clothing buyer-supplier setting in Hong Kong. *A priori* power analysis showed that sample size of 79 (at least) was required in order to determine the medium effect size, if a power level of 0.8 was to be obtained. Individuals who were sales manager, product manager, or holding other similar titles, and working in Hong Kong clothing manufacturing companies were selected as target respondents, because they were the potential candidates from whom the required information could be provided. The data were collected from a sample of 200 randomly selected companies via a self-administrated mail survey. Informant competence was examined in order to assure the respondents were adequately qualified to report on the issues under investigation. The measures for the theoretical constructs of the model were developed, and many items of the questionnaire required the respondents to score on a seven-point Likert-type format. A set of preliminary analyses on the data, including detection of outliner, examination of normality of the data, and linearity of relationships between two variables, were undertaken. The psychometric properties (including convergent

validity, discriminant validity and reliability) of all measures were examined by factor analysis and the test for internal consistency, before the hypotheses were to be tested by zero-order correlation analysis and multiple regression analysis.

Chapter 5 : Empirical results

The analysis and empirical results are presented in this Chapter. In Section 5.1, the characteristics of the respondents and responding firms, including informant competence, company size, and the target market and category of the clothes supplied, are described. The assessment of early and late response bias is also presented. In Section 5.2, the descriptive statistics of survey data, and the assessment of potential outliners, normality, and linearity of the relationships between variables are articulated. In addition, the examination of psychometric properties of all measures of variables and common method bias are presented. In Sections 5.3-5.9, the results of hypotheses testing are described. The final Section 5.10 concludes the Chapter.

5.1 Characteristics of the respondents and responding firms

Of the 200 companies contacted, respondents from 63 companies returned questionnaires, representing a 31.5% response rate, which is comparable with other studies of SCM in clothing industry (e.g. Kincade et al. 2001). Of these 63 questionnaires, data on 123 pairs of buyer-supplier relationships were collected. Each of the 60 respondents provided data on two dyads, which represented 120 pairs of relationships, whereas three respondents each provided data on only one dyad.

As Hair et al. (1995, p.104) indicated, “sample sizes of 100 will detect fairly small R^2 values (10 percent to 15 percent) with up to ten independent variables and a significant level of .05”, when the power level is 0.8. As the R^2 values of all multiple

regression analyses exceeded 0.15 (shown in the following Sections), the responded sample size of 123 was considered adequate.

Regarding informant competence, only 5% of the respondents had less than 3 years experience in working with their suppliers, 34% had from 3 to 4 years experience, 46% had from 5 to 9 years experience, and the remaining 15% had 10 or more than 10 years experience. The mean value of respondent's knowledge on supplier characteristics was 6.21 (SD=0.73), relationship with supplier was 6.24 (SD=0.69), and tasks performed jointly by the company and supplier was 6.17 (SD=0.75). None of the respondents indicated less than a four on these 7-point Likert measures. These results show that the respondents were adequately informed in the areas covered by the survey.

The size of the responding firms varies, with 8% of the firms had less than 100 employees, 19% had 100 to 299 employees, 46% had 300 to 499 employees, 16% had 500 to 999 employees, and 11% had 1000 or more than 1000 employees. This indicates the sample is not restricted by firm size. For the category of clothes supplied, 22% of the responding firms produced woven wear for men or boys (SITC 841), 46% produced woven wear for women or girls (SITC 842), 11% produced knitwear for men or boys (SITC 843), and 21% produced knitwear for women or girls (SITC 844). That is, 68% and 32% of the responding firms produced woven wear and knitwear, respectively. For the geographic regions of target market, 40% of the clothes were exported to North America, 24% to Europe, 19% to South East Asia, and 17% to other regions, as reported by the responding firms.

The general characteristics of the responding firms including their geographic regions of target markets and category of clothes supplied were comparable to those of the research population. According to the trade statistics in 2003 (Census and

Statistics Department 2003), Hong Kong's domestic exports of outerwear to North America, Europe, South East Asia and other regions were in the share of 48.9%, 23.3%, and 27.8%. A similar pattern was also observed in the distribution of Hong Kong's exports of woven and knitwear clothing by category. In 2003, Hong Kong's domestic exports of woven wear (SITC 841 and SITC 842) and knitwear (SITC 843 and SITC 844) were 29,982 million HK dollars and 11,672 million HK dollars, representing the share of 72% and 28%, respectively. Thus, this indicates that the sample is a fair representation of the population.

Following the procedure suggested by Armstrong and Overton (1977), response bias between early and late respondents was assessed by comparing on key variables by t-tests. The last wave of surveys received was considered as representative of non-respondents. No significant mean differences at $p \leq 0.05$ were found across two groups on ten randomly selected survey items (cf. Tan et al. 1998a, Handfield and Bechtel 2002) and on three demographic variables including the respondents' knowledge on supplier characteristics, their relationship with supplier, and tasks performed jointly by their company and supplier. This suggests that response bias between early and late respondents was not found in this study. However, this result may not rule out the possibility of non-response bias. As such, interpretation of findings should be made with caution.

5.2 Descriptive statistics

The mean, standard deviation, skewness, statistic value (z) of skewness, and internal consistency using Cronbach's α of all variables are showed in Table 5.1. Potential outliners, normality, and linearity of the relationships were examined prior to factor analysis and multiple regression analysis. No univariate outliners were

identified, as the standard scores of all cases fall within the normal range of -2.5 and +2.5. The skewness of all variables was examined to assess normality. The observed values of skewness were tested against the null hypotheses of zero because the value of skewness is zero when a distribution is normal. The calculated statistic value (z), which is $skewness/\sqrt{6/N}$ (N=sample size), of all variables fall within the range of ±1.96 ($p \leq 0.05$) (Hair et al. 1995).

Table 5.1 Univariate statistics of variables

Variables	# items	Mean	Standard deviation	Skewness	Statistic value (z) of skewness	Cronbach's α
1. Demand uncertainty	2	4.37	1.10	-0.02	-0.07	0.93
2. Complementary capabilities	4	5.25	0.92	-0.03	-0.15	0.91
3. Tacit capabilities	3	5.20	0.87	0.04	0.20	0.76
4. Complex capabilities	3	5.20	0.90	-0.19	-0.87	0.77
5. Competence trust	8	5.39	0.88	-0.20	-0.92	0.95
6. Goodwill trust	4	5.24	0.93	-0.08	-0.37	0.89
7. Product development and pre-production integration	7	4.51	1.15	0.02	0.09	0.91
8. Purchasing and production integration	4	4.46	1.13	0.14	0.65	0.92
9. Delivery and distribution integration	6	4.49	1.08	-0.05	-0.24	0.84
10. Sales and inventory information sharing	3	4.53	1.04	-0.08	-0.35	0.86
11. Purchasing information sharing	4	4.78	1.07	0.19	0.87	0.92
12. Operations performance	9	4.97	0.96	-0.14	-0.63	0.86
13. Idiosyncratic investments	3	5.02	1.04	-0.15	-0.70	0.94
14. Collective competitive advantage	3	4.92	1.08	-0.18	-0.80	0.88
15. Relational norms	4	4.90	1.06	0.16	0.74	0.91
16. Historical transactions	4	4.61	1.17	-0.03	-0.12	0.89
17. Bilateral interactions	3	4.50	1.14	0.15	0.69	0.90
18. Reputations	4	4.63	1.11	0.28	1.26	0.85

Normal probability plots, which compare the cumulative distribution of a normal distribution with the cumulative distribution of actual data values, for all variables were also examined, and no significant departure from normality was found. Scatterplots, which reflect the patterns of association between each pair of variables, were examined, and no apparent nonlinear relationships were revealed. Missing data

on seven items were identified in six different cases, and substituted by the mean of the corresponding measures.

The factor structure of 24 items developed to operationalize SCM practices was examined using principal component analysis with varimax rotation. Five factors having eigenvalue greater than the minimum criterion value of 1.0 were extracted, which together explained 91.6% of the variance (see Table 5.2). Individual factors were identified by those items with loadings exceeding the cut-off value of 0.5. Based on this criterion, 17 items loaded on their theoretically appropriate factors, including purchasing information sharing, sales and inventory information sharing, purchasing and production integration, and delivery and distribution integration. The three items developed to measure product design information sharing and the four items developed to measure early supplier involvement in product development merged to form a single factor, which was labeled as product development and pre-production integration. This finding indicates that information sharing and practices pertaining to product development are distinct in theory, but they are closely related in practice.

Table 5.2 shows that the item loadings of five factors are high (0.71-0.93) and cross-loadings are low, indicating satisfactory convergent validity of each measure and discriminant validity among the measures of SCM practices. Similarly, the items developed to measure the other 13 variables were factor-analyzed separately by principal component analysis. The results indicate satisfactory convergent validity of the measures, as all items loaded correctly on their respective factors, with all loadings greater than 0.5 and eigenvalues greater than 1.0.

Table 5.2 Varimax rotated component analysis factor matrix of SCM practices

Item	Factor 1 Delivery-distribution	Factor 2 Product development-pre-production	Factor 3 Purchasing-production	Factor 4 Purchasing information sharing	Factor 5 Sales and inventory information sharing
SCM1 Contribute to the use standard components and accessories	0.34	**0.76**	0.37	0.25	0.23
SCM2 Contribute to simplifying product design	0.32	**0.71**	0.42	0.14	0.21
SCM3 Contribute to developing product specifications	0.35	**0.74**	0.39	0.14	0.21
SCM4 Prepare samples promptly and reliably	0.37	**0.72**	0.38	0.13	0.21
SCM5 Exchange product design through web/e-mail	0.25	**0.79**	0.22	0.34	0.26
SCM6 Exchange product specifications through web-based PDM/e-mail	0.25	**0.76**	0.23	0.37	0.24
SCM7 Exchange information for product development	0.25	**0.76**	0.23	0.36	0.25
SCM8 Pre-ticketing of products	**0.78**	0.44	0.22	0.17	0.11
SCM9 Standardized bar-coding of products	**0.78**	0.40	0.29	0.17	0.13
SCM10 Scan and pack system for delivery of store-ready products	**0.89**	0.13	0.25	0.17	0.03
SCM11 Frequent and small-lot shipments	**0.88**	0.15	0.18	0.18	0.04
SCM12 Cross-docking or direct-to-store shipments	**0.88**	0.30	0.23	0.17	0.11
SCM13 Minimal inspection/free pass for deliveries	**0.91**	0.24	0.23	0.15	0.07
SCM14 Place blanket purchase orders	0.28	0.29	**0.84**	0.12	0.15
SCM15 Inform changes in purchase order and production plan	0.25	0.32	**0.84**	0.12	0.09
SCM16 Match development of ordering plan and production schedule	0.31	0.25	**0.83**	0.15	0.10
SCM17 Frequent and small-lot purchases	0.28	0.29	**0.88**	0.14	0.14
SCM18 Exchange purchase orders through EDI/web	0.22	0.40	0.16	**0.81**	0.21
SCM19 Exchange packing instructions through EDI/web	0.24	0.39	0.18	**0.80**	0.25
SCM20 Exchange advance shipment notices through EDI/web	0.16	0.15	0.10	**0.92**	0.21
SCM21 Exchange invoices through EDI/web	0.19	0.14	0.11	**0.91**	0.21
SCM22 Exchange Point-of-Sale (POS) data through EDI/web	0.10	0.30	0.16	0.27	**0.88**
SCM23 Exchange sales forecasts through EDI/web	0.11	0.37	0.20	0.31	**0.82**
SCM24 Exchange inventory data through EDI/web	0.05	0.17	0.07	0.21	**0.93**
Eigenvalue	14.62	3.04	1.94	1.29	1.09
Percentage of variance	60.93	12.65	8.08	5.37	4.54

The discriminant validity of related measures was examined when the items of measures of dependent and independent variables were factor-analyzed together. Individual factors were identified by those items with loadings exceeding 0.5. Firstly, Table 5.3 shows that the measures of operations performance (OP1-9), idiosyncratic investments (INV1-3), collective competitive advantage (ADV1-3), and SCM practices (SCM1-24) are distinctive, as the items were factored correctly into their component measures with all loadings and eigenvalues greater than 0.5 and 1.0, respectively.

Secondly, Table 5.4 shows that the measure of SCM practices (SCM1-24) differed from the measures of six antecedents including competence trust (CT1-8), goodwill trust (GT1-4), complementary capabilities (CPL1-4), tacit capabilities (TC1-3), complex capabilities (CPX1-3), and demand uncertainty (DU1-2), as all items loaded correctly to their respective factors and not loaded to others. Similarly, Table 5.5 shows that the measure of idiosyncratic investments (INV1-3) also differed from the measures of these six antecedents.

Thirdly, Table 5.6 shows that the measures of competence trust (CT1-8), goodwill trust (GT1-4), relational norms (N1-4), bilateral interactions (INT1-3), historical transactions (HIS1-4), and reputations (RP1-4) are distinctive, as all items loaded strongly on the appropriate factors.

Table 5.3 Varimax rotated component analysis factor matrix of SCM practices (SCM1-24), idiosyncratic investments (INV1-3), operations performance (OP1-9), and collective competitive advantage (ADV1-3)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
SCM1	0.31	0.29	**0.69**	0.34	0.23	0.21	0.19	0.14
SCM2	0.30	0.26	**0.67**	0.39	0.12	0.19	0.17	0.11
SCM3	0.32	0.24	**0.69**	0.37	0.12	0.19	0.22	0.10
SCM4	0.35	0.22	**0.67**	0.36	0.12	0.20	0.24	0.11
SCM5	0.21	0.27	**0.71**	0.20	0.33	0.22	0.24	0.18
SCM6	0.21	0.32	**0.69**	0.20	0.35	0.20	0.19	0.15
SCM7	0.21	0.30	**0.68**	0.21	0.33	0.22	0.19	0.18
SCM8	**0.76**	0.19	0.41	0.20	0.15	0.10	0.15	0.15
SCM9	**0.74**	0.26	0.35	0.27	0.15	0.09	0.14	0.23
SCM10	**0.84**	0.26	0.09	0.22	0.13	-0.02	0.15	0.18
SCM11	**0.84**	0.21	0.10	0.16	0.15	0.02	0.13	0.13
SCM12	**0.85**	0.22	0.26	0.21	0.14	0.09	0.16	0.15
SCM13	**0.87**	0.23	0.20	0.21	0.12	0.03	0.14	0.18
SCM14	0.25	0.25	0.24	**0.81**	0.09	0.11	0.14	0.13
SCM15	0.24	0.19	0.27	**0.83**	0.11	0.09	0.12	0.06
SCM16	0.27	0.24	0.22	**0.80**	0.12	0.06	0.11	0.16
SCM17	0.25	0.21	0.26	**0.86**	0.12	0.11	0.14	0.11
SCM18	0.18	0.26	0.36	0.13	**0.78**	0.17	0.15	0.16
SCM19	0.20	0.23	0.35	0.16	**0.77**	0.22	0.15	0.19
SCM20	0.13	0.19	0.13	0.08	**0.90**	0.18	0.09	0.14
SCM21	0.16	0.20	0.10	0.09	**0.88**	0.19	0.09	0.16
SCM22	0.07	0.24	0.27	0.13	0.25	**0.84**	0.12	0.16
SCM23	0.07	0.28	0.32	0.17	0.28	**0.78**	0.15	0.17
SCM24	0.02	0.16	0.14	0.06	0.19	**0.90**	0.09	0.17
OP1	0.20	**0.72**	0.27	0.16	0.08	0.24	0.11	0.32
OP2	0.18	**0.69**	0.29	0.24	0.33	0.04	0.06	0.09
OP3	0.33	**0.60**	0.15	0.25	0.29	0.27	0.32	0.05
OP4	0.34	**0.73**	0.26	0.25	0.26	0.15	0.17	0.16
OP5	0.38	**0.60**	0.15	0.25	0.35	0.20	0.32	0.07
OP6	0.21	**0.72**	0.31	0.14	0.09	0.16	0.12	0.32
OP7	0.40	**0.51**	0.14	0.28	0.34	0.26	0.30	0.04
OP8	0.36	**0.66**	0.22	0.24	0.27	0.23	0.29	0.16
OP9	0.34	**0.73**	0.23	0.28	0.24	0.19	0.20	0.16
ADV1	0.25	0.19	0.25	0.26	0.13	0.11	**0.75**	0.15
ADV2	0.15	0.23	0.21	0.05	0.22	0.14	**0.79**	0.15
ADV3	0.22	0.20	0.22	0.17	0.06	0.08	**0.78**	0.22
INV1	0.26	0.18	0.15	0.13	0.22	0.21	0.17	**0.84**
INV2	0.19	0.26	0.18	0.07	0.17	0.15	0.16	**0.78**
INV3	0.28	0.16	0.11	0.21	0.19	0.14	0.18	**0.78**
Eigen-value	22.90	3.10	2.10	1.62	1.47	1.32	1.22	1.01
% of variance	58.72	7.94	5.38	4.15	3.77	3.38	3.12	2.60

