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Institute of Textiles and Clothing

SUPPLY CHAIN FLEXIBILITY AND
RESPONSIVENESS: AN EMPIRICAL ANALYSIS
OF THE CHINESE TEXTILE AND CLOTHING
INDUSTRY

YI YING

A Thesis Submitted in Partial Fulfilment of the
Requirements for the Degree of Doctor of Philosophy

December, 2010

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ABSTRACT

Today's textile and clothing business environment is characterized by proliferation in product variety and volatility of the global marketplace. In the fast-fashion and high-fashion industry, in which product ranges and styles are constantly renewed, and in the basic apparel industry, where long production and distribution lead times are always found, uncertainty is an especially important issue. As a result, many firms have restructured their operational processes to better cope with environmental dynamics and to achieve competitive priority.

Flexibility represents the capability of a firm to respond to unanticipated environmental changes in its production process and in the marketplace (Upton, 1994; Zhang *et al.*, 2003). Manufacturing flexibility, which is perceived to be one of the major competitive weapons for manufacturers in today's increasingly uncertain environment and turbulent markets (Beamon, 1999; Oke, 2005), has been well acknowledged and studied in previous research. In the supply chain context, as more participants have become involved, including various suppliers, manufacturers, distributors, and customers, the relationships among them have become much more complicated. To respond to customers' dynamic demands, the importance of implementing a flexibility strategy in supply chain management has been perceived. However, there is a lack of research on supply chain flexibility strategies, and, in particular, the impact of flexibility strategies on supply chain responsiveness has not been adequately addressed.

The objective of this research was to examine how the implementation of supply chain flexibility strategies impacts on the responsiveness of the supply chain beyond the boundaries of an individual firm. A two-stage research methodology was used in this study. In the first stage, an exploratory study, which was composed of a literature review and a multiple-case study, was conducted. The literature review provided theoretical bases for research model development, while the multiple-case study examined and confirmed the components of the supply chain flexibility construct. In the second stage, a postal survey was adopted to collect data from the textile and apparel industry on the Chinese mainland to verify the research model developed in the first stage.

Specifically, a measurement model of supply chain flexibility (SCF) was developed on the basis of the literature review and multiple-case study, and was validated using the data collected from a survey study. The findings support the assertion that SCF is a multifaceted construct that consists of four dimensions, namely sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility.

Further, the mediating role of SCF between two organizational culture characteristics (market orientation and supply chain partnership orientation) and the responsiveness of the supply chain was investigated. An integrative model which explicates the mediating role of SCF in marketing strategy frameworks is proposed and empirically verified using the data collected exclusively from 192 companies involved in the textile and apparel industry.

Results from partial least squares (PLS) analyses suggest that the level of SCF can be enhanced through an organization's particular cultural characteristics. In turn, the SCF enhances the ability of the organization's supply chain to promptly respond to customer demand.

This study sheds light on the understanding of flexibility from a supply chain perspective which involves both upstream suppliers and downstream distributors. The findings of this study demonstrate that SCF fosters responsiveness to customers' enquiries and requirements, and the ability to meet their various demands. Further, the results of this study indicate that the implementation of an SCF strategy is facilitated by a firm's strong market orientation and supply chain partnership orientation. The results also provide valuable insights for managerial personnel to integrate flexibility into their strategic business development within their supply chain environment.

Key words: Supply chain flexibility; Market orientation; Supply chain partnership orientation; Supply chain responsiveness; Customer orientation; Partial least squares (PLS)

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One month after I finally submit this thesis, my baby will come to this world. I am so excited and anxious to kiss him and give him all my love. You are my angel!

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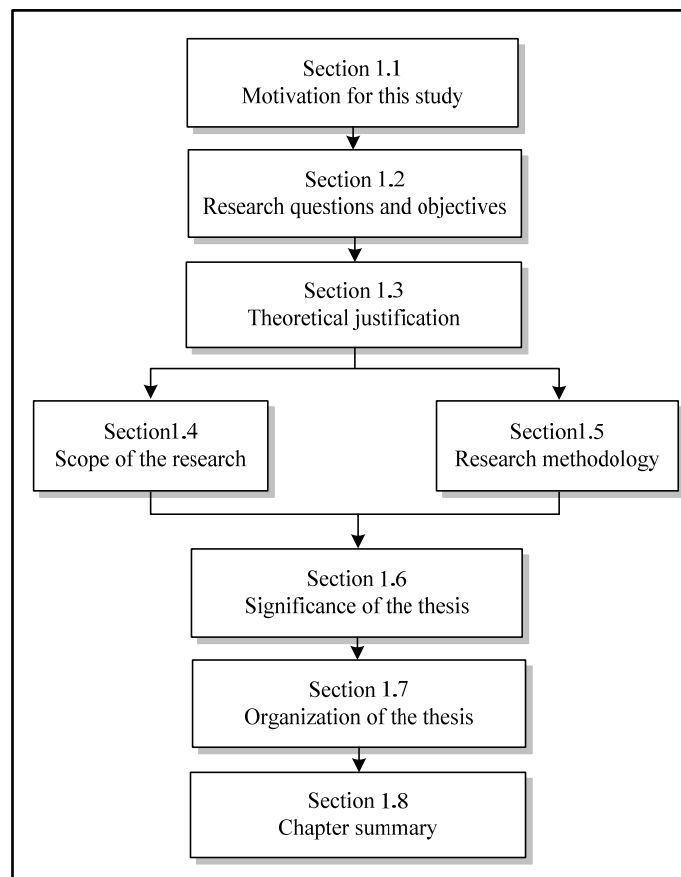
Figure 1.1 Outline of Chapter 1

1.1 Motivation for this study

In today's global scenario, enterprises face ever increasing complexities and competition. The increasingly diverse mass of customer demand requires firms to couple services, technologies, and other market capabilities. Firms must develop new products desired by the mass markets of both advanced and newly developed countries in order to survive and achieve competitive advantage. In the context of a supply chain, as more participants, including various suppliers, manufacturers, distributors and customers, get involved, the relationships among them become much more complicated. On the demand side, complexities arise from the reduced product life cycle, product forecast errors, or the evolution of multi-channel commerce; while on the supply side, complexities result from the way supply networks are designed and their ability to respond to demand.

Given today's ever-changing environment, resources that have historically sustained an organization's competitive advantage in business may no longer be viable. It is essential for supply chain members to adjust and reconfigure themselves to achieve harmony between their organizations' responsiveness and customer demand. Supply chain managers have to consider a number of strategic choices made by organizations. For instance, multiple supplier relationships can be set up so that organizations can find another back-up supplier in the event that there is an interruption in one supplier's service; or different logistic channels of the supply chain can be activated in case of emergencies such as demand peaks (Garavelli, 2003).

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Flexibility is the capability of firms to respond to unanticipated changes in their customers' needs as well as their competitors' activities (Upton, 1994; Zhang *et al.*, 2003). In the context of supply chain management, firms have increasingly recognized that interconnected and interdependent supply chain participants must consciously incorporate flexibility strategies into their supply chain management. Not only manufacturing, but also procurement or distribution can be important sources of competitive advantage because of their strong effect on material flows (Duclos *et al.*, 2003). While a great deal of previous research on the topic of flexibility has been done and the importance of it has been recognized for a long time, most of this work concentrates on intra-organization flexibility concerning the scales for manufacturing flexibility (Gerwin, 1993; Koste and Malhotra, 1999; Slack, 1983; Upton, 1994; Vokurka and O'Leary-Kelly, 2000). There is a lack of research that focuses on supply chain flexibility as well as its antecedents and consequences. Specifically, extant conceptualizations of flexibility give little consideration to strategic marketing perspectives or incorporate market-linking strategies and issues (Johnson *et al.*, 2003). A firm's survival and competitive advantage depend on the creation and delivery of superior value propositions to its markets through a series of market-linking activities, such as new product introduction, new market entry, and adjustment of the product mix. Without being market focused, the implementation of flexibility strategies will hardly result in superior value creation and sustainable competitive advantage (Johnson *et al.*, 2003).