Table 5.4 Varimax rotated component analysis factor matrix of SCM practices (SCM1-24), competence trust (CT1-8), goodwill trust (GT1-4), complementary capabilities (CPL1-4), tacit capabilities (TC1-3), complex capabilities (CPX1-3), and demand uncertainty (DU1-2)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11
SCM1	0.14	0.34	**0.72**	0.34	0.23	0.14	0.12	0.18	0.10	0.14	0.10
SCM2	0.12	0.29	**0.69**	0.39	0.12	0.21	0.13	0.16	0.12	0.09	0.08
SCM3	0.12	0.32	**0.71**	0.37	0.12	0.15	0.22	0.16	0.05	0.10	0.07
SCM4	0.09	0.35	**0.68**	0.36	0.12	0.20	0.14	0.16	0.11	0.13	0.10
SCM5	0.18	0.25	**0.73**	0.21	0.33	0.15	0.08	0.22	0.03	0.14	0.13
SCM6	0.21	0.23	**0.72**	0.21	0.35	0.14	0.06	0.18	0.02	0.14	0.17
SCM7	0.22	0.26	**0.71**	0.22	0.34	0.10	0.04	0.21	0.02	0.15	0.15
SCM8	0.10	**0.75**	0.41	0.20	0.16	0.21	0.16	0.08	0.07	0.04	0.01
SCM9	0.15	**0.74**	0.38	0.25	0.15	0.15	0.22	0.07	0.07	0.08	0.10
SCM10	0.19	**0.84**	0.11	0.23	0.13	0.23	0.18	-0.01	-0.01	0.01	0.04
SCM11	0.12	**0.84**	0.12	0.16	0.15	0.21	0.15	0.01	0.08	0.04	0.03
SCM12	0.14	**0.84**	0.28	0.20	0.14	0.21	0.20	0.07	0.04	0.02	0.05
SCM13	0.13	**0.87**	0.24	0.19	0.12	0.17	0.20	0.03	0.04	0.02	0.03
SCM14	0.11	0.28	0.31	**0.79**	0.09	0.06	0.12	0.11	0.14	0.03	0.12
SCM15	0.03	0.24	0.34	**0.80**	0.11	0.12	0.15	0.06	0.06	0.05	0.09
SCM16	0.09	0.29	0.25	**0.81**	0.13	0.11	0.14	0.06	0.09	0.04	0.16
SCM17	0.07	0.26	0.30	**0.84**	0.12	0.12	0.16	0.10	0.12	0.04	0.13
SCM18	0.15	0.21	0.36	0.15	**0.80**	0.13	0.10	0.16	0.09	0.10	0.13
SCM19	0.17	0.22	0.38	0.16	**0.77**	0.13	0.10	0.21	0.11	0.02	0.12
SCM20	0.14	0.14	0.15	0.08	**0.90**	0.11	0.10	0.17	0.13	0.01	0.10
SCM21	0.12	0.16	0.15	0.08	**0.89**	0.14	0.09	0.16	0.11	0.03	0.05
SCM22	0.18	0.07	0.31	0.13	0.26	0.13	0.13	**0.83**	0.05	0.11	0.10
SCM23	0.19	0.09	0.37	0.17	0.29	0.10	0.12	**0.77**	0.10	0.13	0.13
SCM24	0.17	0.02	0.17	0.05	0.20	0.14	0.13	**0.88**	0.10	0.07	0.10
CT1	**0.82**	0.09	0.30	-0.03	0.08	0.03	0.06	0.08	0.11	-0.12	0.04
CT2	**0.84**	0.13	-0.08	0.03	0.03	0.07	0.01	0.02	-0.02	0.21	0.16
CT3	**0.77**	0.06	0.31	-0.04	0.10	0.06	0.08	0.07	0.13	-0.14	0.05
CT4	**0.82**	0.15	-0.03	0.04	0.01	0.09	0.05	0.01	-0.08	0.25	0.13
CT5	**0.92**	0.06	0.06	0.11	0.12	0.00	0.06	0.10	-0.01	-0.05	-0.10
CT6	**0.92**	0.14	0.06	0.01	0.07	0.03	0.06	0.04	0.05	0.09	0.11
CT7	**0.85**	-0.01	0.14	0.11	0.09	-0.02	0.02	0.12	0.05	-0.16	-0.06
CT8	**0.90**	0.10	0.04	0.10	0.09	0.02	0.08	0.09	-0.03	-0.01	-0.09
CPL1	0.02	0.17	0.15	0.08	0.00	**0.83**	0.03	0.00	0.02	-0.04	-0.07
CPL2	0.01	0.26	0.11	0.07	0.12	**0.79**	0.09	0.12	0.09	0.08	0.04
CPL3	0.10	0.16	0.09	0.10	0.17	**0.82**	0.06	0.10	0.16	-0.01	0.11
CPL4	0.06	0.22	0.17	0.09	0.14	**0.90**	0.15	0.09	0.05	0.03	0.03
GT1	-0.06	0.26	0.03	0.24	0.02	0.02	**0.80**	0.06	0.09	-0.05	0.03
GT2	0.12	0.07	0.12	0.09	0.12	0.16	**0.78**	-0.01	-0.10	0.01	0.02
GT3	0.16	0.21	0.10	0.03	0.03	0.07	**0.79**	0.17	0.07	-0.03	-0.01
GT4	0.10	0.24	0.13	0.10	0.13	0.06	**0.90**	0.09	-0.02	-0.03	0.03
CPX1	0.09	0.13	-0.03	0.22	0.13	0.13	-0.09	0.08	**0.78**	0.07	-0.07
CPX2	-0.02	0.07	0.05	0.12	0.22	0.13	-0.01	0.16	**0.78**	0.07	-0.04
CPX3	0.04	-0.02	0.16	-0.02	-0.02	0.02	0.10	-0.03	**0.83**	-0.01	0.13
TC1	-0.01	0.15	0.24	-0.05	0.00	0.02	-0.12	-0.04	-0.10	**0.82**	0.03
TC2	-0.07	-0.10	0.17	0.05	0.06	0.01	0.17	0.04	0.11	**0.76**	-0.16
TC3	0.13	0.08	-0.01	0.15	0.08	0.02	-0.16	0.28	0.14	**0.76**	0.06
DU1	0.06	0.06	0.14	0.14	0.12	0.07	0.06	0.10	0.04	-0.01	**0.91**
DU2	0.07	0.07	0.21	0.22	0.17	0.00	-0.02	0.13	-0.01	-0.07	**0.87**
Eigen-value	18.33	5.20	3.48	2.59	2.42	2.01	1.93	1.72	1.37	1.14	1.08
% of variance	38.19	10.83	7.24	5.39	5.04	4.19	4.02	3.59	2.85	2.38	2.26

Table 5.5 Varimax rotated component analysis factor matrix of idiosyncratic investments (INV1-3), competence trust (CT1-8), goodwill trust (GT1-4), complementary capabilities (CPL1-4), tacit capabilities (TC1-3), complex capabilities (CPX1-3), and demand uncertainty (DU1-2)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
CT1	**0.84**	0.06	0.09	0.18	0.11	-0.07	0.09
CT2	**0.82**	0.05	-0.01	0.15	-0.05	0.17	0.05
CT3	**0.79**	0.09	0.10	0.13	0.14	-0.09	0.11
CT4	**0.81**	0.08	0.03	0.14	-0.11	0.21	0.02
CT5	**0.94**	0.02	0.10	0.01	0.03	-0.02	-0.04
CT6	**0.92**	0.04	0.06	0.18	0.03	0.08	0.06
CT7	**0.87**	0.00	0.06	-0.02	0.10	-0.12	0.06
CT8	**0.92**	0.05	0.11	0.04	0.00	0.01	-0.04
CPL1	0.03	**0.85**	0.06	0.07	0.03	-0.02	-0.06
CPL2	0.03	**0.84**	0.13	0.16	0.10	0.11	0.05
CPL3	0.12	**0.85**	0.09	0.10	0.18	0.00	0.14
CPL4	0.09	**0.94**	0.19	0.14	0.07	0.06	0.05
GT1	-0.05	0.07	**0.85**	0.07	0.11	-0.03	0.05
GT2	0.14	0.17	**0.79**	0.05	-0.09	0.01	0.04
GT3	0.18	0.10	**0.82**	0.14	0.08	0.00	-0.01
GT4	0.12	0.10	**0.94**	0.15	0.00	-0.01	0.04
INV1	0.22	0.21	0.16	**0.90**	0.05	0.01	0.20
INV2	0.20	0.12	0.11	**0.87**	0.07	0.00	0.13
INV3	0.19	0.18	0.19	**0.83**	0.12	0.04	0.19
CPX1	0.10	0.16	-0.04	0.07	**0.81**	0.09	-0.06
CPX2	0.01	0.16	0.04	0.07	**0.84**	0.10	0.02
CPX3	0.04	0.00	0.08	0.04	**0.78**	-0.02	0.10
TC1	0.01	0.06	-0.08	0.08	-0.12	**0.85**	0.03
TC2	-0.06	0.01	0.17	-0.10	0.12	**0.78**	-0.10
TC3	0.14	0.06	-0.12	0.06	0.19	**0.79**	0.10
DU1	0.07	0.08	0.08	0.22	0.05	0.03	**0.92**
DU2	0.10	0.04	0.03	0.20	0.02	-0.01	**0.94**
Eigenvalue	7.77	3.97	2.59	2.23	1.94	1.83	1.18
% of variance	28.76	14.69	9.58	8.27	7.17	6.77	4.39

Table 5.6 Varimax rotated component analysis factor matrix of competence trust (CT1-8), goodwill trust (GT1-4), relational norms (N1-4), bilateral interactions (INT1-3), historical transactions (HIS1-4), and reputations (RP1-4)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
CT1	**0.82**	0.15	0.12	0.18	0.07	0.08
CT2	**0.82**	0.00	0.17	0.13	0.00	-0.03
CT3	**0.77**	0.17	0.13	0.20	0.08	0.08
CT4	**0.80**	-0.02	0.15	0.18	0.04	0.00
CT5	**0.91**	0.12	0.08	0.13	0.08	0.08
CT6	**0.91**	0.09	0.18	0.16	0.05	0.02
CT7	**0.85**	0.12	0.03	0.14	0.04	0.11
CT8	**0.89**	0.09	0.16	0.13	0.09	0.06
RP1	0.13	**0.94**	0.11	0.19	0.10	0.10
RP2	0.12	**0.93**	0.07	0.17	0.10	0.13
RP3	0.14	**0.88**	0.16	0.20	0.12	0.22
RP4	0.12	**0.94**	0.11	0.21	0.11	0.10
N1	0.18	0.15	**0.87**	0.10	0.20	0.08
N2	0.26	0.11	**0.86**	0.16	0.17	0.20
N3	0.20	0.08	**0.88**	0.14	0.28	0.17
N4	0.23	0.13	**0.87**	0.15	0.23	0.20
HIS1	0.31	0.27	0.17	**0.86**	0.12	0.19
HIS2	0.33	0.26	0.16	**0.83**	0.14	0.21
HIS3	0.35	0.19	0.13	**0.86**	0.13	0.07
HIS4	0.30	0.27	0.16	**0.86**	0.13	0.18
GT1	-0.07	0.05	0.13	0.08	**0.83**	0.23
GT2	0.10	0.11	0.17	0.12	**0.78**	0.06
GT3	0.16	0.09	0.20	0.07	**0.80**	0.09
GT4	0.08	0.15	0.21	0.12	**0.91**	0.13
INT1	0.11	0.16	0.21	0.18	0.14	**0.89**
INT2	0.05	0.16	0.15	0.13	0.18	**0.90**
INT3	0.08	0.18	0.17	0.15	0.19	**0.92**
Eigenvalue	11.51	4.12	2.90	1.78	1.67	1.51
% of variance	42.63	15.25	10.72	6.60	6.20	5.59

The findings of factor analysis presented in Tables 5.2-5.6 indicate that both convergent and discriminant validity of the measures are established. The reliability of the measures is good, as Table 5.1 shows that the internal consistency of all measures exceeded the threshold value of 0.7.

Given that dependent and independent variable data were collected from a single informant, common method bias can be a potential problem. Following Podsakoff and Organ (1986), we use the Harman's one-factor test to examine the extent of the bias: if common method variance was a serious problem in this research, a single factor explaining a large portion of the covariance in the independent and dependent variables would emerge when all study items were factor-analyzed together. The result did not indicate that a single factor emerged, nor was there a general factor which could account for the majority of covariance in these variables. Furthermore, the results of factor analysis on dependent and independent variables presented in Tables 5.3-5.6 also show that items of related variables did not merge into a single factor. Thus, no common method variance problem was detected.

Based on these established psychometric properties, composite measures of 18 variables were created by taking the average of corresponding item scores for testing hypotheses. Responses for the measures were distributed from 1 to 7, thus capturing the full range of the 7-point Likert response format. As shown in Table 5.1, the means for the measures ranged from 4.37 (demand uncertainty) to 5.39 (competence trust) and the standard deviations were neither exceptionally small nor large (i.e. 0.87 to 1.17), suggesting that none of the measures was characterized by restriction in range. The calculated statistic values (z) of skewness of all variables fall within the range of ±1.96, indicating no evidence of non-normality at a 0.05 error level.

5.3 Testing of Hypotheses 1a-d

H1a: There are positive associations between integration of product development and pre-production, purchasing and production, and delivery and distribution processes.

H1b: There are positive associations between sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means (EDI or web-based applications).

H1c: There are positive associations between process integration (product development and pre-production, purchasing and production, and delivery and distribution processes) and information sharing (product information, purchasing information, and sales and inventory information sharing).

H1d: There are positive associations between SCM practices and idiosyncratic investments committed by a buyer and a supplier.

The hypotheses of the positive relationships among process integration variables (H1a), among information sharing variables (H1b), and between information sharing and process integration variables (H1c) were examined by zero-order correlation analysis of the five variables indicating information sharing and process integration between buyers and suppliers. As shown in Table 5.7, the correlation coefficients range from 0.34 to 0.71, and are significant at $p \leq 0.001$.

Table 5.7 Correlations among variables of SCM practices

Variables	1	2	3	4	5	6
1. Product development and pre-production integration	1.00					
2. Sales and inventory information sharing	0.61	1.00				
3. Purchasing information sharing	0.63	0.57	1.00			
4. Purchasing and production integration	0.71	0.40	0.43	1.00		
5. Delivery and distribution integration	0.69	0.34	0.48	0.61	1.00	
6. Idiosyncratic investments	0.56	0.49	0.51	0.45	0.56	1.00

Note: All correlation coefficients are significant at $p \leq 0.001$ (2-tailed)

As expected, strong associations among information sharing variables and among process integration variables were indicated. Strong correlation between purchasing information sharing and sales and inventory information sharing (r=0.57) was found. Similarly, purchasing and production integration correlated strongly with delivery and distribution integration (r=0.61). Product development and pre-production integration was also found to be correlated strongly with purchasing and production integration (r=0.71), delivery and distribution integration (r=0.69), sales and inventory information sharing (r=0.61), and purchasing information sharing (r=0.63). However, as the variable of product development and pre-production integration encompassed both information sharing and process integration components (see the result of factor analysis in Table 5.2), the unique associations between this information sharing component and the other two information sharing variables as well as between this process integration component and the other two process integration variables were not distinguished.

Consistent with expectation, purchasing and production integration correlated moderately with purchasing information sharing (r=0.43) and sales and inventory information sharing (r=0.40). Similarly, delivery and distribution integration correlated moderately with purchasing information sharing (r=0.48) and sales and inventory information sharing (r=0.34). In summary, these results provide support for Hypotheses 1a-c.

Table 5.7 also shows that idiosyncratic investments correlated significantly with all five SCM practices: product development and pre-production (r=0.56), sales and inventory information sharing (r=0.49), purchasing information sharing (r=0.51), purchasing and production integration (r=0.45), and delivery and distribution integration (r=0.56) at $p \leq 0.001$, thus supporting Hypothesis 1d.

5.4 Testing of Hypotheses 2a, 3a, 3c-d and 4a-b

H2a: There is a positive association between SCM implementation and demand uncertainty (indicated by the fashion level and seasonality of the product).

H3a: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive SCM practices are implemented by them.

H3c: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive SCM practices are implemented by them.

H3d: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive SCM practices are implemented by them.

H4a: There is a positive association between inter-organizational competence trust and implementation of SCM practices.

H4b: There is a positive association between inter-organizational goodwill trust and implementation of SCM practices.

A global measure of SCM implementation was constructed for testing the effect of six antecedents on SCM implementation and idiosyncratic investments, and the effect of idiosyncratic investments on SCM implementation in addition to that attributable to six antecedents (Hypotheses 2-4). Consistent with the approach applied by past empirical research in combining various related components of operations and manufacturing practices such as JIT (e.g. Sakakibara et al. 1997, Gonzalez-Benito and Suarez-Gonzalez 2001), a second-order factor analysis (principle component method) was used to determine the dimensionality of the global measure of SCM implementation. The score for each SCM practice was the mean of the scores on its associated scale. Thus, in each case five new items were generated, and each item indicated its associated SCM practice. The factor analysis results indicate that all five items were assigned to one construct factor (loadings

range from 0.72 to 0.92, eigenvalue=3.2, and the percentage explained=64.1), with high internal consistency (Cronbach's α=0.86). Based on the established psychometric properties, the scores on these five items were averaged to obtain a new indicator, which was labeled as SCM implementation (mean=4.55, standard deviation=0.88, and skewness=0.032).

The hypotheses of the positive relationship between SCM implementation (the global measure) and six antecedents including environment (H2a), strategic factors (H3a, 3c-d), and social factors (H4a-b) were examined by forward stepwise multiple regression analysis. This analysis used variance explained to enter predictors sequentially and statistical significance to decide the number of predictors to be included. That is, the most powerful predictor, which had the highest F-ratio or lowest p-value, was entered first, followed by the second most powerful, and so on until none of the remaining predictors had F-ratios sufficiently large or p-values sufficiently small to merit inclusion in the model. The threshold of the significance level of the F value for adding variables to the regression model was set at 0.05.

Table 5.8 Correlations among variables of SCM implementation, six antecedents, and idiosyncratic investments

Variables	1	2	3	4	5	6	7	8
1. SCM implementation	1.00							
2. Demand uncertainty	0.43***	1.00						
3. Complementary capabilities	0.50***	0.15	1.00					
4. Tacit capabilities	0.27**	0.03	0.10	1.00				
5. Complex capabilities	0.34***	0.09	0.25**	0.14	1.00			
6. Competence trust	0.38***	0.17	0.16	0.07	0.12	1.00		
7. Goodwill trust	0.46***	0.14	0.27**	-0.01	0.09	0.21*	1.00	
8. Idiosyncratic investments	0.64***	0.42***	0.35***	0.06	0.20*	0.36***	0.32***	1.00

Note: ***p≤0.001, **p≤0.01 and *p≤0.05 (2-tailed)

Table 5.8 shows that SCM implementation correlated significantly with six antecedent variables including demand uncertainty (r=0.43, p≤0.001), complementary capabilities (r=0.50, p≤0.001), tacit capabilities (r=0.27, p≤0.01),

complex capabilities (r=0.34, p≤0.001), competence trust (r=0.38, p≤0.001) and goodwill trust (r=0.46, p≤0.001). This indicates that all proposed antecedents are potential predictors of SCM implementation.

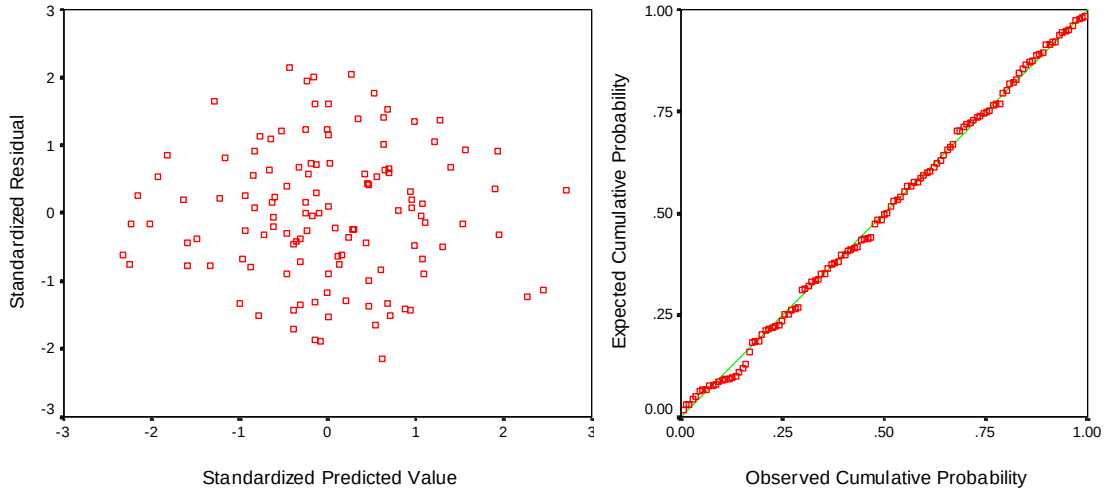
The extent of multicollinearity among the six antecedent variables was examined by their corresponding Variance Inflation Factors (VIF), which indicate the degree to which each predictive variable is explained by the other predictive variables (Neter et al. 1985). The presence of high correlations among predictors makes estimating the individual contribution of each predictor difficult, as their predictive effects are confounded (Hair et al. 1995). The VIF values of the six antecedent variables were small, ranging from 1.03 to 1.17 (see Table 5.9), indicating that multicollinearity does not significantly affect the results. As Myers (1990) notes, VIF values exceeding 10 are indicative of possible bias due to multicollinearity.

Table 5.9 Forward stepwise multiple regression predicting SCM practices

Predictors	Standardized regression coefficient (β)	p-value	VIF
1. Complementary capabilities	0.28	0.000	1.17
2. Demand uncertainty	0.29	0.000	1.06
3. Goodwill trust	0.30	0.000	1.12
4. Tacit capabilities	0.20	0.001	1.03
5. Competence trust	0.20	0.002	1.08
6. Complex capabilities	0.16	0.011	1.09
Dependent variable:	SCM implementation		
F-statistic (6,116):	27.17 (p≤0.001)		
Multiple R^2 (adjusted):	0.584 (0.563)		

Table 5.9 shows the forward stepwise multiple regression results. The value of multiple R^2 indicates the total amount of variance in SCM implementation accounted for by the predictors entered. For the full model, multiple R^2 was significant, F (6,116) = 27.17, p≤0.001, and indicated that 58.4% of the variance in

SCM implementation was explained when all six predictors were included. All standardized regression coefficients (β) were significant at p=0.011 or better, showing all antecedents contribute to the prediction of SCM practices. Among the six antecedents, goodwill trust (β=0.30), demand uncertainty (β=0.29), and complementary capabilities (β=0.28) were found to be the most influential predictors of SCM practices. This is followed by tacit capabilities (β=0.20), competence trust (β=0.20), and complex capabilities (β=0.16).



(a) (b)

Figure 5.1 Residual plot and Normal probability plot of standardized residuals of SCM implementation

Figure 5.1(a) shows the residual plot of standardized residuals (residual is the difference between the actual dependent variable value and its predicted value) against standardized predicted values of SCM practices. In this residual plot, the standardized residuals are fairly evenly scattered above and below their mean of zero, and most of them lie between -2 and +2, as would be expected from variables with a normal distribution. Figure 5.1(a) does not exhibit any nonlinear pattern to the residuals, thus indicating a linear relationship between the predictors and the dependent variable. In addition, there is no pattern of increasing or decreasing residuals across values of the predictors in Figure 5.1(a), thus showing the

homogeneity of the variance of the residuals. That is, the width of the distribution of the residuals is constant. In the Normal probability plot of the residuals (Figure 5.1(b)), the values fall along the diagonal with no substantial or systematic departures, thus indicating normality of the distribution of the residuals. Given that the three assumptions of multiple regression analysis (including linearity of the proposed relationship between predictors and dependant variable, homogeneity of residual variance, and normality of residual distribution) are met, it is concluded that the regression results support Hypotheses 2a, 3a, 3c-d and 4a-b.

That is, there is a positive association between SCM implementation and demand uncertainty (Hypothesis 2a). The more a buyer and a supplier perceive each other's competitive capabilities to be complementary, tacit, and complex in contributing to the achievement of shared competitive priorities, the more extensive SCM practices are implemented by them (Hypotheses 3a, 3c-d). In addition, there is a positive association between inter-organizational competence trust and implementation of SCM practices (Hypothesis 4a), and between inter-organizational goodwill trust and implementation of SCM practices (Hypothesis 4b).

5.5 Testing of Hypotheses 2b, 3b, 3e-f and 4c-d

H2b: There is a positive association between idiosyncratic investments and demand uncertainty (indicated by the fashion level and seasonality of the product).

H3b: The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive idiosyncratic investments are committed by them.

H3e: The more a buyer and a supplier perceive each other's competitive capabilities to be tacit, the more extensive idiosyncratic investments are made by them.

H3f: The more a buyer and a supplier perceive each other's competitive capabilities to be complex, the more extensive idiosyncratic investments are made by them.

H4c: There is a positive association between inter-organizational competence trust and commitment of idiosyncratic investments.

H4d: There is a positive association between inter-organizational goodwill trust and commitment of idiosyncratic investments.

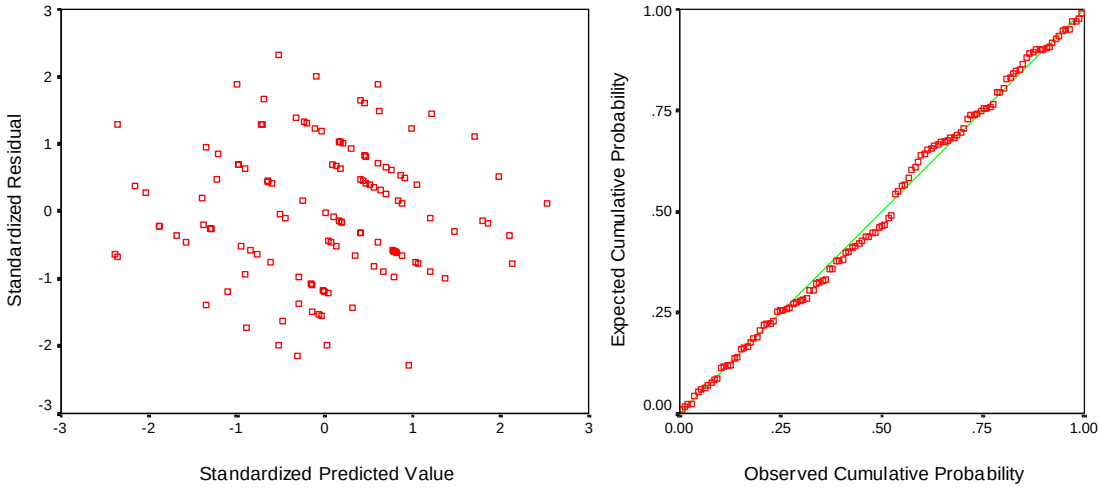
The effect of six antecedents on idiosyncratic investments was examined by forward stepwise multiple regression analysis. The threshold of the significance level of the F value for adding variables to the regression model was set at 0.05. Table 5.8 shows that idiosyncratic investments correlated significantly with four antecedent variables including demand uncertainty ($r=0.42$, $p\leq0.001$), complementary capabilities ($r=0.35$, $p\leq0.001$), complex capabilities ($r=0.20$, $p\leq0.05$), competence trust ($r=0.36$, $p\leq0.001$) and goodwill trust ($r=0.32$, $p\leq0.001$), but not with tacit capabilities ($r=0.06$) at $p\leq0.05$. This indicates that five out of six antecedents are potential predictors of idiosyncratic investments.

Table 5.10 Forward stepwise multiple regression predicting idiosyncratic investments

Predictors	Standardized regression coefficient (β)	p-value	VIF
1. Demand uncertainty	0.33	0.000	1.05
2. Complementary capabilities	0.22	0.006	1.11
3. Competence trust	0.23	0.003	1.08
4. Goodwill trust	0.17	0.034	1.12
Dependent variable:	Idiosyncratic investments		
F-statistic (4,118):	15.93 ($p\leq0.001$)		
Multiple R^2 (adjusted):	0.351 (0.329)		

Table 5.10 shows the forward stepwise multiple regression results. The regression model achieved a significant F-value at $p\leq0.001$, and indicated that 35.1%

of the variance in idiosyncratic investments was explained by four predictors, including demand uncertainty (β=0.33), competence trust (β=0.23), complementary capabilities (β=0.22), and goodwill trust (β=0.17), which are significant at p=0.034 or better. The VIF values of the four predictors range from 1.05 to 1.12 (see Table 5.10), indicating that multicollinearity does not significantly affect the results. The variable of complex capabilities was shown to be a non-significant predictor at p≤0.05.



(a) (b)

Figure 5.2 Residual plot and Normal probability plot of standardized residuals of idiosyncratic investments

Figure 5.2(a) shows the residual plot of standardized residuals against standardized predicted values of idiosyncratic investments. No systematic or nonlinear pattern of residuals was found, as the residuals fall fairly evenly above and below their mean of zero, and most of them lie between -2 and +2, thus indicating the linearity of the proposed relationship between predictors and dependent variable, and homogeneity of the residual variance. The normal probability plot of the residuals (Figure 5.2(b)) also shows that the residual values fall along the diagonal

with no substantial or systematic departures, thus indicating normality of the distribution of the residuals.

Given that the three assumptions of multiple regression analysis are met, it is concluded that Hypotheses 2b, 3b and 4c-d are supported, whereas Hypotheses 3e-f are not supported. That is, there is a positive association between idiosyncratic investments and demand uncertainty (Hypothesis 2b). The more a buyer and a supplier perceive each other's competitive capabilities to be complementary in contributing to the achievement of shared competitive priorities, the more extensive idiosyncratic investments are committed by them (Hypotheses 3b). However, the results show no support for the hypotheses that the more a buyer and a supplier perceive each other's competitive capabilities to be tacit and complex, the more extensive idiosyncratic investments are made by them (Hypotheses 3e-f). Hypotheses 4c-d are supported, as there is a positive association between inter-organizational competence trust and commitment of idiosyncratic investments, and between inter-organizational goodwill trust and commitment of idiosyncratic investments.

5.6 Testing of Hypothesis 4e

H4e: Idiosyncratic investments provide explanatory power in SCM implementation over and above that attributable to the six contextual factors.

The hypothesis that idiosyncratic investments will provide predictive power over and above that attributable to the six antecedents on SCM implementation was examined by hierarchical multiple regression. In this analysis, order of entering each variable into the model equation was specified before the analysis was conducted. In the first step, six antecedents were entered as a set, and forward stepwise variable selection method was used. Then, the variable idiosyncratic investments was entered

into the equation to determine whether a significant amount of additional variance (ΔR^2) was explained.

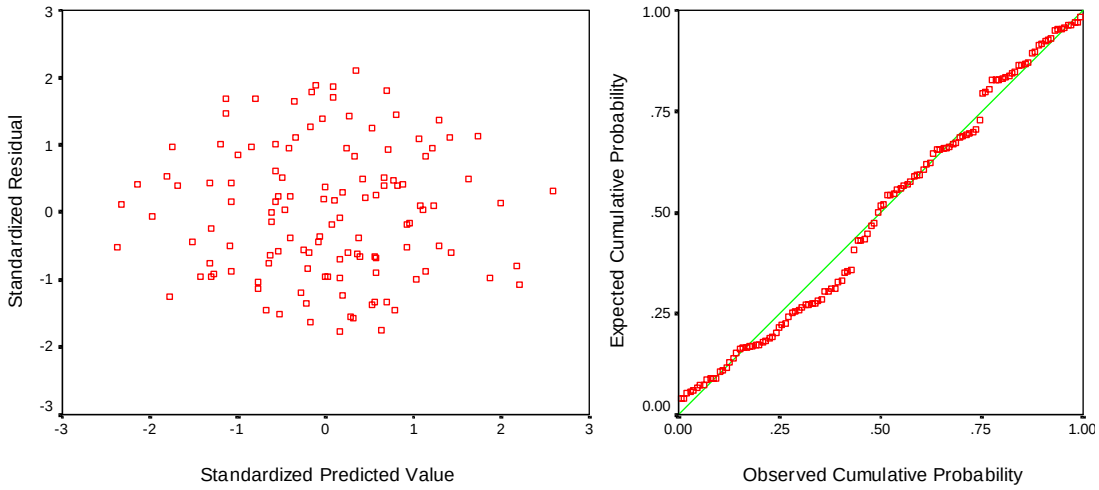
Table 5.11 shows that in Model 1, multiple R^2 was significant, with F-value=27.17 ($p \leq 0.001$), and that 58.4% of variance in SCM implementation was explained by six antecedents as a set. In Model 2, idiosyncratic investments contributed significantly for an additional 6.9% of the variance ($p \leq 0.001$). The VIF values ranged from 1.03-1.17 for the first model and 1.03-1.55 for the second model, indicating multicollinearity does not significantly affect the results.

Table 5.11 Hierarchical multiple regression predicting SCM implementation

Predictors	***Model 1*** Standardized regression coefficient (β)	***Model 2*** Standardized regression coefficient (β)
1. Complementary capabilities	0.28***	0.21***
2. Demand uncertainty	0.30***	0.19**
3. Goodwill trust	0.30***	0.24***
4. Tacit capabilities	0.20***	0.20***
5. Competence trust	0.20**	0.12*
6. Complex capabilities	0.16*	0.14*
7. Idiosyncratic investments		0.33***
R^2	0.584***	0.653***
ΔR^2		0.069***
F-value	27.17	30.96
Dependent variable:	SCM implementation	

Note: ***$p \leq 0.001$, **$p \leq 0.01$, and *$p \leq 0.05$

Figure 5.3(a) shows the residual plot of standardized residuals against standardized predicted values of idiosyncratic investments of Model 2, whereas Figure 5.3(b) shows the Normal probability plot of standardized residuals of idiosyncratic investments of Model 2. As examination of these plots does not indicate violation of the three assumption of multiple regression analysis, thus the regression results support Hypothesis 4e.



(a) (b)

Figure 5.3 Residual plot and Normal probability plot of standardized residuals of idiosyncratic investments (Model 2)

5.7 Testing of Hypotheses 5a-d

H5a: There is a positive association between inter-organizational competence trust and successful historical transactions.

H5b: There is a positive association between inter-organizational goodwill trust and relational norms shared by a buyer and a supplier.

H5c: Relational norms shared by a buyer and a supplier are less influential than successful historical transactions in predicting inter-organizational competence trust.

H5d: There is a positive association between inter-organizational goodwill trust and bilateral interactions (the frequency of interactions between members of a buyer and a supplier).

The effect of historical transactions and relational norms on competence trust (Hypotheses 5a,c) and the effect of relational norms and bilateral interactions on goodwill trust (Hypotheses 5b,d) were examined by zero-order correlation analysis and forward stepwise multiple regression analysis, with the threshold of the significance level of the F value for adding variables to the regression model set at

0.05. Table 5.12 shows that competence trust correlated significantly with historical transactions (r=0.54, p≤0.001), whereas goodwill trust correlated significantly with relational norms (r=0.48, p≤0.001) and bilateral interactions (r=0.38, p≤0.001), thus supporting Hypotheses 5a-b, and 5d.

Table 5.12 Correlations among competence trust, goodwill trust, and its predictors

Variables	1	2	3	4	5	6
1. Competence trust	1.00					
2. Goodwill trust	0.21*	1.00				
3. Relational norms	0.42**	0.48**	1.00			
4. Historical transactions	0.54**	0.33**	0.43**	1.00		
5. Bilateral interactions	0.21*	0.38**	0.42**	0.42**	1.00	
6. Reputations	0.29**	0.29**	0. 33**	0.51**	0.38**	1.00

Note: **p≤0.001 and *p≤0.05 (2-tailed)

The regression results presented in Table 5.13 indicate that the model achieves a significant F-value at p≤0.001, and that 33% of the variance in competence trust was explained by historical transactions (β=0.44, p≤0.001) and relational norms (β=0.22, p≤0.01).