Market orientation and supply chain partnership orientation are key elements in an organization's culture and provide strong norms for

organizational behavior (Deshpande *et al.*, 1993). Market orientation highlights the acquisition of and response to market intelligence, which suggests that capturing, managing, and responding to intelligence on the external market is essential to an organization's success. Market orientation encourages the creation of an environment which maximizes opportunities for learning about markets, for sharing information among all functions in the organization so that common interpretations are reached, and for taking coordinated action (Kohli and Jaworski, 1990). Supply chain partnership orientation, on the other hand, underlines the belief in and corporate norms of "goodness for all" from a supply chain perspective, that is, success of a supply chain depends on the efforts and cooperation of all participants in a supply chain (Min, 2001).

Although market orientation considers the acquisition and dissemination of market intelligence, which may be a key for success with some competitive strategies (Slater and Narver, 1994), without action based on market orientation, organizational performance will not be affected. One limitation of extant research is that most of it discusses the relationship between market orientation and performance without considering the specific organizational behaviors necessary to create and sustain competitive advantage (Day, 1992). Understanding the impact of an organization's culture characteristics on its behaviors, for example, the implementation of the strategy of supply chain flexibility, which is the concern of this study, is essential to a comprehensive appreciation of the contribution of organizational culture to organizational effectiveness.

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1.2 Research questions and objectives

Since the strategy of supply chain flexibility can be adopted to respond to uncertainties arising from both inside and outside an individual firm, this research is interested in solving the following research problem:

What are the factors that affect a firm's adoption of supply chain flexibility strategies and what are the impacts of these strategies as a competitive weapon on the responsiveness of the supply chain beyond the boundaries of an individual firm?

Essentially, this research investigates the interrelationships among the culture, behavior and effectiveness of an organization. It addresses the gaps in the current body of knowledge on supply chains through examining the practices involved in supply chain flexibility. To solve the identified research problem, this study proposes and tests an integrative structural model which conceptualizes flexibility from a supply chain perspective that emphasizes the orientation of market and supply chain partnerships. Based on the theoretical support for the relationship among market orientation, supply chain partnership orientation, and supply chain flexibility, this study raises the following questions:

1. What are the key properties that define the supply chain flexibility construct?

2. What are the factors that affect a firm's adoption of supply chain flexibility strategy?

3. What are the consequences of a firm's adoption of supply chain flexibility strategy?

4. Are there any interrelationships among the organizational culture characteristics, supply chain flexibility, and the responsiveness of the supply chain?

To answer these research questions, the following objectives are intended to be achieved in this study:

1. To identify the critical measures for evaluating the elements of market orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness.

2. To develop a reliable and valid instrument for measuring the supply chain flexibility construct.

3. To examine the effects of an organization's market orientation and supply chain partnership orientation on the practice of supply chain flexibility.

4. To analyze the impact of supply chain flexibility on supply chain responsiveness.

5. To explore the mediating impact of supply chain flexibility between the degree of market orientation, supply chain partnership orientation, and the degree of supply chain responsiveness.

1.3 Theoretical justifications

In this study, an integrative conceptual model that explicates the mediating role of supply chain flexibility in marketing strategy frameworks is proposed and empirically investigated. Essentially, it is proposed that supply chain flexibility can be enhanced through an organization's particular cultural characteristics, namely a strong orientation to the market and supply chain

partnerships; and this flexibility, in turn, can enhance the responsiveness of the supply chain. This conceptual model and seven hypotheses were developed to guide data collection and analysis. This conceptual model is largely supported by two theories: the culture theory of organizational effectiveness (Denison, 1990; Deshpande and Webster Jr, 1989) and the resource-based view (Barney, 1991; Wernerfelt, 1984).

Culture theory of organizational effectiveness

Dension (1990) offers a culture theory of organizational effectiveness and theorizes that organizational culture gives rise to a set of organizational practices or activities that are related to the effectiveness of an organization. As indicated by Deshpande and Webster Jr. (1989), organizational culture helps the members of an organization understand why things happen and, thus, teaches them the business philosophy or behavioral norms of the organization. Using this theory as a basis, it is theorized that two important cultural aspects of organization, that is, market orientation (MO) and supply chain partnership orientation (SCPO), serve as a foundation for organizational behavioral aspects, that is, the supply chain flexibility examined in this study.

A market orientation encourages continuous learning about customers' expressed and latent needs and about competitors' capabilities and strategies across the whole supply chain. It is the implementation behavior of a firm's values and beliefs in its marketing concept (Narver *et al.*, 1990). Therefore purchasing, manufacturing, and logistics functions must also be market oriented for the organization to have a true customer focus. Market orientation enables an organization to learn faster than its competitors and to be more

responsive to the market's ever-changing demands, thus improving the flexibility and responsiveness of the supply chain.

Similarly, a higher level of supply chain partnership orientation reflects a clear and coherent perception of the cooperation among supply chain partners, which in turn enables a comprehensive understanding of the marketplace across the supply chain, and facilitates the organization's arrangements for its sourcing, manufacturing, and distribution (Mentzer and Minand, 2000). This belief suggests a higher degree of cooperation in the supply chain to achieve a higher degree of supply chain flexibility.

Theory of resource-based view

Extant flexibility literature is clear and consistent with regard to the role of available resources and the role of a firm's capabilities in resource application (Johnson *et al.*, 2003). That is, supply chain flexibility depends significantly on the firms' internal and external resources portfolio. As suggested by the resource-based view (RBV) (Wernerfelt, 1984), a clear and comprehensive understanding of the firm in terms of its resources and capabilities and how the resources are used is important to the understanding of the dynamism of an organization's competitive actions. Supply chain resources which can be acquired and deployed by a firm include the availability of suppliers, the quality of sales forces, the relationships of supply chain members, the loyalty of dealers, and so forth (Day, 1994; Johnson *et al.*, 2003; Laurence and John, 1999). These tangible or intangible assets contribute to the generation of multiple options in achieving the firm's superior supply chain performance and competitive position. In essence, the implementation of

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a supply chain flexibility strategy involves the development and maintenance of a resource portfolio according to the marketing dynamics and customer demand. Consequently, superior responsiveness of the supply chain is expected where firms can better manage uncertain markets that are changing rapidly.

1.4 The textile and clothing industry

To verify the proposed research model, an empirical research instrument was designed and used to get data from firms in China's textile and clothing industry. The background of the industry as well as the focus of this research on the textile and clothing industry will be reviewed in this section.

1.4.1 The global textile and clothing industry

The textile and clothing industry is highly diverse, complex, and fragmented in both customer demand and its supply chain (Berger and Gartnerand, 1997; Underhill, 1998). It involves a variety of production techniques and processes in a complicated network of relationships from various operations (Underhill, 1998). The activities involved in textile and clothing manufacturing include fiber production, spinning, weaving, dyeing, finishing, knitting, linking, assembling, cutting, pattern-making, sample-making, sewing, packaging, and trading (Berger *et al.*, 1997). Despite of the variety of production processes which involves distinct technologies, each process is essentially interdependent of others. The textile and clothing industry is fairly self-contained for all its diversity, but each segment of the production stream may be produced in a separate location. Products at different production stages can be produced either within an integrated

company structure, or traded individually across either domestic or international markets (Underhill, 1998).