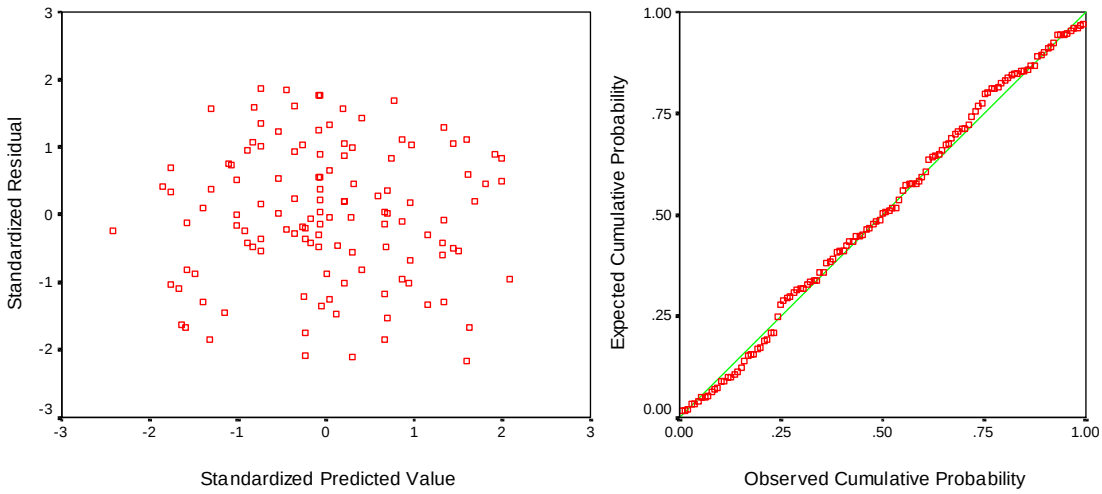
Table 5.13 Forward stepwise multiple regression predicting competence trust

Predictors	Standardized regression coefficient (β)	p-value	VIF
Historical transactions	0.44	0.000	1.23
Relational norms	0.22	0.008	1.23
Dependent variable:	Competence trust		
F-statistic (2,120):	29.56 (p≤0.001)		
Multiple R^2 (adjusted):	0.330 (0.319)		

The VIF values of all predictors are 1.23, indicating lack of substantial multicollinearity influence. Historical transactions were shown to be the most

influential predictor of competence trust, whereas relational norms were shown to be less influential, as indicated by the smaller weight of β. This is also indicated by their bivariate correlation coefficients (r=0.54 for historical transactions and r=0.42 for relational norms).

Figure 5.4(a) shows the residual plot of standardized residuals against standardized predicted values of competence trust. Figure 5.4(b) shows the Normal probability plot of the residuals of competence trust. Examination of both plots indicates that the three assumptions of multiple regression are met, thus the results support Hypothesis 5c. That is, the influence of historical transactions on competence trust is greater than that of relational norms on competence trust.



(a) (b)

Figure 5.4 Residual plot and Normal probability plot of standardized residuals of competence trust

5.8 Testing of Hypotheses 6a-b

H6a: The positive association between inter-organizational competence trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by successful historical transactions and relational norms.

H6b: The positive association between inter-organizational goodwill trust and diffusion of a buyer's and a supplier's good reputations in the industry is mediated by relational norms and the frequency of interactions between members of the buyer and the supplier.

The mediating effect of historical transactions and relational norms on the positive relationship between reputations and competence trust (Hypothesis 6a), and the mediating effect of bilateral interactions and relational norms on the positive relationship between reputations and goodwill trust (Hypothesis 6b) were examined by hierarchical multiple regression analysis. According to Baron and Kenny (1986, p.1176), "a given variable may be said to function as a mediator to the extent that it accounts for the relation between the predictor and the criterion". Testing of a mediation model (see Figure 5.5) involves the achievement of three conditions (Baron and Kenny 1986).

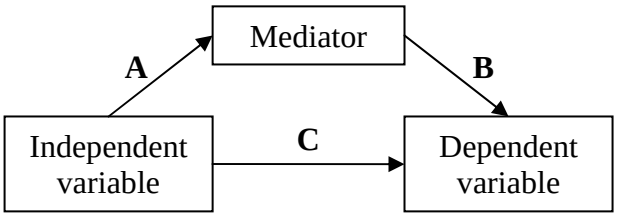


Figure 5.5 Mediation model

First, the independent variable must affect the mediating variable (path A). This is satisfied as reputations correlated significantly with relational norms, historical transactions, and bilateral interactions (r=0.33, 0.51, 0.38 at p≤0.001, respectively), as shown in Table 5.12. Second, the mediator(s) must affect the dependent variable (path B). This is also achieved as relational norms and historical transactions correlated significantly with competence trust (r=0.42 and 0.54 at p≤0.001, respectively), and relational norms and bilateral interactions correlated significantly with goodwill trust (r=0.48 and 0.38 at p≤0.001, respectively). Third,

when paths A and B are controlled, a previous significant relationship between the independent and dependent variables (path C) becomes insignificant. A single, dominant mediator or complete mediation is found when path C is reduced to zero, whereas partial mediation is indicated when the residual path C is not zero. To examine this mediating effect, hierarchical multiple regression analysis on two models was undertaken (cf. Saks et al. 1995). In the first model, independent variable was entered into the regression model first, which was followed by mediator, whereas in the second model, the order of entry of variables was reversed.

As shown in Table 5.14(a), reputations entered into the regression equation first, and then followed by historical transactions and relational norms (forward stepwise variable selection method was used in step 2) in Model 1. The results indicate that historical transactions and relational norms explained a significant amount of incremental variance in competence trust (ΔR^2=0.248, $p \leq 0.05$), when the variable of reputations was held constant. In addition, the β of reputations became non-significant at $p \leq 0.05$ in step 2.

Table 5.14(a) Hierarchical multiple regression predicting competence trust (Model 1)

	Model 1	
Predictors	Step 1 Standardized regression coefficient (β)	Step 2 Standardized regression coefficient (β)
1. Reputations	0.29***	-0.02
2. Historical transactions		0.45***
3. Relational norms		0.23**
R^2	0.082***	0.330***
ΔR^2		0.248*
F-value	10.83	19.56
Dependent variable:	Competence trust	

Note: ***$p \leq 0.001$, **$p \leq 0.01$, and *$p \leq 0.05$

As shown in Table 5.14(b), in Model 2, historical transactions and relational norms entered into the regression equation first (forward stepwise variable selection method was used in step 1). This was then followed by reputations. The results indicate that reputations did not explain additional variance in competence trust (ΔR^2=0.000, p>0.05), when historical transactions and relational norms were held constant. The β of reputations was also shown to be non-significant at p≤0.05 in step 2.

Table 5.14(b) Hierarchical multiple regression predicting competence trust (Model 2)

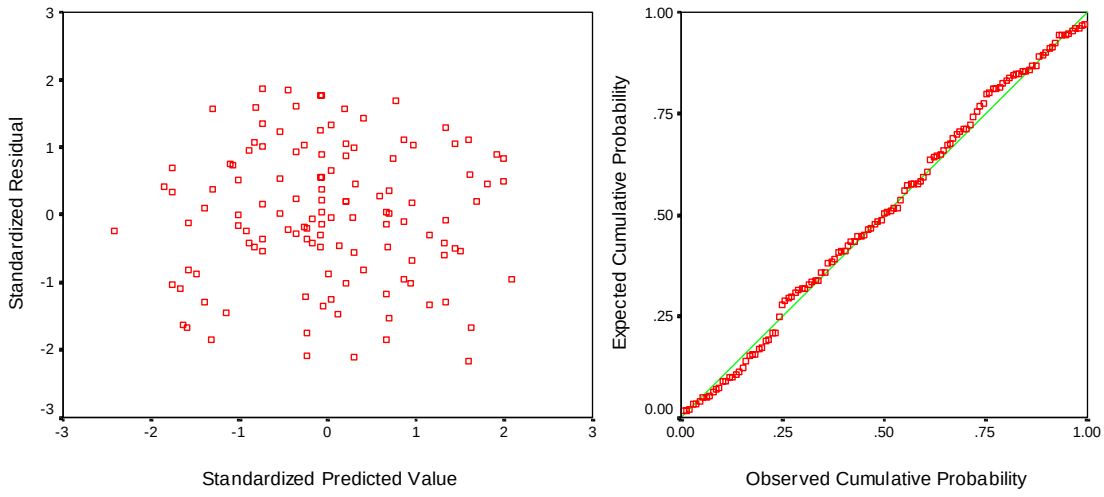
	Model 2	
	Step 1	Step 2
Predictors	Standardized regression coefficient (β)	Standardized regression coefficient (β)
1. Historical transactions	0.44***	0.45***
2. Relational norms	0.22**	0.23**
3. Reputations		-0.18
R^2	0.330***	0.330***
ΔR^2		0.000
F-value	29.56	19.56
Dependent variable:	Competence trust	

Note: ***p≤0.001, **p≤0.01, and *p≤0.05

These results give support for complete mediation, as no additional variance of competence trust was explained by reputations, when historical transactions and relational norms, together acting as a mediator, were controlled. However, when the variable of reputation was controlled, historical transactions and relational norms continued to explain significant additional variance in competence trust (i.e. 24.8%). Thus, historical transactions and relational norms were found to mediate the positive influence of reputations on competence trust (Hypothesis 6a).

The VIF values of historical transactions and relational norms were 1.23 in step 1 of Model 2 (i.e. competence trust was regressed on historical transactions and

relational norms), indicating the influence of multicollinearity on regression results was not substantial. Examination of the residual plot (Figure 5.6(a)) and Normal probability plot of standardized residuals of operations performance (Figure 5.6(b)) in step 1 of Model 2 indicates no violation of the three assumptions of multiple regression. Thus, these results support Hypothesis 6a.



(a) (b)

Figure 5.6 Residual plot and Normal probability plot of standardized residuals of competence trust (step 1 of Model 2)

To examine Hypothesis 6b (i.e. relational norms and bilateral interactions mediate the positive influence of reputations on goodwill trust), hierarchical multiple regression analysis on two models was undertaken. As shown in Table 5.15(a), reputations entered into the regression equation first, and then followed by bilateral interactions and relational norms (forward stepwise variable selection method was used in step 2) in Model 1. The results indicate that bilateral interactions and relational norms explained a significant amount of additional variance in goodwill trust (ΔR^2=0.191, $p \leq 0.05$), when the variable of reputations was held constant. The β of reputations also became non-significant at $p \leq 0.05$ in step 2.

Table 5.15(a) Hierarchical multiple regression predicting goodwill trust (Model 1)

	Model 1	
Predictors	Step 1 Standardized regression coefficient (β)	Step 2 Standardized regression coefficient (β)
1. Reputations	0.29***	0.10
2. Relational norms		0.36***
3. Bilateral interactions		0.19*
R^2	0.083***	0.274***
ΔR^2		0.191*
F-value	10.90	14.96
Dependent variable:	Goodwill trust	

Note: ***p≤0.001, **p≤0.01, and *p≤0.05

Table 5.15(b) shows that in Model 2, bilateral interactions and relational norms entered into the regression equation first (forward stepwise variable selection method was used in step 1), and reputations came the second. The results indicate that reputations did not explain significant additional variance in competence trust (ΔR^2=0.008, p>0.05), when bilateral interactions and relational norms were held constant. The β of reputations was also shown to be non-significant at p≤0.05 in step 2.

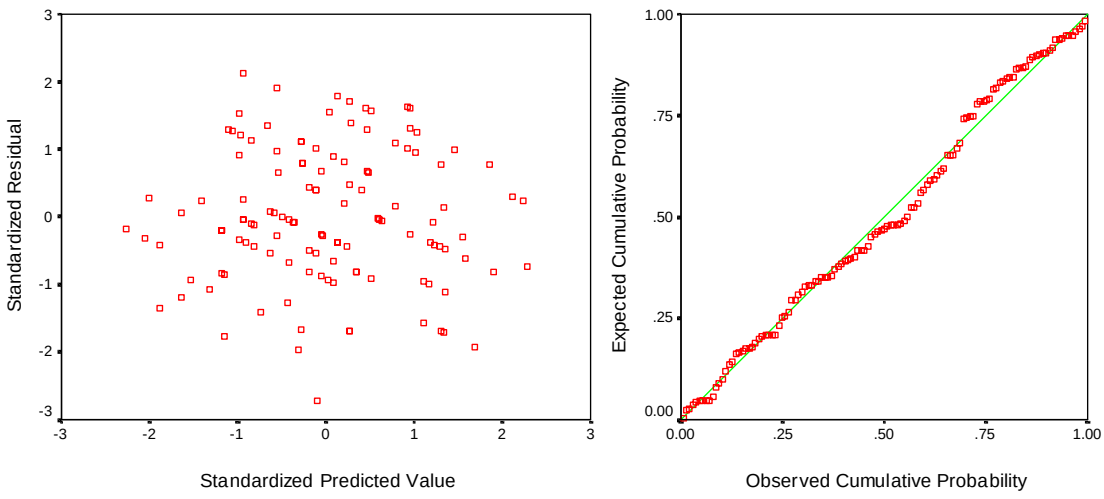
Table 5.15(b) Hierarchical multiple regression predicting goodwill trust (Model 2)

	Model 2	
Predictors	Step 1 Standardized regression coefficient (β)	Step 2 Standardized regression coefficient (β)
1. Relational norms	0.38***	0.36***
2. Bilateral interactions	0.22*	0.19*
3. Reputations		0.10
R^2	0.266***	0.274***
ΔR^2		0.008
F-value	21.76	14.96
Dependent variable:	Goodwill trust	

Note: ***p≤0.001, **p≤0.01, and *p≤0.05

These results give support for complete mediation, as no additional variance of goodwill trust was explained by reputations, when bilateral interactions and relational norms, together acting as a mediator, were controlled. However, when the variable of reputations was controlled, bilateral interactions and relational norms continued to explain significant additional variance in goodwill trust (i.e. 19.1%). Thus, bilateral interactions and relational norms were found to mediate the positive influence of reputations on goodwill trust (Hypothesis 6b).

The VIF values of bilateral interactions and relational norms were 1.22 in step 1 of Model 2 (i.e. goodwill trust was regressed on bilateral interactions and relational norms), indicating the influence of multicollinearity on regression results was not substantial. Examination of the residual plot (Figure 5.7(a)) and Normal probability plot of standardized residuals of operations performance (Figure 5.7(b)) in step 1 of Model 2 indicate no violation of the three assumptions of multiple regression. Thus, these results support Hypothesis 6b.



(a) (b)

Figure 5.7 Residual plot and Normal probability plot of standardized residuals of goodwill trust (step 1 of Model 2)

5.9 Testing of Hypotheses 7a-b

H7a: There is a positive association between SCM practices and operations performance improvement.

H7b: There is a positive association between operations performance and collective competitive advantage.

The hypothesis of the positive influence of SCM practices on operations performance (Hypothesis 7a) was examined by forward stepwise multiple regression analysis. Operations performance correlated significantly with five SCM practices, including product development and pre-production integration (r=0.78), purchasing and production integration (r=0.66), delivery and distribution integration (r=0.71), purchasing information sharing (r=0.66), and sales and inventory information sharing (r=0.60) at $p \leq 0.001$. This indicates all five SCM practices are potential contributors to operations performance.

Table 5.16 Forward stepwise multiple regression predicting operations performance

Predictors	Standardized regression coefficient (β)	p-value	VIF
1. Product development and pre-production integration	0.22	0.021	3.67
2. Delivery and distribution integration	0.30	0.000	2.09
3. Sales and inventory information sharing	0.19	0.004	1.81
4. Purchasing information sharing	0.20	0.003	1.89
5. Purchasing and production integration	0.16	0.031	2.16
Dependent variable:	Operations performance		
F-statistic (5,117):	62.63 ($p \leq 0.001$)		
Multiple R^2 (adjusted):	0.728 (0.716)		

Table 5.16 shows that the model achieved a significant F-value at $p \leq 0.001$. The five SCM practices together explained 72.8% of variance in operations performance, as product development and pre-production integration (β=0.22),

purchasing and production integration (β=0.16), delivery and distribution integration (β=0.30), sales and inventory information sharing (β=0.19), and purchasing information sharing (β=0.20) were shown to be significant predictors at p=0.031 or better.

However, examination of the extent of multicollinearity among the predictors shows that product development and pre-production integration had the highest VIF value of 3.67 (see Table 5.16). As Blaikie (2003, p.150) notes, "a VIF value of more than 2 indicates a close correlation". Examination of the bivariate correlations between product development and pre-production integration and the other four SCM practices (r ranged from 0.61-0.71, p≤0.001) also confirms their strong correlations (see Table 5.7 in p.129). Specifically, product development and pre-production integration correlated strongly with purchasing and production integration (r=0.71, VIF=2.16) and delivery and distribution integration (r=0.69, VIF=2.09). Further support is found, as product development and pre-production integration became the second influential predictor (judged by the β weight), when in fact it was the predictor with the highest bivariate correlation with the dependent variable (r=0.78).

This pattern of relationships indicates potential mediating effect of the four SCM practices (purchasing and production integration, delivery and distribution integration, sales and inventory information sharing, and purchasing information sharing) on the relationship between operations performance and product development and pre-production integration. That is, the observed positive influence of product development and pre-production integration on operations performance can be explained by a causal order in which product development and pre-production integration (independent variable) facilitates the functioning of the four SCM

practices (mediator), which in turn contribute to operations performance (dependent variable).

Examination of the mediation model was undertaken in three steps (Baron and Kenny 1986). First, the condition that independent variable must affect the mediating variable is satisfied, as product development and pre-production integration correlated significantly with the four SCM practices at $p \leq 0.001$. Second, the condition that mediating variable must affect the dependent variable is also achieved, as operations performance correlated significantly with the four SCM practices (r ranged from 0.60-0.71, $p \leq 0.001$). Third, to examine the mediating effect, hierarchical multiple regression analysis on two models was undertaken.

Table 5.17(a) Hierarchical multiple regression predicting operations performance (Model 1)

	Model 1	
Predictors	Step 1 Standardized regression coefficient (β)	Step 2 Standardized regression coefficient (β)
1. Product development and pre-production integration	0.78***	0.22*
2. Delivery and distribution integration		0.30***
3. Sales and inventory information sharing		0.19**
4. Purchasing information sharing		0.20**
5. Purchasing and production integration		0.16*
R^2	0.602***	0.728***
ΔR^2		0.126*
F-value	182.95	62.63
Dependent variable:	Operations performance	

Note: ***$p \leq 0.001$, **$p \leq 0.01$, and *$p \leq 0.05$

As shown in Table 5.17(a), product development and pre-production integration entered into the regression equation first, and then followed by the four

SCM practices (forward stepwise variable selection method was used in step 2) in Model 1. The results indicate that the four SCM practices explained a significant amount of incremental variance in operations performance (ΔR^2=0.126, $p \leq 0.05$), when product development and pre-production integration was held constant.

Table 5.17(b) show that in Model 2, the four SCM practices entered into the regression equation first (forward stepwise variable selection method was used in step 1). This was then followed by product development and pre-production integration. The results indicate that product development and pre-production integration explained a very small amount of additional variance in operations performance (ΔR^2=0.013, $p \leq 0.05$), when the four SCM practices as a set was held constant.

Table 5.17(b) Hierarchical multiple regression predicting operations performance (Model 2)

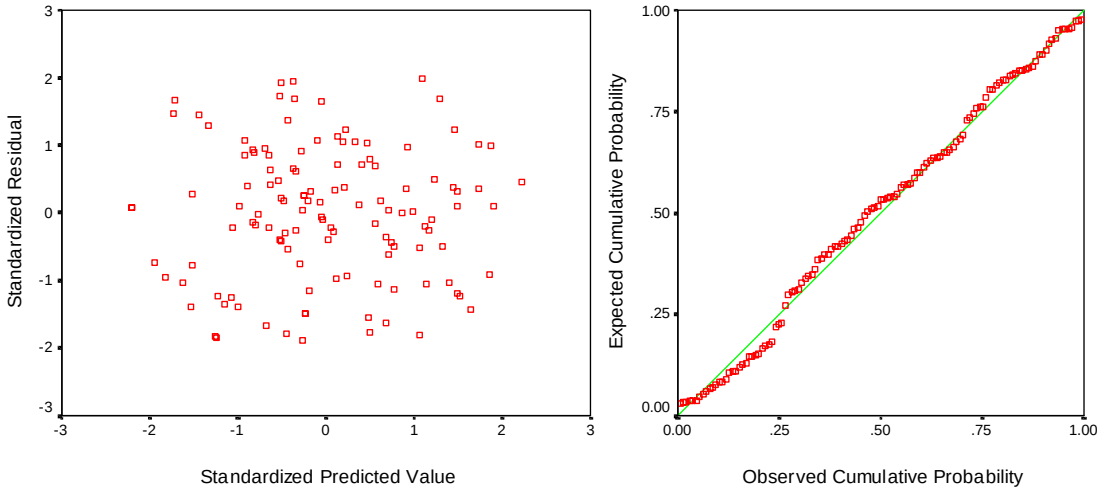
	Model 2	
Predictors	Step 1 Standardized regression coefficient (β)	Step 2 Standardized regression coefficient (β)
1. Delivery and distribution integration	0.37***	0.30***
2. Sales and inventory information sharing	0.25***	0.19**
3. Purchasing information sharing	0.24***	0.20**
4. Purchasing and production integration	0.23***	0.16*
5. Product development and pre-production integration		0.22*
R^2	0.715***	0.728***
ΔR^2		0.013*
F-value	74.09	62.63
Dependent variable:	Operations performance	

Note: ***$p \leq 0.001$, **$p \leq 0.01$, and *$p \leq 0.05$

These results give support for partial mediation, as additional variance of operations performance explained by product development and pre-production integration (i.e. 1.3%) was negligible, when the four SCM practices, acting as a mediator, were controlled.

However, when product development and pre-production integration was controlled, the four SCM practices continued to explain significant additional variance in operations performance (i.e. 12.6%). Thus, the four SCM practices, including purchasing information sharing, sales and inventory information sharing, purchasing and production integration, and delivery and distribution integration, were found to mediate a large part of the positive influence of product development and pre-production integration on operations performance.

The VIF values of the four mediators ranged from 1.56-1.77 in step 1 of Model 2 (i.e. operations performance was regressed on the four SCM practices), indicating the influence of multicollinearity on regression results was not substantial.



(a) (b)

Figure 5.8 Residual plot and Normal probability plot of standardized residuals of operations performance (step 1 of Model 2)

Examination of the residual plot (Figure 5.8(a)) and Normal probability plot of standardized residuals of operations performance (Figure 5.8(b)) in step 1 of Model 2 indicate no violation of the three assumptions of multiple regression. Thus, these results support Hypothesis 7a.

Operations performance correlated strongly with collective competitive advantage ($r=0.64$, $p \leq 0.001$), thus Hypothesis 7b was supported.

5.10 Summary

This Chapter presents the analyses and findings of the study. The results indicate that the sample was a fair representation of the population, and the sample size was adequate. Evidence of early and late response bias and common method bias, as well as non-normality and non-linearity of relationships between variables was not found. All measures of the variables were shown to possess good psychometric properties including convergent and discriminant validity and reliability (internal consistency). For the measures of SCM practices, five factors including (1) product development and pre-production integration, (2) purchasing and production integration, (3) delivery and distribution integration, (4) purchasing information sharing, and (5) sales and inventory information sharing, were identified from a factor analysis of 24 SCM practices. Having established the psychometric properties of all measures, hypotheses were tested by correlation analysis and multiple regression analysis.

A summary of research findings is presented in Table 5.18. Support for the theoretical SCM model was found, as all seven sets of hypotheses were confirmed, except Hypotheses 3e-f (i.e. the more a buyer and a supplier perceive each other's

competitive capabilities to be tacit and complex, the more extensive idiosyncratic investments are made by them).

Table 5.18 A summary of research findings

Hypothesis	Relationship	Result
1a	Positive associations between integration of product development and pre-production, purchasing and production, and delivery and distribution processes.	Supported
1b	Positive associations between sharing of product information, purchasing information, and sales and inventory information between buyers and suppliers through electronic means.	Supported
1c	Positive associations between process integration and information sharing.	Supported
1d	Positive associations between SCM practices and idiosyncratic investments.	Supported
2a	Positive association between SCM implementation and demand uncertainty.	Supported
2b	Positive association between idiosyncratic investments and demand uncertainty.	Supported
3a	Positive association between complementary competitive capabilities and SCM implementation.	Supported
3b	Positive association between complementary competitive capabilities and idiosyncratic investments.	Supported
3c	Positive association between tacit competitive capabilities and SCM implementation.	Supported
3d	Positive association between complex competitive capabilities and SCM implementation.	Supported
3e	Positive association between tacit competitive capabilities and idiosyncratic investments.	Not supported
3f	Positive association between complex competitive capabilities and idiosyncratic investments.	Not supported
4a	Positive association between inter-organizational competence trust and SCM implementation.	Supported
4b	Positive association between inter-organizational goodwill trust and SCM implementation.	Supported
4c	Positive association between inter-organizational competence trust and idiosyncratic investments.	Supported
4d	Positive association between inter-organizational goodwill trust and idiosyncratic investments.	Supported
4e	Idiosyncratic investments provide explanatory power in SCM implementation over and above that attributable to the six contextual factors.	Supported

Table 5.18 (cont.) A summary of research findings

Hypothesis	Relationship	Result
5a	Positive association between inter-organizational competence trust and successful historical transactions.	Supported
5b	Positive association between inter-organizational goodwill trust and relational norms.	Supported
5c	Relational norms are less influential than successful historical transactions in predicting inter-organizational competence trust.	Supported
5d	Positive association between inter-organizational goodwill trust and bilateral interactions.	Supported
6a	Positive association between inter-organizational competence trust and reputations is mediated by successful historical transactions and relational norms.	Supported
6b	Positive association between inter-organizational goodwill trust and reputations is mediated by relational norms and bilateral interactions.	Supported
7a	Positive association between SCM practices and operations performance improvement.	Supported
7b	Positive association between operations performance and collective competitive advantage.	Supported

As expected, the results show that all five sets of SCM practices contribute to operations performance, which in turn confers collective competitive advantage. All of six contextual factors including demand uncertainty, complementary, tacit, and complex competitive capabilities, inter-organizational competence and goodwill trust influence SCM implementation. Also, four of these contextual factors affect idiosyncratic investments made by the buyers and suppliers. In addition, the results show that the influence of the buyers' and suppliers' reputations in the industry on inter-organizational competence and goodwill trust is mediated by historical transactions, bilateral interactions, and relational norms. Discussion of the findings is presented in Chapter Six.

Chapter 6 : Discussion

Based on a context-practices-performance framework, this study proposed a theoretical model that hypothesized that (1) SCM implementation encompassed the practice of information sharing and process integration between partner firms; (2) environmental, strategic and social factors influenced SCM implementation; and (3) SCM implementation improved operations performance and conferred collective competitive advantage. The empirical evidence obtained in the Hong Kong clothing industry provided support for this model.

6.1 SCM practices and idiosyncratic investments

The result of factor analysis on the 24 items developed to measure SCM practices shows that SCM implementation encompasses five different but related practices, including (1) integration of purchasing and production processes, (2) integration of delivery and distribution processes, (3) sharing of purchasing information, (4) sharing of sales and inventory information, and (5) a practice that combines sharing of product information and integration of product development and pre-production processes (this practice is labeled as integration of product development and pre-production processes).

The zero-order correlation analysis of these five SCM practices shows that the hypotheses of the positive relationships among process integration variables (H1a), among information sharing variables (H1b), and between information sharing and process integration variables (H1c) are supported.

The results of factor analysis and correlation analysis corroborate the predominant approach to SCM research in the literature of SCM, QR, IT, and new product development. Firstly, the results substantiate the process-based view of SCM (Hammer 2001, Lambert et al. 1998) and the notion of 'information enriched' supply chain (Mason-Jones and Towill 1999). Specifically, the strong interdependence among the practices of information sharing and process integration supports the notion that SCM implementation involves (1) sharing of product, purchasing, and sales and inventory information, and (2) integration of product development and pre-production, purchasing and production, and delivery and distribution processes between buyers and suppliers. This finding echoes the thesis that open communication and information sharing and a high level of transparency in ordering, inventory and transportation are essential for cross-functional and cross-enterprise integration in SCM (Gunasekaran and Ngai 2004a). This is because the key enabler for tight coordination between buyers and suppliers in a supply chain is sharing of important information (such as inventory, sales, demand forecast, order status, and production schedule), which has been greatly facilitated by advanced IT applications (Lee and Whang 2000).

Secondly, these results support a complementary view of QR and SCM in the clothing industry (Kincade et al. 2000, Lee and Kincade 2003). That is, the application of core QR technologies including barcoding, EDI, and CAD, among others, facilitates the integration of key inter-organizational business processes, which is a core SCM principle. This complementary view has expanded the prime focus of past QR studies in the clothing industry (e.g. Kincade et al. 2001, Ko et al. 2000, Sullivan and Kang 1999) on the application of IT to improve operations performance to a focus on using IT to integrate key business processes between

clothing buyers and suppliers, which improves usage and flow of information and product, and adds more value for customers.

Thirdly, the result of factor analysis indicates a close relationship between sharing of digitized product information and suppliers' participation in product development, as the items developed to measure these two variables were found to form a factor of SCM implementation. This supports the prevalent view of considering IT as a key enabler of SCM (see a literature review of the role of IT in SCM by Gunasekaran and Ngai 2004b). More importantly, the finding indicates that using computer system, such as CAD, as a tool to share information between clothing buyers and suppliers *per se* is insufficient to improve product development, as it requires extensive interactions and joint efforts of all parties involved in the product development and pre-production processes that span multiple functions and organizations to co-develop products effectively. This illustrates that better management of the clothing supply chain depends not only on applying IT to share information efficiently, as this has been stressed in QR literature, but more importantly on the joint efforts of clothing buyers and suppliers in using information effectively to coordinate and execute key business processes.

Fourthly, the close relationship between the exchange of digitized product information and suppliers' participation in product development also indicates that the practice of supplier involvement in product development does not limit to automobile or electronic industries in which product complexity is generally high, as depicted in new product development literature. In addition, this finding shows that competent offshore clothing suppliers can play an active role in product development, although in QR literature they are considered to be specialized in manufacturing only.

In fact, as shown in this study, offshore clothing suppliers are able to contribute to new product development in several ways. Firstly, they can provide advice to clothing designers on the adoption of standard components and accessories (e.g. buttons and zippers), which could reduce the costs and lead time of sourcing materials as well as provide a more reliable supply of materials. Secondly, clothing suppliers can advise clothing designers on product simplification, which involves reduction of product structure complexity and removal of unnecessary features or components, while satisfying essential aesthetic requirements. Thirdly, clothing suppliers and designers can jointly develop precise and rigorous product specifications, which serve as a good basis for materials sourcing, manufacturing, and quality tests. Finally, clothing suppliers can prepare samples timely and reliably, which could shorten the design-prototype-test cycle in the process of developing new products.

In addition to the factor analysis result, an examination of the correlations among all SCM practices shows that the integration of product development and pre-production processes has the strongest positive relationships with the integration of purchasing and production processes and the integration of delivery and distribution processes. This clearly indicates the importance of developing the right product at the beginning, as it affects the planning and execution of downstream processes significantly. Consistent with the contemporary approach to new product development (De Toni and Nassimbeni 2001), the importance of suppliers' co-design effort in managing the clothing supply chain is highlighted.

As expected, the support of Hypothesis 1d indicates that the application of all five SCM practices involves idiosyncratic investments committed by both clothing buyers and suppliers in specialized equipment and facilities, skilled human resources,

and developing and implementing specialized operating processes that are dedicated to their transactions. This suggests that clothing buyers and suppliers in Hong Kong do not view SCM as merely another management fad nor pay lip service to the implementation of SCM practices.

6.2 Antecedents of SCM implementation

The support of Hypotheses 2a, 3a, 3c-d and 4a-b indicates that all six antecedents including environmental, strategic and social factors facilitate SCM implementation. Specifically, among these antecedents, inter-organizational goodwill trust, demand uncertainty, and complementary competitive capabilities are shown to be the three most influential predictors. This supports three sets of explanations of the need, incentive, and opportunity for clothing buyers and suppliers to collaborate and implement SCM from several different theoretical perspectives.

6.2.1 Environmental factor

The support of the positive impact of demand uncertainty on SCM implementation in this study indicates that environmental pressure (manifested itself as demand uncertainty) drives the need for firms providing apparels that have high fashion elements and seasonal demand to better manage the clothing supply chain in order to match demand and supply more effectively. This result corroborates Kincade et al.'s (2001) finding that implementation of QR technology could contribute to improved management of the clothing supply chain for firms providing innovative products.

The result indicates that high demand uncertainty can be coped with process integration and information sharing that span the stage of product development to

product delivery and distribution. To this end, clothing buyers need to incorporate suppliers early in the product development process, so that the new product development process can be improved through the adoption of standard components and accessories; simplification of product design; development of accurate product specifications; and rapid sample preparation.

In addition, clothing buyers need to collect and analyze POS data quickly in order to determine sales and inventory at SKU level, and update the demand forecast and purchase order accordingly. Such information together with product information need to be transferred to clothing suppliers immediately via electronic means like EDI or web-based technology, so that suppliers can make use of the updated information and apply bar coding technology and new methods of distribution (i.e. cross-docking or direct-store shipment) to plan their production schedule, coordinate with their suppliers for raw materials supply, and deliver the ordered products quickly to the buyers. In this way, efficient product flow could be achieved through better management of the clothing supply chain.

More generally, the result of this study is consistent with that of Ramdas and Spekman's (2000) survey study of 22 extended supply chains from North America, South America, and Europe across six broad industry groups (life sciences, oil and gas, consumer products, agricultural and food processing, utilities, and manufacturing—high tech electronics and automotive) that reported firms in innovative-product supply chains applied integrative information practices in planning, production and control more than their counterparts in functional-product supply chains. It appears that the need for buyer-supplier collaboration and effective management and integration of key business processes in innovative-product supply chains is heightened across industries and national boundaries.

6.2.2 Strategic factors

Recognizing the need to collaborate and implement SCM in order to manage demand uncertainty does not necessarily imply that all firms are able to apply this strategy successfully, as firms are heterogeneous in terms of their resource base, and thus affecting the strategic value of the resources they contribute to a strategic alliance and their attractiveness to other firms. Consistent with the resource-based view of strategic alliances (Das and Teng 2000), in this study complementary competitive capabilities are shown to be the most important strategic factor in explaining SCM implementation.

Although Das and Teng (2000, p.49) argue that it is important to assess "the degree to which the resources contributed by the partners are utilized for achieving the goals of the alliance" when judging the alignment of partner resources, past empirical studies tended to use some general and broad-brush indicators of partner resource alignment and overlook the specific goals to be achieved by the alliance (e.g. Jap 1999). To address this deficiency, this study explicitly operationalized the fit between partner resources with reference to the potential of complementary competitive capabilities to achieve shared goals in improving product innovation flexibility, quality, delivery, and costs/prices, which has been the focus of operations strategy literature.