Another characteristic of the textile and clothing industry is that the industrial customers are generally the key decision makers in the supply chain (Yeung, 2006). The industrial customers in the clothing industry are generally the brand owners like H&M and Nike, or the retailers like Wal-Mart or Marks & Spencer. Such industrial customers greatly influence the fashion and thus demand for their products (Lo *et al.*, 2005). They generally prefer to design their own products and source globally for their production. This trend of globalization in the textile and clothing supply chain results in many companies either sourcing components from overseas, or moving manufacturing to countries with lower labor costs like China, Indonesia, Thailand and India (Jones, 2000; Lam and Postle, 2006).

Since the textile and clothing industry is characterized as labor intensive, industrial customers tend to select their qualified manufacturers from low cost regions (Lo *et al.*, 2005). Further, the apparel industry is characterized by a number of factors, namely short lifecycle, high volatility, low predictability, and high impulse purchase, especially for the fashion items (Fisher, 1997). Therefore, managing the logistics and supply chain for the suppliers and retailers of textiles and apparels has to be synchronized and is driven by the exigencies of dynamic patterns of demand (Bruce and Dalyand, 2004).

1.4.2 China's textile and clothing industry

With a population of over 1.3 billion, China is the world's largest and most populous country. As an emerging economy, China is undergoing tremendous change in the past 30 years. In recent years, the ability to provide high quality products at competitive prices, with reliable quality and delivery times has enabled China to enhance and maintain its status as a major manufacturer in the global clothing and textile industry. With support from the government, China's textile and clothing manufacturing has grown rapidly and achieved good penetration of global markets. The investment in modern plants and equipment has been increased, and the international logistics and marketing networks have been established and developed (Bolisani and Scarso, 1996). A great number of industrial customers in America and the Europe send their new designs to qualified manufacturers in China, together with specified delivery dates and quantities for delivery as reference points. These manufacturers start their planning processes accordingly. In the event that their own capacity is not sufficient to complete the entire order, they will subcontract part of the order to other manufacturers. At the same time, they source the required textiles and accessories from their domestic or even overseas suppliers.

Since textile and clothing manufacturing is one of the mature industries in China, which has been developing for over two decades, many manufacturers have established long-term co-operative partnerships and have formed strong marketing networks. In addition, transportation networks have developed rapidly in recent years, which has enabled convenient connections to airports, railway stations, and container ports. The export value of textiles

and clothing from mainland China in 2009 reached US$169 billion (World Trade Organization, 2009), making it the world's largest exporter of these goods. These developments have helped China maintain its main clothing manufacturing areas of the world (Lo *et al.*, 2005).

Moreover, prompted by China's economic boom and the explosive growth of the Chinese middle class, an increasing numbers of retailers regard the world's most populous nation as a budding clothing market (Fong and Dodes, 2006). Increasing number of people in China demand luxury products. Further encouraged by the Olympic Games in Beijing in 2008 and the World-Expo in Shanghai in 2010, many shopping malls were developed and international brands established their stores, boutique flagship stores in China.

In summary, China has undergone tremendous changes in the past 30 years: from a standard uniform to varieties of clothing, from a planned economy to a free one, and from a focus on manufacturing and wholesaling to one that includes retailing (Chan, 2011). China's important role in the world's textile and apparel trade justify the delimitation of scope of this research.

1.5 Research methodology

A two-stage research methodology was used in this study. The first stage was an exploratory study to identify the relevant issues, gather ideas and insights, and explore the research questions. A theoretical model was proposed as well as a series of corresponding hypotheses. Specifically, a measurement model illustrating the component of supply chain flexibility was developed based on a comprehensive literature review and a multiple-case study made at this stage. In the second stage, a postal survey was adopted to collect data from

China's textile and apparel industry to test the seven hypotheses developed in the first stage and to finalize the conceptual model. The following provides a brief discussion of these two stages.

Stage one: Exploratory study

An exploratory study is concerned with discovering the general nature of a research problem and variables that relate to a research topic (Perreault Jr. and Leigh, 1989). It is characterized by a high degree of flexibility, and tends to rely on secondary data, small-scale surveys or case analyses. In this research, the exploratory study was executed through a literature review and a multiple-case study methodology.

To understand the current situation encountered by the target sample firms, historical documents and industry reports were consulted. To provide a theoretical framework for the research topic, an in-depth literature review was conducted in the areas of the culture theory of organizational effectiveness, the resource-based view, market orientation, supply chain partnership orientation, supply chain flexibility and supply chain responsiveness. The literature review is discussed in Chapter 2 and the model is developed in Chapter 3.

Since little research has focused on the conceptualization of supply chain flexibility, a multiple-case study using individual in-depth interviews of representatives from five textile and clothing firms was conducted and is described in Chapter 4. The purpose of this multiple-case study was to investigate the different flexibility strategies adopted by supply chain participants, to examine the conceptual framework of supply chain flexibility,

and to confirm the initial scales for the supply chain flexibility construct based on the literature review.

Stage two: Questionnaire survey

To examine the proposed research model, a questionnaire survey was adopted in the second stage because it provides a basis for establishing generalizebility, allows replicability, and has statistical power (Aaker *et al.*, 2001; Hair *et al.*, 1998; Malhotra and Peterson, 2002).

Before conducting the survey, the developed questionnaire was refined by a pre-test to improve the quality and refine the data collection plan. The survey was administered to obtain data from the practitioners in China's textile and clothing industry. A total of 192 usable responses were received. Data from the survey were analyzed using SPSS, AMOS, and PLS. A more detailed discussion of the research methodology and the data analysis of this second stage is presented in Chapters 5 and 6.

1.6 Significance of this thesis

This study is significant at the academic, firm, and industry levels. At the academic level, it provides a new theoretical framework to explain the practices of supply chain flexibility as well as its antecedents and consequences. At the firm level, it can provide decision-making guidelines for industrial practitioners that are intent on developing supply chain flexibility to improve their supply chain responsiveness. At the industry level, it can be used as a source of information for depicting the development of China's textile and clothing industry. A detailed discussion of the significance of this study will be presented in Chapter 7.

1.7 Organization of this thesis

This thesis has seven chapters. Chapter 1 presents the background, motivation, objectives and questions, theoretical basis, methodology, and significance of the research, and gives an outline of the organization of this thesis.

Chapter 2 reviews the literature relating to the theoretical foundations of the resource-based view and the culture theory of organizational effectiveness, as well as the relevant concepts of supply chain flexibility, organizational culture, and supply chain responsiveness. It provides the background and foundation upon which this present study is based. It also leads to the identification of research questions, and to the preparation of a multiple-case study.

Chapter 3 deals with the theoretical development and proposes an approach for the main research model for this study. The hypotheses regarding the relationships between the constructs are also proposed.

In Chapter 4, an exploratory multiple-case study, which involved five Chinese companies in the textile and apparel industry, is described. The critical supply chain actions for promoting supply chain flexibility were identified and were categorized into four dimensions, which provide an understanding of the SCF construct.

Chapter 5 describes the research methodology of this study. The paradigm and the two-stage design (i.e., the exploratory study in Stage 1 and the quantitative mail survey in Stage 2) are justified. The sampling criteria and

technique of the postal survey, the design and administration of the questionnaire, and the issues of data analysis of the research are also discussed.