The finding shows that buyers and suppliers have strong incentive to collaborate and implement SCM if they perceive each party has complementary competitive capabilities that help to achieve these four competitive goals. This provides support for the notion that a firm is able to access its most wanted resources that are controlled or owned by its supplier or buyer, without acquisition of resources from the owner or development of these resources by itself, as the firm can leverage

these resources through a collaborative arrangement with the resource owner in the form of strategic alliance (i.e. a strategic buyer-supplier partnership in the current case) (Das and Teng 2000, Dyer and Singh 1998). As such, the possession of complementary competitive capabilities becomes an important criterion in selecting partners to implement SCM.

The finding also indicates that the perceived tacitness and to a lesser extent perceived complexity of complementary competitive capabilities influence SCM implementation. This highlights the central role played by the "causally ambiguous" nature of knowledge (Reed and DeFillippi, 1990) as a key criterion in evaluating the strategic value of partners' complementary competitive capabilities. Specifically, the attractiveness of a firm in the formation of collaborative arrangement and consequently implementation of SCM depends partly on the tacitness and complexity of its competitive capabilities, as capabilities that are difficult to codify and are the product of many interdependent techniques, routines, individuals, and resources create barriers to imitation, and thus providing potential sources of competitive advantages. This suggests that firms willing to share their own competitive capabilities are likely to demand complementary competitive capabilities that are tacit and complex from their partners.

6.2.3 Social factors

Having identified an appropriate partner who possesses complementary competitive capabilities does not necessarily ensure a successful implementation of SCM, because having a strong desire to utilize a potential partner's competitive capabilities is one thing, whereas being able to create a collaborative relationship is quite another thing. Consistent with social network perspective on strategic alliances

(Gulati 1998) and social embeddedness of firm behavior (Granovetter 1985), the finding of this study demonstrates that possession of social resources greatly promotes buyers and suppliers to collaborate and implement SCM. Specifically, inter-organizational goodwill trust and to a lesser extent competence trust provide opportunities to buyers and suppliers with regard to collective action, as these social resources can be utilized to manage and reduce both relational risk and performance risk inherent in a strategic alliance (Das and Teng 2001). In other words, buyers and suppliers can effectively operate as a collective because members of these partner firms believe that each party is able to perform effectively and reliably and more importantly to act in other's best interests when facing opportunities to abuse trust.

Although past empirical SCM studies have repeatedly stressed the importance of building mutual trust in trading partners, most of these studies did not explicitly distinguish the various forms of trust conceptually (e.g. Mentzer et al. 2000) nor examined the impact of various forms of trust on SCM empirically (e.g. Handfield and Bechtel 2002, Monczka et al. 1998). The finding of this study has provided insight into the relative importance of two forms of inter-organizational trust in promoting SCM implementation. Specifically, inter-organizational competence trust lays the foundation for buyers and suppliers to collaborate, but the implementation of SCM to its full extent could not be achieved unless inter-organizational goodwill trust is present.

This is evident for an advanced level of integration in the clothing supply chain. For example, sensitive information of sales and inventory is shared between a clothing buyer and its supplier for an integrated purchasing and production planning. Given that the clothing supplier may supply products to multiple customers at one time, the buyer is reluctant to pass such sensitive information to the supplier if an

adequate level of goodwill trust is not established for the fear of leakage of the buyer's commercial secret to competitors when such opportunities arise, even though competence trust is well established between both parties. Furthermore, in an effort to respond more effectively to a high level of demand uncertainty by fulfilling a blanket order, the clothing supplier will provide the buyer with privileged access to its production resources and will reserve production capacity of upstream suppliers in advance, even though the details of the purchase order are yet to finalize by the buyer. Indeed, this SCM practice cannot be applied effectively if the clothing supplier is uncertain about whether the buyer truly collaborates with it to jointly exploiting developing marketing opportunities or just simply want to pass the risk of demand uncertainty to it. Neither can this practice work if the buyer is uncertain whether the supplier truly acts in its interests or just pays lip service to its demand. Again, inter-organizational goodwill trust is vital in this situation to enhance the buyer's and the supplier's confidence of the other's motives. As such, successful SCM implementation depends not only on the level of inter-organizational trust, as has been stressed in prior studies, but more importantly on the differential effects of various forms of inter-organizational trust.

6.3 Idiosyncratic investments and SCM implementation

The support of Hypotheses 2b, 3b and 4c-e indicates that demand uncertainty, complementary capabilities, inter-organizational competence trust and goodwill trust promote bilateral idiosyncratic investments, which also facilitate SCM implementation. Consistent with Jap's (1999) result, this finding demonstrates that demand uncertainty motivates buyers and suppliers to commit investments in

transaction-specific assets that are necessary to support the need for efficient and effective coordination.

In addition, the incentive for a clothing buyer and its supplier to make idiosyncratic investments is strong when they perceive that each party possesses complementary competitive capabilities, and that when such capabilities are combined the benefits resulted from productivity improvement are far greater than the costs incurred. The finding also shows that the perceived tacitness and complexity of complementary competitive capabilities do not form an important concern in making idiosyncratic investments, as Hypotheses 3e-f are not supported. This may suggest that the potential performance improvement achieved from such investments, which is unattainable to competing dyads applying general purpose assets in arm's-length exchanges, has already provided sufficient incentive for partner firms to invest in transaction-specific assets as long as both parties' competitive capabilities are complementary.

Furthermore, as idiosyncratic investments have little or no value outside a particular exchange relationship and therefore involve a substantial amount of risk, a clothing buyer and its supplier are likely to commit in such investments only if they believe that each party will perform as expected and will develop a long term mutually beneficial business relationship. As such, the role played by inter-organizational competence trust and goodwill trust in enabling idiosyncratic investments is important.

In addition to the environmental, strategic and social factors, idiosyncratic investments are also shown to be influential in explaining SCM implementation. This clearly indicates that the potential benefits from investing in transaction-specific

assets can be realized only if these assets are applied extensively by the partner firms to facilitate information sharing and process integration.

6.4 Bases of inter-organizational trust

The support of Hypotheses 5a-d indicates that there are different bases on which two forms of inter-organizational trust are developed. Although McAllister (1995) found no support for the hypothesized positive relationship between successful historical performance and cognition-based trust, the finding of this study demonstrates that successful historical transactions promote inter-organization competence trust. That is, positive information about the partner's trustworthy behavior in past transactions provides each party confidence that its partner can be trusted now. Consistent with prior studies (e.g. Aulakh et al. 1996, Das and Teng 1998), relational norms provide a solid base for inter-organizational goodwill trust to grow. As expected, when compared with successful historical transactions, relational norms are less influential in developing inter-organizational competence trust. This highlights the distinctive nature of competence trust which is associated more with tasks and task-related performance, whereas goodwill trust is more related to people and their internal motives. Such a difference is further demonstrated in the finding that when the members of a clothing buyer and its supplier frequently initiate formal and more importantly informal work-related interactions, they are likely to develop inter-organizational goodwill trust. This supports Lewis and Weigert's (1985) view and corroborates McAllister's (1995) finding that frequent interaction allows members of each party to gather sufficient social data to increase their confidence in making attributions concerning the motives for others' behavior.

6.5 Embeddedness effects on inter-organizational trust

The support of Hypotheses 6a-b provides an important insight into the relationship between network embeddedness and relational embeddedness on the development of inter-organizational trust. Specifically, the support for a complete mediating model indicates that extensive diffusion of positive third-party information concerning a clothing buyer's reputation and its supplier's reputation in the industry promotes the establishment of inter-organizational trust. However, this effect is an indirect one. That is, partner firms' positive reputations in the industry facilitate both parties to achieve successful transactions, develop relational norms, and initiate formal and informal interactions, which in turn elicit inter-organizational trust. This finding suggests that the roles relational and network embeddedness play in the development of inter-organizational trust can only be understood with reference to the other.

Past studies tended to examine the effect of relational and network embeddedness on inter-organizational trust independently. For example, Ganesan (1994) in a study of retailer-vendor relationship hypothesized that a firm's reputation in the industry promoted its partner to develop competence trust, but such reputation did not work for goodwill trust, which could be realized only through actual interaction, not word-of-mouth. Based on the findings that there was no support for the positive relationship between reputations and goodwill trust and that there was mixed support for reputation's positive impact on competence trust (i.e. vendor's reputation had a significant effect on retailer's perceived credibility of the vendor but retailer's reputation did not have any effect on vendor's perceived credibility of the retailer), Ganesan (1994, p.14) suggested that:

> Retailers and vendors could be influenced by a different set of cues regarding the trustworthiness of their partners. Retailers could rely on external cues, such as reputation for fairness in the marketplace, whereas vendors could rely more on internal cues, such as actual interaction with the retailers.

In contrast to Ganesan's (1994) study, the finding of this study highlights the need and the importance to examine how external and internal cues interact and how such interactions jointly influence trust development. It demonstrates that both buyers and suppliers do not establish inter-organizational trust simply based on each party's reputation in the industry. Rather, positive reputations provide a solid base on which both parties send, collect and interpret signals concerning the credibility and benevolence of each party through their actual bilateral interactions. It is possible that a clothing buyer and its supplier fail to develop inter-organizational trust at last, even though both parties have positive, initial perceptions of each other's reputation in the industry. Here, the keys lie in whether over time a good track record of transactions is established, relational norms are developed, and a deep mutual understanding is formed through frequent formal and informal social interactions. However, this does not suggest that only internal cues matter. Rather, external cues in the network inform the development of internal cues in the dyad, and inter-organizational trust grows when the consistency of the cues is revealed.

Looking at the finding from a social network perspective, it seems that the more diffused positive third-party information about a firm in a network (as such information is reflected by the firm's good reputation ascribed by others in the industry on the basis of its past actions in this case), the more opportunities the firm enjoys to develop social resources (e.g. inter-organizational trust) with a potential partner in the dyad quickly through mobilizing and utilizing its social resources that are embedded in the network (e.g. reputation in the industry).

6.6 Performance consequences of SCM implementation

The support of Hypotheses 7a-b indicates that SCM implementation leads to positive performance consequences. The finding shows that each of five SCM practices contributes to operations performance improvements. More importantly, as indicated in the partial mediation model, integration of product development and pre-production processes facilitates the other four SCM practices including purchasing information sharing, sales and inventory information sharing, purchasing and production integration, and delivery and distribution integration. These four SCM practices collectively contribute to operations performance improvement, which in turn confers collective competitive advantage.

The important role played by integration of a buyer's product development and its supplier's pre-production processes in supporting other SCM practices and improving operations performance is evident in this study. This result corroborates Uzzi's (1997) qualitative finding of transferring fine-grained information between partner firms and solving problems jointly by partners to improve operations performance. In his ethnographic study of the New York apparel industry, Uzzi (1997, p.46) reported the experience of a designer in reducing errors and time to bring products to market:

> If we have a factory that is used to making our stuff, they know how it's supposed to look. They know a particular style. It is not always easy to make a garment just from the pattern. Especially if we rushed the pattern. But a factory that we have a relationship with will see the problem when the garment starts to go together. They will know how to work the fabric to make it look the way we intended. A factory that is new will just go ahead and make it. They won't know any better.

Indeed, a supplier's participation in product development involves the transfer of information that is more tacit and proprietary than the price and quantity data that are traded in arm's-length ties. Consistent with new product development

literature (De Toni and Nassimbeni 2001), such information exchanged between partner firms is important to facilitate subsequent SCM practices, ranging from purchasing to production and distribution, which in turn improve operations performance.

Relatedly, similar to the results reported by Shah et al. (2002), higher operations performance can be achieved if process integration between partner firms is supported by appropriate inter-organizational IT applications to share information.

The finding also supports the relational view of competitive advantage that an important source of collective competitive advantage is "the combining of complementary, but scarce, resources or capabilities (typically through multiple functional interfaces), which results in the joint creation of unique new products, services, or technologies" (Dyer and Singh 1998, p.662). More importantly, the application of SCM practices is an important means to exploit partners' competitive capabilities in an effort to improve operations performance and achieve collective competitive edge.

6.7 Summary

This Chapter presents the discussion of the findings. The empirical results obtained in the Hong Kong clothing industry have provided support for the proposed SCM model. Several major theses concerning the components, antecedents, and performance consequences of SCM are indicated:

SCM in the industrial setting of clothing buyers and suppliers in Hong Kong involves the practice of integrating product development and pre-production processes, purchasing and production processes, and delivery and distribution processes, as well as sharing of product, purchasing, and sales and inventory

information. These practices of process integration and information sharing together form a set of integrated SCM practices.

The implementation of SCM practices involves idiosyncratic investments committed by both clothing buyers and suppliers in specialized equipment and facilities, skilled human resources, and developing and undertaking specialized operating processes that are dedicated to their transactions.

Demand uncertainty creates a need for clothing buyers and suppliers to implement SCM, whereas complementary competitive capabilities provide an incentive for clothing buyers and suppliers to apply SCM practices, and inter-organizational goodwill trust provides an opportunity for them to collaborate and implement SCM.

The reputations of a buyer and a supplier in the clothing industry provide a basis for both parties to achieve successful transactions, develop relational norms, and initiate formal and informal interactions, which in turn promote inter-organizational trust.

Successful integration of product development and pre-production processes facilitates other SCM practices, which collectively improve operations performance, and consequently confer collective competitive advantage.

Chapter 7 : Conclusions

This final Chapter presents the limitations of the study, and the implications of findings for future research and management. The main conclusions derived from the empirical results are presented in the final Section.

7.1 Limitations and implications for future research

The present results should be interpreted in light of the study's limitations. This study dealt with only one industry and was cross-sectional in nature, thus generalizing the results to other industries and drawing a definitive conclusion on the causal relationships between contextual factors, SCM practices and performance should be done with caution. Additional research on the proposed model of SCM should be expanded to other manufacturing (e.g. textile and footwear industries) and service industries (e.g. grocery industry), and should be done longitudinally in order to assess the impact of time.

In further study, the effect of company size of both suppliers and buyers on SCM implementation should be examined, as the financial and human resources that can be allocated to the investment of transaction specific assets tend to vary with company size. A positive relationship between company size and SCM implementation may be anticipated, as both large suppliers and buyers can mobilize their resources to establish the required transaction specific assets when they apply SCM practices jointly.

However, this does not imply that smaller companies can never implement SCM with success. The recent development of information and communication

technologies has dramatically reduced the cost of applying sophisticated hardware and software to share business information between suppliers and buyers. In parallel, the rapid development of electronic commerce has made the establishment of inter-organizational electronic connections increasingly feasible and affordable for small- and medium-sized enterprises in the Hong Kong clothing industry (Au and Ho 2002b). Through these electronic linkages, business processes can be integrated more swiftly and information can be shared more quickly between suppliers and buyers than before. If these trends continue to develop, SCM implementation would spread from large to small companies quickly. In that the positive impact of company size on SCM implementation may not be as strong as it was thought.

Furthermore, it is interesting to examine the effect of the businesses supply chain members are involved in (e.g. manufacturing, trading, and retailing) on SCM implementation. It is expected that some SCM practices may be applied more extensively by certain parties in a clothing supply chain. For example, if a trading company sources some basic, staple garments designed originally by a manufacturer, the incentive for the trading company and the manufacturer to integrate product development and pre-production processes may be minimal. In contrast, in a case where a retailer, who has no production facilities, designs its branded fashion garments and subcontracts the production to a manufacturer, both of them would want to integrate product development and pre-production processes, as the room for improving operations performance is large.

Although the emphasis on different SCM practices may vary, the practice of sharing business information especially Point-of-Sales data and sales forecast by all partner firms regardless of their positions in the supply chain would be expected, if good operations performance is to be achieved. This is because sharing such

information is very useful in addressing the problem of demand distortion (the well-known “bullwhip effect”) throughout a supply chain and consequently improving the responsiveness of the supply chain (Lee et al. 1997).

The results of this study are built on the data collected from one side of the partnership dyad. Given that some variables examined reflect the bilateral characteristics of both buyers and suppliers, data collected only from one partner may not fully indicate the bilateral properties. Thus, interpretation of the findings should keep this limitation in mind. Although the difficulty in collecting dyadic responses (e.g. firms are unwilling to identify their partners for confidential reasons) is acknowledged in the literature, future research should examine the model with data collected from both buyers and suppliers. By doing so, a more complete picture can be obtained.

Despite these limitations, this study contributes to research of SCM in several ways. Firstly, it has been noted in this study that applying a process-based view to examine SCM expands the focus on technologies in past QR studies and transcends the conventional approach to study SCM that focuses narrowly on either purchasing or logistics function. Indeed, the construct of SCM should be further refined and operationalized in order to reflect this perspective. In particular, more research is needed to identify the key business processes that span functional and organizational boundaries in various stages of a supply chain and in different industrial settings.

Secondly, this study provides insights into the impact of IT innovations especially the Internet on the organizational structure of a clothing supply chain. Recently, there is a thesis that with the widespread of electronic procurement (i.e. procurement of industrial goods through exchanges in electronic markets), firms can form and reform business relationships instantly, which drives a total disintegration

of supply chains, where long-lasting and close linkages of trading partners fall apart. This deconstruction view is exemplified by some recent discussions about the influence of the Internet on business operations. For example, Evans and Wurster (2000) observe that the recent advancement and deployment of IT, signified by the notable explosion of connectivity combined with the growing adoption of common information standards, are driving the disintegration of organizations and supply chains as well as challenging conventional sources of competitive advantage. Specifically, Evans and Wurster (2000, p.37) argue:

> When everyone can exchange rich information without constraints on reach, the channel choices for marketers, the inefficiencies of consumer search, the hierarchical structure of supply chains, the organizational pyramid, asymmetries of information, and the boundaries of the corporation itself will all be thrown into question. The competitive advantages that depended on them will be challenged. The business structures that had been shaped by them will fall apart.

Cronin (2000, p.23) considers that in this transformation process:

> The competitive landscape now favors those firms with dynamic and flexible networks of relationships and 'just-in-time' infrastructure access that can scale to meet surges in demand from millions of global customers.