Chapter 6 reports the analysis of the collected data in Stage 2. The research findings that are relevant to the research issues are examined, interpreted, and reported accordingly.

Finally, Chapter 7 closes the thesis by drawing conclusions and providing an overall discussion of the hypotheses, evaluating the contributions and implications of this study, and stating the limitations of this study. Future research directions are also suggested in this chapter.

1.8 Chapter summary

This chapter has provided an overview of this research by introducing the motivation of the research, highlighting the research questions, objective, theoretical justification, scope, methodology, and significance of the study, and by delineating the structure of this thesis. The following chapter will review the literature concerning the conceptual framework of this study and its involved constructs.

CHAPTER 2 LITERATURE REVIEW

The previous chapter introduced the research questions about the role of supply chain flexibility between organizational cultural characteristics (market orientation and supply chain partnership orientation) and supply chain responsiveness. The aim of this chapter is to provide an in-depth review the literature concerning the conceptual framework of this study and its involved constructs. The chapter is divided into five sections, as shown in Figure 2.1. The first section clarifies the rationale for the model structure and outlines the theoretical framework of this study, that is the resource-based view in Section 2.1.1 and the culture theory of organizational effectiveness in Section 2.1.2. This follows a comprehensive literature review of the three relevant concepts of this study, that is supply chain flexibility in Section 2.2, organizational culture in Section 2.3, and supply chain responsiveness in Section 2.4. Finally, the main points of the chapter are summarised in Section 2.5.
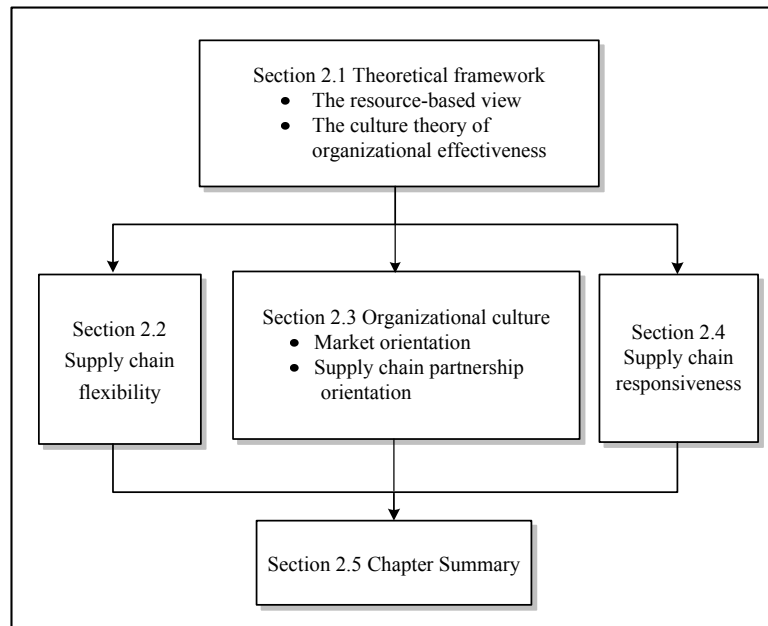
Figure 2.1 Outline of Chapter 2

2.1 Theoretical framework

The foundation of the theoretical framework for this study comprises two elements: the theory of resource-based view (RBV) and the culture theory of organizational effectiveness. During the last two decades, RBV (Barney, 1991; Hooley *et al.*, 1998; Wernerfelt, 1984) has emerged as a powerful explanation of resources as essential antecedents to production and, ultimately, organizational performance. Extant literature is clear and consistent with regard to the role of resources in the implementation of flexibility strategies and the role of a firm's capabilities in resource application (Johnson *et al.*, 2003). From a supply chain perspective, it is argued in this study that supply chain flexibility depends significantly on the involved firms' internal and external resources portfolios.

Further, the culture theory of organizational effectiveness (Denison, 1990; Denison and Mishra, 1995; Deshpandé and Webster Jr, 1989) indicates that organizational culture gives rise to a set of organizational behaviors which are related to the effectiveness of an organization. It is argued in this study that two important cultural aspects of organization, that is, market orientation (MO) and supply chain partnership orientation (SCPO), serve as a foundation for organizational behavioral aspects such as supply chain flexibility. As illustrated in Figure 2.2, the theoretical framework of this study is grounded in the proposition that other than the direct effect of organizational culture on the responsiveness of the supply chain, the organizational culture also affects the responsiveness of the supply chain after being mediated by the implementation of SCF strategy.
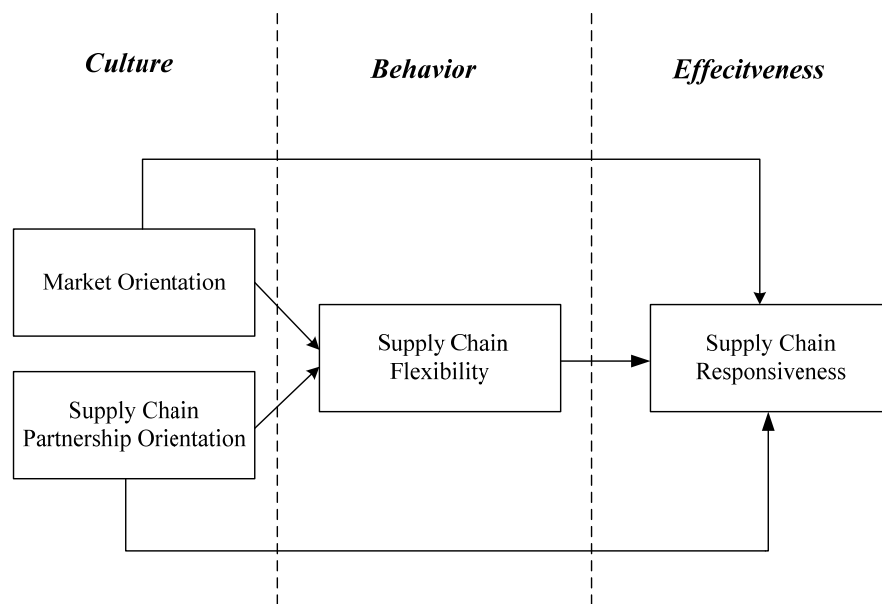
Figure 2.2 The conceptual framework

The following is a detailed discussion of these two theories.

2.1.1 The resource-based view

From a resource perspective, firms may be viewed as a collection of productive resources (Wernerfelt, 1984). Therefore, a clear and comprehensive understanding of the firm in terms of its resources and capabilities in terms of how the resources are used is important to understand the dynamism of an organization's competitive actions. The resources of a firm include a bundle of assets, capabilities, organizational processes, its attributes, information, and knowledge (Barney, 1991). Both tangible (capital, production facilities, human, etc.) as well as intangible (skills, reputation, efficiently procedures, etc.) resources tied semi-permanently to the firm which may contribute to its competitive advantage (Hooley *et al.*, 1998). In addition, the resources must be valuable, rare, inimitable, and non-substitutable (so called VRIN resources) (Barney, 1991). Day (1994) indicates that assets are the resource endowments an organization has accumulated (e.g. investments in scale, plants, location and brand equity) while capabilities are the glue that binds these assets together and enables them to be deployed advantageously. The latter are complex bundles of skills and collective learning, exercised through organizational processes, and which ensure superior coordination of functional activities.