Koulopoulos and Palmer (2001, p.xvii) also reflect the emphasis on the temporary nature of business relationships and on liquidity of supply chain structure in their analogy of the new exchange economy, which is described as:

> A molecular economy of infinitely malleable and instantly responsive enterprises. This ability to rapidly form and reform the bonds that tie businesses together is not unlike the analogy of relationships among the basic process of any chemical interaction.

The finding of this study is converse to the thesis of this deconstruction view. Looking at the finding from a resource-based perspective, it is suggested that some critical resources that a firm needs to create value may span its organizational

boundaries, and the need for resources motivates the firm to engage in collaborative arrangements with other firms in order to share and utilize the required resources. Although some of these resources can be obtained through market exchange, arm's-length market relationships fail to generate any competitive advantage for the allied firms because such relationships are neither rare nor difficult to imitate (Dyer and Singh 1998). Despite the fact that market efficiency is greatly enhanced with IT innovations, business relationships established in electronic markets do not differ qualitatively from those formed in physical markets and, therefore, both have low strategic value. Nevertheless, electronic markets are of high value in accessing commodity resources.

Although firms fail to gain competitive advantage from participating in electronic markets, they could gain competitive advantage from exploiting each other's resources through the establishment of electronic hierarchies. To the extent that the complementary resources combined are rare and difficult to imitate, partner firms can deploy these resources to create value in a unique way to catch market opportunities, which could generate inter-organizational competitive advantage. It is in this context that electronic hierarchies are considered to be an effective mechanism for integrating the strategic resources of partner firms. As such, the co-existence of electronic markets and electronic hierarchies, instead of the dominance of electronic markets, seems to better reflect the structural transformation of supply chains in the presence of IT innovations.

The growing deployment of both electronic markets (Au and Ho 2002b) and electronic hierarchies (as shown in this study) in the Hong Kong textiles and clothing industry seems to have provided evidence supporting this structural change. However, more empirical research is needed to examine to what extent the share of electronic

markets and electronic hierarchies of a supply chain is explained by firms' need for commodity and strategic resources.

Thirdly, supporting Croom's et al. (2000, p.75) view that "developments in our understanding of supply chain management require multi-disciplinarity in order to address the contrasting antecedents", this research contributes to the theoretical development of SCM study by proposing the application of a context-practices-performance framework for identification and examination of key factors influencing SCM implementation. This study highlights the importance of drawing insights from organization studies literature in studying the impact of some socio-cultural contextual factors on the application of SCM practices. In particular, more research is encouraged to distinguish various forms of inter-organization trust and the nature of relational and network embeddedness when examining their impacts on SCM implementation, since their differences are more important than may have been recognized in prior studies. It will be also important to find out, in future studies, the effect of other social resources in addition to inter-organizational trust such as organizational culture on SCM implementation.

7.2 Implications for management

To cope with demand uncertainty effectively, clothing buyers and suppliers are encouraged to collaborate, commit to idiosyncratic investments, and implement SCM. To identify a potential partner, managers want to assess the extent to which their firm's and the partner's competitive capabilities are complementary in achieving shared goals in improving product innovation flexibility, quality, delivery, and costs/prices. In addition, the more tacit and complex the partner's complementary competitive capabilities are, the more strategic value these

capabilities have and thus the more attractive the partners are. As such, a collaborative relationship may form if mutual attraction is present. That is, both partner firms have competitive capabilities that the other party wants.

Identifying a potential partner does not mean that a collaborative relationship can finally materialized. Managers could maintain a good track record of successful transactions, develop relational norm, and initiate frequent formal and informal social interactions to establish inter-organization competence trust and more importantly goodwill trust with the potential partners in an effort to foster mutual commitment in transaction-specific investments and SCM implementation. Indeed, if both partner firms have already had good reputations in the industry, the process of developing inter-organization trust may be faster and easier.

Managers are reminded that SCM implementation is by no means a simple task. The strong interdependence among SCM practices clearly indicates the need to apply SCM in a holistic fashion. In particular, special attention should be paid to the integration of product development and pre-production processes and sharing of digitized product information at the initial stage of SCM implementation. Successful adoption of this practice may contribute significantly to operations performance improvement through its influence on all subsequent business processes ranging from purchasing to distribution.

In addition, SCM implementation involves commitment of partner firms in idiosyncratic investments that are required to facilitate information sharing and process integration. Although adoption of advanced IT such as web-based technologies helps to exchange information more efficiently, using information effectively to coordinate and execute key business processes should be the prime focus. To avoid jumping on the bandwagon of electronic business blindly, managers

need to understand that these emerging technologies are means to achieve higher performance, rather than ends in themselves.

The finding also lends credence to the notion of 'supply chain competition'. Increasingly, foreign clothing buyers want to restructure their relationships with competent suppliers in Hong Kong, moving from arm's-length market relationships to trust-based relationships, if suppliers are considered to be strategic partners and their competitive capabilities are to be leveraged in order to achieve collective competitive advantage. The criteria of selecting suppliers should focus on their abilities to achieve a set of competitive priorities and not just on their abilities to offer competitive prices. For clothing suppliers in Hong Kong, the abilities to upgrade their knowledge and skill sets to harness IT to share important information and integrate key business processes with buyers are essential, if they want to become more responsive to demand uncertainty and to maintain their competitiveness in the globalization of clothing industry. Migrating to new low-cost production bases was a viable strategy in the past but now becomes less effective in winning orders, especially in the current trend of removing international trade barriers (e.g. the quotas for textile and clothing trades assigned under the Multi-Fiber Arrangement have been eliminated in 2005).

7.3 Conclusions

This study has proposed and examined a conceptual model of SCM that posits that environmental, strategic and social factors affect the application of SCM practices, which in turn improves operations performance and confers collective competitive advantage. Empirical results from the analysis of the model in the Hong Kong clothing industry demonstrate that the practices of sharing product, purchasing,

sales and inventory information as well as process integration in the interfaces of product development and pre-production, purchasing and production, and delivery and distribution are essential and mutually supporting components of SCM in the clothing supply chain.

Regarding the performance consequences of SCM implementation, all SCM practices are shown to have significant contribution to operations performance improvement in the areas of finished product inventory; price; product quality; flexibility in supplying new products; time to develop new products; order-to-delivery cycle time; shipment accuracy; efficiency and accuracy of information transmission; and labor productivity. Improvements in operations performance, in turn, provide clothing buyers and suppliers with collective competitive advantage.

Regarding the antecedents, all of three sets of contextual factors are shown to be influential. First, demand uncertainty (acting as an environmental factor) creates strong pressure for clothing buyers and suppliers to collaborate in managing the supply chain. Specifically, firms providing products that have high fashion content and seasonal demand are likely to commit idiosyncratic investments and implement SCM, due of the need to cope with high variability in demand.

Second, the characteristics of competitive capabilities possessed by clothing buyers and suppliers (acting as a strategic factor) have a decisive effect on the establishment of collaborative relationship and inter-organizational linkages between them. That is, a buyer and a supplier in the clothing supply chain are likely to implement SCM when both of them perceive that (1) there is a close fit between their competitive capabilities (i.e. their competitive capabilities are complementary), and (2) to a lesser extent that their complementary competitive capabilities are tacit and complex. This suggests that complementary competitive capabilities that are difficult

to codify (i.e. tacit) and are the product of many interdependent techniques, routines, individuals, and resources (i.e. complex) create barriers to imitation, and therefore provide strong incentives for the partner firms to implement SCM. The result also shows that the clothing buyer and the clothing supplier are likely to make idiosyncratic investments when they perceive a proper alignment between their competitive capabilities, even though their capabilities may not be tacit and complex.

Third, inter-organizational goodwill trust and competence trust (acting as a social factor) have important influence on the establishment of collaborative relationship and inter-organizational linkages in the clothing supply chain. That is, a clothing buyer and a supplier are likely to implement SCM and make idiosyncratic investments when they have developed inter-organizational goodwill trust and competence trust.

When the individual effect of antecedents is compared to each other, SCM implementation in the clothing supply chain is influenced strongly by inter-organizational goodwill trust, demand uncertainty, and complementary competitive capabilities, and to a lesser extent by tacit competitive capabilities, inter-organizational competence trust, and complex competitive capabilities. In addition, clothing buyers' and suppliers' commitment to idiosyncratic investments is affected strongly by demand uncertainty, and to a lesser extent by inter-organizational competence trust, complementary competitive capabilities, and inter-organizational goodwill trust. This indicates that there is not a single theoretical perspective that can fully explain the complex contextual influence.

The result also shows a close relationship between network embeddedness and relational embeddedness on the development of inter-organizational trust. That is, inter-organizational goodwill trust and competence trust are likely to develop when a

clothing buyer and a supplier are well known for credibility and benevolence in the industry, as both parties want to maintain a good track record of transactions, develop relational norms, and initiate frequent formal and informal interactions, which collectively promote trust creation. This suggests the interactions between dyad and network factors have to be considered in the examination of inter-organizational trust.

In summary, these findings indicate that successful SCM implementation in the Hong Kong clothing industry builds on several factors.

- Clothing manufacturers and buyers consider partners' competitive capabilities, mutual trust, the fashion content and demand variation of the garments they supply carefully, when they assess the need and possibility of implementing SCM.
- When the clothing manufacturers and buyers have ascertained such a need and identified their partners to apply SCM practices jointly, they invest in transaction-specific assets to enable process integration and information sharing.
- Clothing manufacturers and buyers also pay special attention to process integration of product development and pre-production and information sharing of product design, as this practice would facilitate effective application of other SCM practices.

Specifically the results support the context-practices-performance framework of SCM (Figure 7.1) and lead to five conclusions.

1. Clothing manufacturers and buyers in Hong Kong tend to integrate inter-organizational business processes in the interfaces of product development and pre-production, purchasing and production, and delivery and distribution, as

well as share business information including product, purchasing, and sales and inventory, when they implement SCM.

2. These clothing manufacturers and buyers would invest in transaction-specific assets including specialized equipment and facilities, skilled human resources, and specialized operating routines to facilitate SCM implementation.
3. A sophisticated level of SCM implementation could lead to a high level of operations performance and confer collective competitive advantage for manufacturers and buyers in the Hong Kong clothing industry.
4. Clothing manufacturers and buyers in Hong Kong tend to apply SCM practices when they are facing a high degree of demand uncertainty; perceive each other having complementary, tacit, and complex competitive capabilities; and have developed inter-organizational goodwill and competence trust.
5. The manufacturers and buyers are likely to develop inter-organizational goodwill and competence trust when they have achieved successful transactions, developed relational norms, initiated formal and informal interactions, and possessed good reputations in the Hong Kong clothing industry.

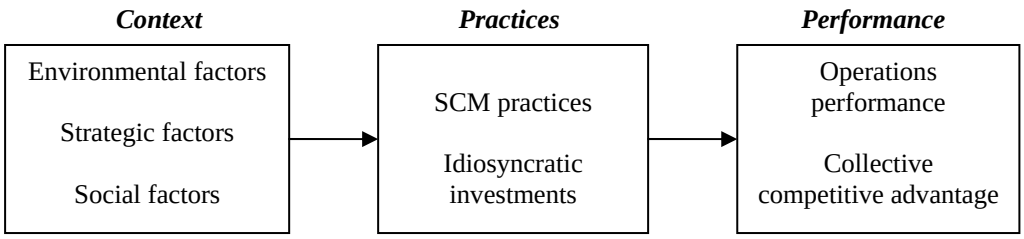


Figure 7.1 Hypothesized SCM model

As the findings support the context-practices-performance framework of SCM, refinement of the theoretical model can be made in several ways. First, a number of critical socio-cultural contextual factors in addition to inter-organizational

trust can be examined to further address the link between context and practices. In particular, it is interesting to examine the effect of organizational culture on SCM implementation, as strong organizational culture has significant impact on how individuals think and act in an organization. If partner firms share some values (such as a high degree of reception to innovative ideas in a continuous-learning culture (Ho and Duffy 2000)) that are conducive to SCM implementation, they tend to participate in making the necessary changes to their organizations.

However, it is very difficult to apply SCM practices if the organizational culture of the partner firms is in conflict with the philosophy of SCM. This is because successful SCM implementation will involve not only changes in operations and administrative routines, but also cultural change, if the existing culture becomes an obstacle. As such, it is important to identify the key organizational cultural values that support SCM implementation in further refinement of the current model. The focus of analysis is on the degree to which both partner firms share a same set of cultural values, and how that affects adoption of SCM practices. Other socio-cultural factors including mutual commitment and dependence of partner firms need to be examined, as they have been indicated in marketing literature for their effect on cooperative behavior between channel members.

Second, the process-based view on SCM could be expanded and SCM practices can be divided into two groups: (1) core SCM practices, which directly contribute to operations performance improvement, and (2) SCM infrastructure practices, which create a supportive organizational environment for core SCM practices to function (c.f. Ho et al. 1999). The practices of process integration and information sharing in the current model belong to the core SCM practices, whereas leadership of top management and SCM-related training could be added to the model

as SCM infrastructure practices. If top management openly and explicitly communicates the importance of SCM to organization members, places the first priority on SCM-related issues, and emphasizes collaboration between trading partners, it is likely that functional managers and operatives will embrace the philosophy of SCM and participate in the implementation of SCM. This will also be true if top management establishes long-term goals and policies for SCM, allocates necessary resources and establishes appropriate organizational structure, and reviews and rewards employees' contribution to SCM performance periodically. Training in SCM principles and different SCM tools and techniques such as product data management (PDM) system, electronic data interchange (EDI) system, sales forecasting, and inventory management is also important to promote functional managers' and operatives' acceptance and involvement in SCM. It is expected that both top management leadership and SCM-related training, as SCM infrastructure practices, are conducive to the development of an organizational environment for application of core SCM practices.

Third, financial performance could be added to the current model to further address the link between practices and performance. It is expected that adoption of SCM practices would lead to improved operations performance, which in turn results in better financial performance. However, it is challenging to indicate the direct impact of SCM on financial return, as there are other factors such as industry structure, competitors' actions, and trade barriers that also affect the financial performance of partner firms at the time.

Unlike past SCM studies which tended to focus on either practices-performance or context-performance relationship, this study has advocated and applied a context-practices-performance framework to establish a theoretical model

of SCM. Despite the study's limitations, this model has addressed the need to examine SCM from a multidisciplinary perspective, and provided a better understanding of the antecedents, components, and performance consequences of SCM.

Appendix

Cover letter and questionnaire

THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學
Institute of Textiles & Clothing

Supply Chain Management Survey 2003

22 April, 2003

Dear respondent,

Invitation of participating in a research survey

I am a doctoral student in Institute of Textiles & Clothing, The Hong Kong Polytechnic University. Under the guidance of Dr. Kin-fan Au and Prof. Edward Newton, I am currently conducting my dissertation research on supply chain management (SCM) in the Hong Kong clothing industry. The main objective of this research is to examine the antecedents, implementation and performance consequences of SCM in the industry.

Being a clothing manufacturer in Hong Kong, you are cordially invited to participate in this research by completing this questionnaire. You may need 15-20 minutes to complete the questionnaire, but I believe you will enjoy it. The information you provide will be kept in strict confidentiality and used for academic purpose only. The success of this survey depends heavily on the responses from the industry. Therefore, your response will be of great value.

Thank you very much for being a participant in my research project. Kindly complete this questionnaire and return it to Mr. Danny C. K. Ho by post in one week on receipt of this questionnaire.

Should you have any questions regarding this survey, please feel free to discuss these with me by e-mail at dannyho.itc@

I thank you again for your cooperation and all of your help.

Yours sincerely,

Danny Ho
The Hong Kong Polytechnic University

Instruction

Develop a list of top and bottom ***clothing buyers*** for whom your company supplies clothes. Buyers in the "Top" group are those that your company has better than average to excellent relationships with, whereas those buyers with whom your company has poor to average relations belong to the "Bottom" group. However, you can list all of your clothing buyers into the top or bottom group if you think that is more accurate. Please answer the following two sets of same questions with reference to any (i) ***one top and one bottom buyers*** or (ii) ***two top/bottom buyers***.

Background information

Please click the appropriate box for your answer of the following questions, and input required data.

Number of employees in our office and factories: ☐<100 ☐<300 ☐<500 ☐<1000 ☐≥1000

My current position: _____

Clothing buyer #1

My experience in working with this buyer: ☐<3 years ☐<5 years ☐<10 years ☐≥10 years

My level of information and knowledge concerning …	Very inadequate						Very adequate
1. the characteristics of this buyer.	☐	☐	☐	☐	☐	☐	☐
2. the relationship between our company and this buyer.	☐	☐	☐	☐	☐	☐	☐
3. the tasks performed jointly by our company and this buyer.	☐	☐	☐	☐	☐	☐	☐

The product our company supplies to this buyer is mainly:
☐ woven wear (women/girls) ☐ woven wear (men/boys)
☐ knitted wear (women/girls) ☐ knitted wear (men/boys) ☐others: _____
sold in ☐ North America ☐ Europe ☐ SE Asia ☐others: _____

The fashion level of the main product that this buyer sourced from our company is:	Highly basic						Highly fashionable
	☐	☐	☐	☐	☐	☐	☐

The demand of this main product occurred throughout the year is:	Highly staple						Highly seasonal
	☐	☐	☐	☐	☐	☐	☐

Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in . . .	Strongly disagree						Strongly agree
1. increasing new product style features.	☐	☐	☐	☐	☐	☐	☐
2. improving product quality.	☐	☐	☐	☐	☐	☐	☐
3. providing fast and on-time deliveries.	☐	☐	☐	☐	☐	☐	☐
4. reducing costs/prices.	☐	☐	☐	☐	☐	☐	☐

The complementary competitive capabilities of our company and this buyer are . . .	Strongly disagree						Strongly agree
1. difficult to be documented comprehensively in manuals or reports.	☐	☐	☐	☐	☐	☐	☐
2. difficult to be understood comprehensively from written documents.	☐	☐	☐	☐	☐	☐	☐
3. difficult to be communicated precisely through written documents.	☐	☐	☐	☐	☐	☐	☐
4. complex.	☐	☐	☐	☐	☐	☐	☐
5. the product of many interdependent techniques, routines, individuals, and resources.	☐	☐	☐	☐	☐	☐	☐
6. the integration of many interconnected processes that span various functional units and organizational boundaries.	☐	☐	☐	☐	☐	☐	☐

Members of our company and this buyer *think* that both of us . . .	Strongly disagree						Strongly agree
1. tell the truth in negotiations.	☐	☐	☐	☐	☐	☐	☐
2. negotiate agreements fairly.	☐	☐	☐	☐	☐	☐	☐
3. keep each other's promises.	☐	☐	☐	☐	☐	☐	☐
4. are reliable.	☐	☐	☐	☐	☐	☐	☐
5. do not take advantage of each other's weaknesses.	☐	☐	☐	☐	☐	☐	☐
6. do not take advantage of ambiguous situations.	☐	☐	☐	☐	☐	☐	☐
7. are competent in performing each other's tasks.	☐	☐	☐	☐	☐	☐	☐
8. are knowledgeable about the products each party supplies or sells.	☐	☐	☐	☐	☐	☐	☐

Members of our company and this buyer *feel* that both of us . . .	Strongly disagree						Strongly agree
1. keep each other's best interests in mind.	☐	☐	☐	☐	☐	☐	☐
2. are concerned with each other's needs.	☐	☐	☐	☐	☐	☐	☐
3. deal with each other kindly.	☐	☐	☐	☐	☐	☐	☐
4. are like friends.	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree						Strongly agree
1. Our company has a good track record in achieving the agreed performance targets.	☐	☐	☐	☐	☐	☐	☐
2. This buyer has a good track record in maintaining on-time payment of orders with us.	☐	☐	☐	☐	☐	☐	☐
3. Our company has established safe and healthy working conditions in factories that comply with international standard.	☐	☐	☐	☐	☐	☐	☐
4. Our company has satisfied requirement of quality management system that complies with international standard (e.g. ISO 9000).	☐	☐	☐	☐	☐	☐	☐
5. Members of our firm and this buyer frequently initiate formal work-related interaction.	☐	☐	☐	☐	☐	☐	☐
6. Members of our firm and this buyer frequently initiate informal work-related interaction.	☐	☐	☐	☐	☐	☐	☐
7. Members of our firm and this buyer frequently initiate social work-related interaction.	☐	☐	☐	☐	☐	☐	☐
8. It is well known in the industry that we have a reputation for being concerned about partners.	☐	☐	☐	☐	☐	☐	☐
9. It is well known in the industry that we have a reputation for performing competently.	☐	☐	☐	☐	☐	☐	☐
10. It is well known in the industry that this buyer has a reputation for being concerned about partners.	☐	☐	☐	☐	☐	☐	☐
11. It is well known in the industry that this buyer has a reputation for performing competently.	☐	☐	☐	☐	☐	☐	☐

Our company and this buyer both *expect* that . . .	Strongly disagree						Strongly agree
1. we stay together in the face of adversity/challenge.	☐	☐	☐	☐	☐	☐	☐
2. our relationship is flexible in accommodating one another if special problems/needs arise.	☐	☐	☐	☐	☐	☐	☐
3. our relationship extends across complex responsibilities and multiple tasks beyond simple buy-and-sell transactions.	☐	☐	☐	☐	☐	☐	☐
4. we find a fair combination of gains and losses for both parties when there is a disagreement over an important issue.	☐	☐	☐	☐	☐	☐	☐

We and this buyer exchange . . .	None						Extensive
1. product design (in the form of Computer Aided Design (CAD) files, scanned images, or digital photos) through web or e-mail.	☐	☐	☐	☐	☐	☐	☐
2. product specifications through web-based Product Data Management (PDM) information system or e-mail.	☐	☐	☐	☐	☐	☐	☐
3. important information that helps to solve problems in product development quickly.	☐	☐	☐	☐	☐	☐	☐
4. purchase orders through Electronic Data Interchange (EDI) or web.	☐	☐	☐	☐	☐	☐	☐
5. packing instructions through EDI or web.	☐	☐	☐	☐	☐	☐	☐
6. advanced shipping notices through EDI or web.	☐	☐	☐	☐	☐	☐	☐
7. invoices through EDI or web.	☐	☐	☐	☐	☐	☐	☐
8. Point-of-Sale (POS) data through EDI or web.	☐	☐	☐	☐	☐	☐	☐
9. sales forecasts through EDI or web.	☐	☐	☐	☐	☐	☐	☐
10. inventory data through EDI or web.	☐	☐	☐	☐	☐	☐	☐

We participate in product development with this buyer in . . .	None						Extensive
1. providing advice for the use and choice of standard components and accessories.	☐	☐	☐	☐	☐	☐	☐
2. contributing towards simplifying product design.	☐	☐	☐	☐	☐	☐	☐
3. providing support in developing product specifications.	☐	☐	☐	☐	☐	☐	☐
4. preparing samples promptly and reliably.	☐	☐	☐	☐	☐	☐	☐

	None						Extensive
1. Blanket purchase orders (orders without complete product specifications) are placed by this buyer.	☐	☐	☐	☐	☐	☐	☐
2. Changes in this buyer's purchase order and our production plan are passed on to each other at once.	☐	☐	☐	☐	☐	☐	☐
3. The development of this buyer's ordering plan and our production schedule are closely integrated.	☐	☐	☐	☐	☐	☐	☐
4. Frequent and small-lot purchases are implemented with this buyer.	☐	☐	☐	☐	☐	☐	☐

We and this buyer have implemented . . .	None						Extensive
1. pre-ticketing of products.	☐	☐	☐	☐	☐	☐	☐
2. standardized bar-coding of products.	☐	☐	☐	☐	☐	☐	☐
3. scan and pack system for delivery of store-ready products.	☐	☐	☐	☐	☐	☐	☐
4. frequent and small-lot shipments.	☐	☐	☐	☐	☐	☐	☐
5. cross-docking or direct-to-store shipments.	☐	☐	☐	☐	☐	☐	☐
6. minimal inspection/free pass for deliveries.	☐	☐	☐	☐	☐	☐	☐

We and this buyer *both* have invested significantly in . . .	Strongly disagree						Strongly agree
1. specialized equipment and facilities that are dedicated to our transactions.	☐	☐	☐	☐	☐	☐	☐
2. skilled human resources that are tailored to our transactions.	☐	☐	☐	☐	☐	☐	☐
3. developing and implementing specialized operating processes that are specific to our transactions.	☐	☐	☐	☐	☐	☐	☐

Over the past 2 to 3 years, our company in collaboration with this buyer has . . .	Strongly disagree						Strongly agree
1. reduced inventory of finished products.	☐	☐	☐	☐	☐	☐	☐
2. offered products with competitive price to customers.	☐	☐	☐	☐	☐	☐	☐
3. offered quality products that fulfill customer expectations.	☐	☐	☐	☐	☐	☐	☐
4. offered products with increased number of new style features that customers desire.	☐	☐	☐	☐	☐	☐	☐
5. reduced new product development time.	☐	☐	☐	☐	☐	☐	☐
6. reduced order-to-delivery cycle time.	☐	☐	☐	☐	☐	☐	☐
7. increased shipment accuracy.	☐	☐	☐	☐	☐	☐	☐
8. improved efficiency and accuracy of information transmission.	☐	☐	☐	☐	☐	☐	☐
9. increased labor productivity.	☐	☐	☐	☐	☐	☐	☐

We and this buyer have . . .	Strongly disagree						Strongly agree
1. gained strategic advantages collectively over our competitors.	☐	☐	☐	☐	☐	☐	☐
2. gained benefits that enable us to compete more effectively as a supply-chain alliance in the marketplace.	☐	☐	☐	☐	☐	☐	☐
3. gained strategically important outcomes jointly.	☐	☐	☐	☐	☐	☐	☐

Clothing buyer #2

My experience in working with this buyer: ☐<3 years ☐<5 years ☐<10 years ☐≥10 years

My level of information and knowledge concerning …	Very inadequate						Very adequate
1. the characteristics of this buyer.	☐	☐	☐	☐	☐	☐	☐
2. the relationship between our company and this buyer.	☐	☐	☐	☐	☐	☐	☐
3. the tasks performed jointly by our company and this buyer.	☐	☐	☐	☐	☐	☐	☐

The product our company supplies to this buyer is mainly:
☐ woven wear (women/girls) ☐ woven wear (men/boys)
☐ knitted wear (women/girls) ☐ knitted wear (men/boys) ☐others: _____
sold in ☐ North America ☐ Europe ☐ SE Asia ☐others: _____

	Highly basic						Highly fashionable
The fashion level of the main product that this buyer sourced from our company is:	☐	☐	☐	☐	☐	☐	☐

	Highly staple						Highly seasonal
The demand of this main product occurred throughout the year is:	☐	☐	☐	☐	☐	☐	☐

Our company and this buyer have complementary competitive capabilities (different but compatible abilities) that are useful to achieve shared goals in . . .	Strongly disagree						Strongly agree
1. increasing new product style features.	☐	☐	☐	☐	☐	☐	☐
2. improving product quality.	☐	☐	☐	☐	☐	☐	☐
3. providing fast and on-time deliveries.	☐	☐	☐	☐	☐	☐	☐
4. reducing costs/prices.	☐	☐	☐	☐	☐	☐	☐

The complementary competitive capabilities of our company and this buyer are . . .	Strongly disagree						Strongly agree
1. difficult to be documented comprehensively in manuals or reports.	☐	☐	☐	☐	☐	☐	☐
2. difficult to be understood comprehensively from written documents.	☐	☐	☐	☐	☐	☐	☐
3. difficult to be communicated precisely through written documents.	☐	☐	☐	☐	☐	☐	☐
4. complex.	☐	☐	☐	☐	☐	☐	☐
5. the product of many interdependent techniques, routines, individuals, and resources.	☐	☐	☐	☐	☐	☐	☐
6. the integration of many interconnected processes that span various functional units and organizational boundaries.	☐	☐	☐	☐	☐	☐	☐

Members of our company and this buyer *think* that both of us . . .	Strongly disagree						Strongly agree
1. tell the truth in negotiations.	☐	☐	☐	☐	☐	☐	☐
2. negotiate agreements fairly.	☐	☐	☐	☐	☐	☐	☐
3. keep each other's promises.	☐	☐	☐	☐	☐	☐	☐
4. are reliable.	☐	☐	☐	☐	☐	☐	☐
5. do not take advantage of each other's weaknesses.	☐	☐	☐	☐	☐	☐	☐
6. do not take advantage of ambiguous situations.	☐	☐	☐	☐	☐	☐	☐
7. are competent in performing each other's tasks.	☐	☐	☐	☐	☐	☐	☐
8. are knowledgeable about the products each party supplies or sells.	☐	☐	☐	☐	☐	☐	☐

Members of our company and this buyer *feel* that both of us . . .	Strongly disagree						Strongly agree
1. keep each other's best interests in mind.	☐	☐	☐	☐	☐	☐	☐
2. are concerned with each other's needs.	☐	☐	☐	☐	☐	☐	☐
3. deal with each other kindly.	☐	☐	☐	☐	☐	☐	☐
4. are like friends	☐	☐	☐	☐	☐	☐	☐

	Strongly disagree						Strongly agree
1. Our company has a good track record in achieving the agreed performance targets.	☐	☐	☐	☐	☐	☐	☐
2. This buyer has a good track record in maintaining on-time payment of orders with us.	☐	☐	☐	☐	☐	☐	☐
3. Our company has established safe and healthy working conditions in factories that comply with international standard.	☐	☐	☐	☐	☐	☐	☐
4. Our company has satisfied requirement of quality management system that complies with international standard (e.g. ISO 9000).	☐	☐	☐	☐	☐	☐	☐
5. Members of our firm and this buyer frequently initiate formal work-related interaction.	☐	☐	☐	☐	☐	☐	☐
6. Members of our firm and this buyer frequently initiate informal work-related interaction.	☐	☐	☐	☐	☐	☐	☐
7. Members of our firm and this buyer frequently initiate social work-related interaction.	☐	☐	☐	☐	☐	☐	☐
8. It is well known in the industry that we have a reputation for being concerned about partners.	☐	☐	☐	☐	☐	☐	☐
9. It is well known in the industry that we have a reputation for performing competently.	☐	☐	☐	☐	☐	☐	☐
10. It is well known in the industry that this buyer has a reputation for being concerned about partners.	☐	☐	☐	☐	☐	☐	☐
11. It is well known in the industry that this buyer has a reputation for performing competently.	☐	☐	☐	☐	☐	☐	☐

Our company and this buyer both *expect* that . . .	Strongly disagree						Strongly agree
1. we stay together in the face of adversity/challenge.	☐	☐	☐	☐	☐	☐	☐
2. our relationship is flexible in accommodating one another if special problems/needs arise.	☐	☐	☐	☐	☐	☐	☐
3. our relationship extends across complex responsibilities and multiple tasks beyond simple buy-and-sell transactions.	☐	☐	☐	☐	☐	☐	☐
4. we find a fair combination of gains and losses for both parties when there is a disagreement over an important issue.	☐	☐	☐	☐	☐	☐	☐

We and this buyer exchange . . .	None						Extensive
1. product design (in the form of Computer Aided Design (CAD) files, scanned images, or digital photos) through web or e-mail.	☐	☐	☐	☐	☐	☐	☐
2. product specifications through web-based Product Data Management (PDM) information system or e-mail.	☐	☐	☐	☐	☐	☐	☐
3. important information that helps to solve problems in product development quickly.	☐	☐	☐	☐	☐	☐	☐
4. purchase orders through Electronic Data Interchange (EDI) or web.	☐	☐	☐	☐	☐	☐	☐
5. packing instructions through EDI or web.	☐	☐	☐	☐	☐	☐	☐
6. advanced shipping notices through EDI or web.	☐	☐	☐	☐	☐	☐	☐
7. invoices through EDI or web.	☐	☐	☐	☐	☐	☐	☐
8. Point-of-Sale (POS) data through EDI or web.	☐	☐	☐	☐	☐	☐	☐
9. sales forecasts through EDI or web.	☐	☐	☐	☐	☐	☐	☐
10. inventory data through EDI or web.	☐	☐	☐	☐	☐	☐	☐

We participate in product development with this buyer in . . .	None						Extensive
1. providing advice for the use and choice of standard components and accessories.	☐	☐	☐	☐	☐	☐	☐
2. contributing towards simplifying product design.	☐	☐	☐	☐	☐	☐	☐
3. providing support in developing product specifications.	☐	☐	☐	☐	☐	☐	☐
4. preparing samples promptly and reliably.	☐	☐	☐	☐	☐	☐	☐

	None						Extensive
1. Blanket purchase orders (orders without complete product specifications) are placed by this buyer.	☐	☐	☐	☐	☐	☐	☐
2. Changes in this buyer's purchase order and our production plan are passed on to each other at once.	☐	☐	☐	☐	☐	☐	☐
3. The development of this buyer's ordering plan and our production schedule are closely integrated.	☐	☐	☐	☐	☐	☐	☐
4. Frequent and small-lot purchases are implemented with this buyer.	☐	☐	☐	☐	☐	☐	☐

We and this buyer have implemented . . .	None						Extensive
1. pre-ticketing of products.	☐	☐	☐	☐	☐	☐	☐
2. standardized bar-coding of products.	☐	☐	☐	☐	☐	☐	☐
3. scan and pack system for delivery of store-ready products.	☐	☐	☐	☐	☐	☐	☐
4. frequent and small-lot shipments.	☐	☐	☐	☐	☐	☐	☐
5. cross-docking or direct-to-store shipment.	☐	☐	☐	☐	☐	☐	☐
6. minimal inspection/free pass for deliveries.	☐	☐	☐	☐	☐	☐	☐

We and this buyer *both* have invested significantly in . . .	Strongly disagree						Strongly agree
1. specialized equipment and facilities that are dedicated to our transactions.	☐	☐	☐	☐	☐	☐	☐
2. skilled human resources that are tailored to our transactions.	☐	☐	☐	☐	☐	☐	☐
3. developing and implementing specialized operating processes that are specific to our transactions.	☐	☐	☐	☐	☐	☐	☐

Over the past 2 to 3 years, our company in collaboration with this buyer has . . .	Strongly disagree						Strongly agree
1. reduced inventory of finished products.	☐	☐	☐	☐	☐	☐	☐
2. offered products with competitive price to customers.	☐	☐	☐	☐	☐	☐	☐
3. offered quality products that fulfill customer expectations.	☐	☐	☐	☐	☐	☐	☐
4. offered products with increased number of new style features that customers desire.	☐	☐	☐	☐	☐	☐	☐
5. reduced new product development time.	☐	☐	☐	☐	☐	☐	☐
6. reduced order-to-delivery cycle time.	☐	☐	☐	☐	☐	☐	☐
7. increased shipment accuracy.	☐	☐	☐	☐	☐	☐	☐
8. improved efficiency and accuracy of information transmission.	☐	☐	☐	☐	☐	☐	☐
9. increased labor productivity.	☐	☐	☐	☐	☐	☐	☐

We and this buyer have . . .	Strongly disagree						Strongly agree
1. gained strategic advantages collectively over our competitors.	☐	☐	☐	☐	☐	☐	☐
2. gained benefits that enable us to compete more effectively as a supply-chain alliance in the marketplace.	☐	☐	☐	☐	☐	☐	☐
3. gained strategically important outcomes jointly.	☐	☐	☐	☐	☐	☐	☐

End

Thank you very much for your cooperation!!

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