Particularly with regard to achieving superior product market position, researchers have noted the importance of certain scarce assets or resources and their deployment (Johnson *et al.*, 2003). In a supply chain scenario, resources which can be acquired and deployed by a firm include the availability of suppliers, the quality of sales forces, the relationships of supply chain members, the loyalty of dealers, and so forth (Day, 1994; Johnson *et al.*, 2003; Laurence and John, 1999). These assets have the VRIN characteristics and

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contribute significantly to the generation of options in achieving superior supply chain performance; therefore, they are critical to a firm's competitive position.

Firms in a supply chain require four different skills to develop their resource-based capabilities (Johnson *et al.*, 2003): (a) the identification of resources, (b) the acquisition of resources, (c) the deployment of resources, and (d) the identification of options. These capabilities are composed of socially complex routines deeply embedded in the firm (Collis, 1994). In addition, they involve the configuration, adjustment, and reconfiguration of resource portfolios over time (Eisenhardt and Martin, 2000; Teece *et al.*, 1997). With regard to supply chain flexibility, resource identification is necessary in that identifying resources in a supply chain can generate potential competitive advantages. Next, the acquisition of capabilities refers to the firm's obtaining and accumulating those resources either through internal development or external sources. In conjunction with identification and acquisition, resource deployment capabilities involve the firm's ability to leverage and use the resources (Johnson *et al.*, 2003). In short, as a participant in a supply chain, a firm must be capable of configuring and deploying its resources. Moreover, the identified and acquired resources in the supply chain must be amenable to change and be able to accommodate flexible deployment and configurations. In this way, multiple options for the firm can be achieved, and the capability of the firm to promptly respond to changing market conditions through adjusting and reconfiguring its available resources can be improved.

2.1.2 The culture theory of organizational effectiveness

A number of empirical studies in the area of flexibility has been approached (i.e. Caputo, 1996; Pagell and Krause, 1999 ;Vickery *et al.*, 1999; and Sawhney, 2006), and only a few of them refer to specific theory. For example, Pagell and Krause (1999) use organizational contingency theories (Venkatraman and Prescott, 1990) to examine whether firm performance will increase when there is a fit between the internal aspects of an organization and the external environment. Sawhney (2006) adopts RBV (Wernerfelt, 1984) to emphasize the importance of flexibility as a internal resources for the performance of a firm. However, studies on how to match the SCF and organizations' market intelligence is still evolving, and no prominent empirical studies on the subject. Without empirical backing, this research goes for a general management framework which explains the impacts of organizational culture and associated behaviors on performance in a broader way (Denison, 1990; Deshpandé and Farley, 1998; Hurley and Hult, 1998).

In his general management framework, Dension (1990) develops an explicit model of organizational culture and effectiveness. This model attributes the success of organizations to some combination of values and beliefs, policies and practices, and the relationships between them. A general framework which considers the relationship among the culture, behaviors and effectiveness of an organization was also presented. Specifically, his research proposes that organizational effectiveness is a function of:

- the values and beliefs shared by the individuals of an organization;

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- the policies and practices adopted by an organization;

- translating the core values and beliefs into organization's policies and practices in a consistent manner; and

- the interrelation of the business environment, the core values and beliefs, and the policies and practices of the organization.

Based on his framework, extensive research has been conducted to explore the specific behaviors associated with organizational culture and their effects on various areas of organizational effectiveness. For example, Deshpandé *et al.* (1993) investigate both culture and market oriented behavior as they relate to the performance of Japanese and Indian firms, and Hurley and Hult (1998) investigate culture as it relates to marketing innovations.

This study seeks to expand the literature by studying organizational culture, supply chain flexibility, and supply chain responsiveness. It is proposed that supply chain flexibility plays a critical role in a firm's success and its ability to earn superior management advantage. More importantly, it is suggested that this happens in conjunction with, and is facilitated by, two organizational culture aspects, namely the firm's market orientation (MO) and supply chain partnership orientation (SCPO). While there has been a relative paucity of research in the operations management literature regarding organizational culture (Nahm *et al.*, 2004), the inclusion of a culture variable will contribute to the body of knowledge by studying the effects of culture on organizational practices such as the implementation of supply chain flexibility strategies.

In the following Sections 2.2 to 2.4, the three relevant concepts of the major components of this study, that is supply chain flexibility, organizational culture and supply chain responsiveness, will be discussed respectively.

2.2 Supply chain flexibility

2.2.1 Extant studies on supply chain flexibility

In the area of operations management, flexibility was initially proposed for manufacturers to help them deal with unexpected changes in their manufacturing systems, such as equipment breakdowns, variable task times, queuing delays and re-works (Sethi and Sethi, 1990). In this regard, flexibility concerns the degree to which an organization possesses a variety of actual and potential procedures, and the rapidity with which it can implement these procedures to increase the control capability of the organization over its environment (Leeuw and Volberda, 1996). It is typically defined in terms of range, mobility and uniformity, that is the various states a system can adopt, the ability to move from making one product to making another, and the ability to perform comparably well when making any product within a specified range (Slack, 1983; Upton, 1994). The various components of manufacturing flexibility have been built up over time and presented hierarchically from shop floor resources up to firm level. Slack (1983) describes five types of flexibility (new product, product mix, quality, volume, and delivery), while Gerwin (1993) examines seven (mix, changeover, modification, volume, rerouting, material, flexibility responsiveness). Later on, Vokurka and O'Leary-Kelly (2000) extend this to 15 (machine, material handling, operations, automation, labor, process, routing, product, new design, delivery, volume, expansion, program, production, and market). In spite of

their various taxonomies, these previous studies examine the principal procedures of manufacturing systems. Strong inter-dependencies between many of these components were found; for example, product mix and process routing flexibility are both influenced by the degree of machine flexibility. However, most of these research studies have been focused on manufacturing flexibility with little consideration of other processes in an organization's supply chain.

With inter-firm competition being extended to inter-chain competition in which both upstream suppliers and downstream distributors cooperate to deliver customer value, the concept of manufacturing flexibility needs to be expanded to supply chain scenarios. This requires both "interfunctional" and "partnership" perspectives, with the avoidance of management approaches that are inward-looking and self-focused (Holmberg, 2000). The concept of supply chain flexibility (SCF) was proposed and has been studied since then (Beamon, 1999; Duclos *et al.*, 2003; Lummus *et al.*, 2003; Vickery *et al.*, 1999). Lummus *et al.* (2003, p2) state that supply chain flexibility refers to "(the capability of) promptness and the degree to which the supply chain can adjust its speed, destinations and volume in line with changes in customer demand". The Supply Chain Council (2006, p7) gives a performance-based definition of supply chain flexibility as "the agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage".

Several studies have adopted the approach of relating components found in the manufacturing flexibility literature to a wider context of the

supply chain. Vickery *et al.* (1999) define five components for supply chain flexibility from an "integrative, customer-oriented perspective". Among these five components, volume flexibility and product flexibility are related to manufacturing systems, while distribution flexibility and access flexibility are used to investigate marketing, and new product introduction flexibility is relevant to new product research and design. Although the above study attempts to extend the investigation boundary from intra-function to inter-function involving multiple departments and processes, it is still focused on the internal perspective of a particular firm. Consequently, the external operations of the firm, especially its relationships with other participants in the supply chain are ignored.

Other than examining the components of supply chains, some research has made a contribution to the flexibility literature through incorporating all the internal issues inherent at the plant and firm-level together with a wider range of a firm's external processes. These processes including sourcing, procurement, and logistics (Stevenson and Spring, 2007). Garaveli (2003) and Sánchez and Pérez (2005) examine two main aspects of supply chain flexibility, namely process flexibility and logistics flexibility. Process flexibility concerns the number of product types that can be produced by each manufacturer; and logistics flexibility refers to the different logistics strategies which can be adopted either to procure a component from a supplier or to release a product to a market. Similarly, Swafford *et al.* (2006) propose a three-dimensional supply chain flexibility which includes procurement/sourcing flexibility, manufacturing flexibility, and distribution/logistics flexibility.

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Despite flexibility and supply chain management having been among the leading concerns of operations managers in recent years, studies that focus on supply chain flexibility are still limited (Garavelli, 2003; Gong, 2008). One of the major limitations of previous research is that most of it has been applied within the confines of a single firm and thereby has neglected the other important processes in, and aspects of the supply chain. Consequently, when considering flexibility options, the proposed frameworks are unable to include the multiple interdependencies that exist between supply chain partners.

Another limitation is that a comprehensive and widely accepted theoretical measurement framework for supply chain flexibility has not yet been formulated (Sawhney, 2006; Sethi and Sethi, 1990; Toni and Tonchia, 1998). Some researchers indicate that the lack of a theoretical base and the wide array of measures used by implementation research without adequate theoretical justification are the main causes of the incomplete state of knowledge in flexibility (Beach *et al.*, 2000; Stevenson and Spring, 2007; Toni and Tonchia, 1998). A well-defined measurement model and measurement instrument with high degrees of validity and reliability is a prerequisite for further empirical study of this area (Moore and Benbasat, 1991). Until it is possible to measure supply chain flexibility adequately, it is difficult to manage it or compare the flexibility of one supply chain with that of another (Stevenson and Spring, 2007).

Finally, extant conceptualizations of flexibility give little consideration to including strategic marketing perspectives or incorporating market-linking strategies and issues (Johnson *et al.*, 2003). Therefore, a reconceptualization of

flexibility from a supply chain perspective that investigates its impact on supply chain responsiveness and emphasizes the demand of the market and cooperation of supply chain partners is proposed in this study. It is expected that the findings of this research will benefit both managers and researchers by providing a deeper understanding of how supply chain flexibility develops in a firm, how it relates to and works with other important marketing and supply chain concepts, and how it works with these concepts to affect outcomes relevant to the supply chain and the firm. The details of this full research model and its relevant hypotheses are discussed in Chapter 3.

2.2.2 A proposed construct model for supply chain flexibility

Since extant literature gives little consideration to a reliable and valid measurement model for supply chain flexibility, as discussed above, this study synthesizes ideas from previous studies for the definition and scale development, for example Koste *et al.* (1999), Lummus *et al.* (2003), Sánchez and Pérez (2005), Sawhney (2006), Sethi *et al.* (1990), and Swafford *et al.* (2006). The *supply chain flexibility* (SCF) is therefore defined as being the capability of an organization to respond to internal and external changes to gain or maintain competitive advantage. The involved activities include raw materials and components sourcing, product manufacturing and assembly, warehousing and inventory tracking, distribution across all channels, and delivery to customers. This study also considers the information system management of all these activities because of its important role in an enterprise's total flexibility. On the basis of existing flexibility literature (Duclos *et al.*, 2003; Koste *et al.*, 2004; Lee and Whang, 2000; Lummus *et al.*, 2003; Sethi and Sethi, 1990; Swafford *et al.*, 2006), a four-dimension model

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was developed to measure the SCF construct according to the different processes in the supply chain. SCF was considered as a higher-order phenomenon consisting of four important component factors, which can reflect a latent construct. These four dimensions are sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. The first three are used to examine the main processes in the supply chain, that is procurement, production or processing, and delivery respectively. This taxonomy of procedures in the supply chain has been generally accepted in the research of supply chain management (Swafford *et al.*, 2006; The Supply Chain Council, 2006). These three processing-related dimensions are operationalized by the ease of achieving various options to accommodate changing market requirements. The fourth dimension, that is information system flexibility, is operationalized by the utilization of information technology in the organization's supply chain management to enable information sharing across the chain. This final dimension is less discussed in extant literature.

The first dimension, sourcing flexibility, is defined in this study as the availability of resources in the form of suitable materials and services, and the ability of purchasing processes to respond effectively to changing requirements. Generally, sourcing activities are the pre-activities of an enterprise's core business. They provide crucial links between suppliers and manufacturers, and are responsible for the upstream procurement of suitable material, components, products, or services to support material requirements (Lummus *et al.*, 2003; Swafford *et al.*, 2006). A primary determinant of

sourcing flexibility is the available materials and products provided by upstream suppliers.

The second dimension, operating system flexibility, is defined in this study as the ability to exploit the uses of obtained resources and provide a range of products and services that can effectively respond to changing requirements. It is concerned with the ability to provide suitable products characterised by numerous features, mixes, and volumes to meet various customer specifications (D'Souza and Williams, 2000; Koste *et al.*, 2004; Sethi and Sethi, 1990). Operating system flexibility enables firms to produce the needed quantity of high-quality products quickly and efficiently through set-up time reduction, cellular manufacturing layouts, preventive maintenance, quality improvement efforts, etc. (Koste and Malhotra, 1999; Sarker *et al.*, 1994; Sethi and Sethi, 1990; Shewchuk and Moodie, 1998; Toni and Tonchia, 1998). The key components of operating system flexibility might include a firm's capability in producing more new products or changing the mix of its products. In this study, an overall assessment of operating system flexibility was measured at the plant level.

The third dimension, that is distribution flexibility, refers to the ability to exploit the uses of logistics resources and effectively adapt the process of controlling the flow and storage of materials, components, finished goods, and services to their destination in response to dynamic marketplace conditions (Duclos *et al.*, 2003; Swafford *et al.*, 2006). Distribution flexibility facilitates the production and deliveries of products through smoothing the flows of materials and components (Porter, 1998). Distribution flexibility is promoted

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by the close coordination of downstream activities in the supply chain, whether these activities are internal or external to the firm (Vickery *et al.*, 1999). A primary determinant of distribution flexibility is the availability of distributors, warehouses, loading capacity, and other distribution facilities.

Finally, information system flexibility refers to the ability of the organization's information system, especially in situations of unexpected disturbance (Duclos *et al.*, 2003; Lee, 2000; Swafford *et al.*, 2006), to adapt, or enable adaptation of other processes, to changing circumstances. With the physical flow of products moving across different supply chain nodes, relevant information should also be transferred across the nodes fluently and efficiently. Lucas Jr and Olson believe (1993) that information technology affects system flexibility in three ways: it changes or blurs the boundaries of an enterprise's systems, it changes the working time in a system and connecting time among different organizations, and it changes working properties and rhythm. To facilitate information flow in the supply chain, it is essential for the organization to set up an efficient and robust information system. The key components of information system flexibility may include the capability of an information system in supporting different internal functional departments or external supply chain partners

In Chapter 4, an exploratory multiple-case study will be described that involved five Chinese companies in the textile and apparel industry. The aim of the study was to examine these proposed four dimensions of SCF and confirm the initial item measures. In Section 5.3, details about the instrument developed to measure supply chain flexibility will be discussed with regard to

the initial proposed item measures (summarized in Table 5.2). The validation of the proposed measurement instrument will also be considered in that section.

2.3 Organizational culture

While a number of scholars have developed integrative frameworks of organizational culture, little consensus exists with regard to a general theory (Barney, 1986; Smircich, 1983). The organizational culture has been defined in various ways and has numbers of identifiable value-sets (Schein, 1985) ascribed to it such as management styles, reward systems, communication styles, manners of decision making, all of which help to define an organization's character and norms (Straub et al., 2002). Hofstede (1990) defined organizational culture as "the manifestation of practices or behaviors evolving from the shared values in the organization".

This study adopts a definition that is consistent with most of the research. In this work, organizational culture typically is expressed as a complex set of values, beliefs, assumptions, and symbols that organization members come to share (Deal and Kennedy, 1982). It helps individuals understand how the organization functions and thus provides the business philosophy or behavioral norms in the organization (Deshpandé and Webster Jr, 1989). In this sense, culture has pervasive impacts on a firm since a firm's culture defines not only who its relevant employees, suppliers, customers, and competitors are, but also how a firm interacts with these key actors.

Various models have been developed in previous research to measure organizational culture or investigate the different organizational behaviors

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which were guided by dominant values shared in these organizations (Leidner and Kayworth, 2006). Since the research scenario in this study is the organization's behaviors and their effectiveness in the supply chain, the investigation of culture focused on the organization's perception of its market and supply chain partnerships. Therefore, two major elements of organizational culture, that is market orientation and supply chain partnership orientation were included and investigated in this study. These are discussed below.

2.3.1 Market orientation

Webster (1992) suggests that marketing has three dimensions that must be understood individually and collectively to realize marketing potential value to the organization. These dimensions are marketing as culture, marketing as strategy, and marketing as tactics. Specifically, the contribution of market orientation as a business culture, which is consistent with the consideration of this study, is strongly supported by the rapidly developing body of empirical evidence that demonstrates a positive relationship between market orientation and business performance (Deshpandé *et al.*, 1993; Narver and Slater, 1990).

Market orientation, as a key element of an organizational culture provides strong norms for implementation of the market concept (Kohli and Jaworski, 1990). It is reflected in the activities and behaviors of an organization which result in the continuous superior performance of a business (Deshpandé *et al.*, 1993). Introduced by McKitterick (1957), Felton (1959) and Keith (1960), the marketing concept defines a distinct organizational culture

that puts the customer in the center of the firm's thinking about strategy and operations. It is also viewed as a philosophy of doing business or as a culture that permeates every aspect of an organization's operations and leads to superior performance of the business in a long term (Houston, 1986; Hunt and Morgan, 1995). Extant research on market orientation mainly focuses on four areas: 1) its definition and conceptualization (Jaworski and Kohli, 1993; Jaworski and Kohli, 1996; Narver and Slater, 1990); 2) its antecedents and consequences (Deshpande and Webster Jr, 1989; Jaworski and Kohli, 1993; Narver and Slater, 1990; Slater and Narver, 1994); 3) the moderators in the market orientation and business performance relationship (Han *et al.*, 1998; Johnson *et al.*, 2003; Slater and Narver, 1994); and 4) its measurement (Gray *et al.*, 1998; Kohli *et al.*, 1993).

To date there is no consensus on a definition of market orientation. Shaprio (1988) indicates that a firm is not market oriented unless information on all important buying influences permeate every corporate function, and strategic and tactical decisions are made interfunctional and interdivisional. In other studies, market orientation has been defined as a response to market information (Harrison-Walker, 2001), or superior skills in understanding and satisfying customers (Day, 1996). Kohli and Jaworski (1990) conceptualized market orientation and developed a measure that focused on a firm's activities and behaviors with regard to customer needs, competitive information, market intelligence, and the sharing of such knowledge across organizational functions. Similarly, Narver and Slater (1990) defined market orientation as an organization culture that most effectively and efficiently creates the necessary behaviors for the creation of superior value for buyers and, thus, continuous

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superior performance for the business . They further distinguish the three behavioral components of a market orientation as being customer orientation, competitor orientation, and interfunctional orientation.

For the purpose and theoretical framework of this study, the concept of market orientation used follows the work of Narver and Slater (1990) and is defined as an organizational culture in which all employees are committed to the continuous creation of superior value for customers. In this context, Narver and Slater (1990) highlight the state of mind of members of an organization and emphasize a normative philosophy advocating the achievement of superior performance through the creation of superior customer value. They also contend that a business's only sustainable competitive advantage is its ability to learn faster than its competitors and that a market orientation implies adaptive organizational learning.

A considerable body of evidence can be found which suggests market oriented businesses are more successful than those that are not (Day and Nedungadi, 1994; Han *et al.*, 1998; Javalgi *et al.*, 2005; Jaworski and Kohli, 1993; Narver and Slater, 1990; Siguaw *et al.*, 1998). Market oriented firms will gather and use information more actively and openly to satisfy customer needs to the betterment of all channel members than will their less market oriented counterparts (Siguaw *et al.*, 1998). In the area of supply chain, however, the relationship between market orientation and supply chain management has been seldom investigated (Martin and Grbac, 2003; Min, 2001). In a supply chain context, effective communication and collaboration among the chain partners enable the retailers, manufacturers, and suppliers to

get their orders when they want them and without error. This philosophy is consistent with a market orientation – making sure that customer needs are met, and at a profit (Mason, 2003). With regard to this study, the research interest is whether there is a link between market orientation and the implementation of supply chain flexibility, and what the impact of market orientation is on the organization's supply chain responsiveness.

2.3.2 Supply chain partnership orientation

Another organizational culture involved in the research framework is supply chain partnership orientation (SCPO). This represents the belief that both parties in a supply chain relationship must combine their efforts and cooperate to be successful (Min, 2001). A SCPO defines a firm's internal and external procedures in a synchronized way to create customer value, reflecting an extension of manufacturing enterprise to encompass the entire supply chain, not just an individual company, as the competitive unit (Greis and Kasarda, 1997). Prior to successfully implementing supply chain management, establishing a SCPO inside a firm is essential for guiding decision making and problem solving both inside the firm and within the boundaries of a supply chain (Mello and Stank, 2005).

To highlight the importance of communication and cooperation among an organization's different functions, Narver and Slater (1990) propose interfunctional coordination to examine the specific aspects of the structure of an organization. To take into consideration the supply chain context, as in this study, it is necessary to expand the contemplation of the individual firm to the supply chain scenario and investigate external cooperation with other supply

chain participants. McAfee *et al.* (2002) introduce corporate culture into a supply chain context and discuss the presence of shared values, beliefs, assumptions, and patterns of behavior both within and between firms in a supply chain. They argue that a high degree of cultural consistency is essential for long term relationship-based strategies to be successful. Both internal corporate culture and external supply chain culture should be consistent for an effective supply chain. Developing this consistency requires the delineation of the underlying assumptions, values, and artifacts which were associated with SCPO. A recent work by Min and Mentzer (2004) identifies supply chain management as an integrative philosophy that guides firms in managing the flows from supplier to ultimate user in a synchronized way. They further propose a term "supply chain orientation" to represent the supply chain management philosophy, which, according to their argument, has the following characteristics:

1. a systems approach to viewing the supply chain as a whole, and to managing the total flow of goods from the supplier to the ultimate customer;

2. a strategic orientation toward cooperative efforts to synchronize and converge intra-firm and inter-firm operational and strategic capabilities into a unified whole; and

3. a customer focus to create unique and individualized sources of customer value, leading to customer satisfaction.

In this study, *supply chain partnership orientation* (SCPO) is defined as the perception of the joint efforts of both the supplier and distributor to

achieve mutual and individual goals successfully (Cannon and Perreault Jr, 1999). As defined here, SCPO does not imply one party's acquiescence to another party's need but rather an integrated systemic perspective with which a group of partners works for the common good of all. The SCPO in this study is similar to the supply chain orientation (SCO) proposed by Min and Menzer (2004) in that both SCPO and SCO emphasize the shared beliefs, values, and norms with supply chain partners. However, the SCO is proposed as a managerial philosophy which may be limited to certain individuals, e.g. managers, in an organization; while the SCPO is treated as a manifestation of organizational culture which is unlimited, existing throughout an organization.

As indicated by Mello and Stank (2005), treating supply chain management from an organizational culture perspective rather than managerial philosophy yields two important benefits. First, it helps to clarify that the guidelines governing supply chain behaviors must filter down through all levels of the firm to enhance the implementation of supply chain partnership orientation. Second, it provides a rich literature basis upon which to frame developing theories of behavioral antecedents/consequences of supply chain management, which is consistent with the research framework of this study.

2.4 Supply chain responsiveness

In a rapidly changing competitive world, organizations need to develop a supply chain which is significantly more responsive than existing ones to meet customers' changing needs as well as to reduce any disruptions in supply (Matson and McFarlane, 1999; McCutcheon *et al.*, 1994). As an important facet of supply chain performance (Beamon, 1999; Christopher, 2000; Fisher,

1997; Lee and Billington, 1992), supply chain responsiveness is being accorded more importance than ever. Gindy *et al.* (1999) refer to responsiveness as the ability of a manufacturer to make rapid and balanced adjustments to the predictable and unpredictable changes under today's manufacturing environment. Their research focused on a firm's internal conditions and operational outcomes. Barclay *et al.* (1996) define responsiveness as the ability to react purposefully, and within an appropriate timescale, to significant events, opportunities or threats in order to achieve or maintain competitive advantage. They also define a company's responsiveness capabilities as the degree of responsiveness that it possesses or needs, that is, its ability to react to and/or predict events in order to manage, control, and take advantage of them. More recently, Reichhart and Holweg (2007) find that most authors seem to link responsiveness exclusively to external events and conclude that responsiveness should be regarded as a concept which is solely customer-focused. Accordingly, they define responsiveness as the speed with which a system can adjust its output within the available range in response to an external stimulus.

In its explicit or implicit definition of supply chain responsiveness, most of the existing literature contains the notion of stimuli and customer needs. Compared with other financial indicators of supply chain performance like cost and profit, supply chain responsiveness considers customer satisfaction as a focus of an organization's performance in supply chain management. In this study, the term supply chain responsiveness (SCR) is adopted to represent an organization's willingness in helping customers and its ability to provide prompt service (Bernardes and Hanna, 2009; Gunasekaran *et*

al., 2004; Lai *et al.*, 2002). It is regarded as a propensity for purposefully and timely behavior change in response to a perceived stimulus (Bernardes and Hanna, 2009). It is not a latent means but an outcome.

2.5 Chapter summary

This chapter has provided a discussion on the theoretical background of this study and the relevant concepts in the research. Based on a comprehensive review of resource-based view (RBV) and the culture theory of organizational effectiveness, a theoretical framework has been adopted for this study. Each relevant concept in the research including the supply chain flexibility, organizational culture, and supply chain responsiveness has been reviewed and justified. The literature review provides justification for each of the constructs and their associated relationships that comprise the relationship structure model. The development of the research model will be discussed in the next chapter.

CHAPTER 3 DEVELOPMENT OF THE RESEARCH MODEL AND HYPOTHESES

The previous chapter reviewed the theoretical basis of this study, i.e. the theory of the source-based view of organizational effectiveness and the theory of organizational culture and effectiveness. The key concepts relevant to this research were also discussed. The objective of this chapter is to build on the ideas discussed in the literature review and develop a research model that explains the mediate role of supply chain flexibility between organizational culture characteristics and supply chain responsiveness. This chapter is divided into six sections. As shown in Figure 3.1, Sections 3.1 to 3.5 discuss the interrelationships among the research variables in the proposed research model; seven hypotheses are also proposed and discussed. Finally, Section 3.6 provides a summary of this chapter.
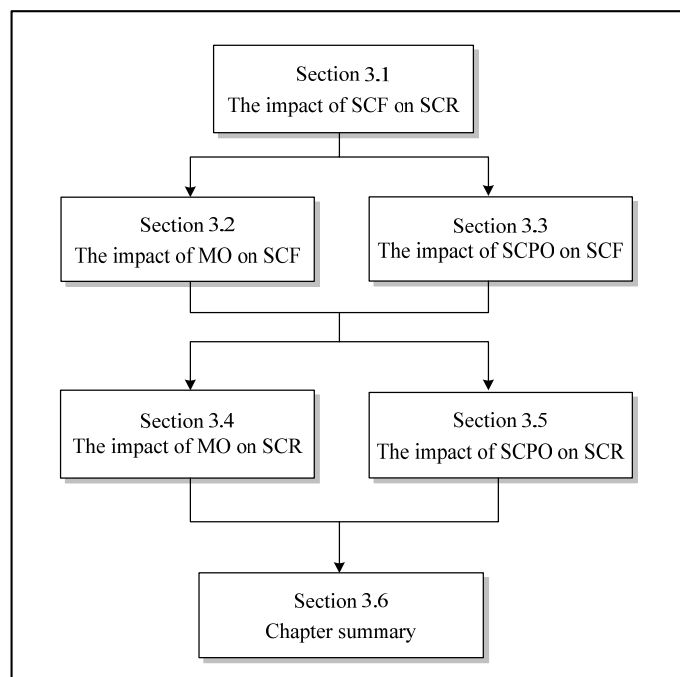
Figure 3.1 Outline of Chapter 3

3.1 The impact of supply chain flexibility on supply chain responsiveness

The RBV theory helps in understanding the necessity of resources and explains how these resources benefit organizations through generating flexible options. Firms in the supply chain are involved in the development and maintenance of a resource portfolio with unique characteristics. The more adaptable the supply chain resources, the better the resource bundle may be reconfigured and redeployed over time (Oliver, 1997). On the basis of the composition and configuration of these resource-based capabilities, real options such as those involving supplier selection, early supplier involvement, product introduction, and distribution channels development are generated. These options allow managers to take flexible organizational actions according to various outcomes, which helps organizations to react quickly and cost effectively with regard to changing market requirements.

In recent years, flexibility has been perceived as a valuable strategy for competitiveness in a dynamic environment. A number of empirical studies have examined the impacts of supply chain flexibility on supply chain performance or organization performance (Avittathur and Swamidass, 2007; Gupta and Somers, 1996; Miller, 1991; Sánchez and Pérez, 2005; Vickery *et al.*, 1999). An early empirical research by Vickery *et al.*(1999) examined five components of supply chain flexibility and found that flexibility of product volume and product launch are the key responses to marketing uncertainty and product uncertainty respectively. Their study indicates an overall positive relationship between supply chain flexibility and a firm's performance. Specifically, performance with respect to product volume, product launch, and

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target market flexibilities has the widest ranging impact on financial and market performance. A recent work by Avittathur and Swamidass (2007) investigates how a strategy of flexibility between a manufacturer and its suppliers affects the firm's profitability. They found that when a plant's strategy of flexibility matches that of its suppliers, greater or at least average profitability can be achieved. In contrast, a mismatch between plant flexibility and supplier flexibility will result in below average profitability.

Previous studies generally indicate a positive relationship between the implementation of flexibility and an organization's performance (Aprile *et al.*, 2005; Avittathur and Swamidass, 2007; Garavelli, 2003; Gupta and Somers, 1996; Llorens *et al.*, 2005; Rajdeep and Patriya, 2001; Sánchez and Pérez, 2005). However, one limitation of these studies is that most of them adopt only financial indicators to evaluate the firm's performance. Since flexibility was seen as a strategy to benefit an organization through meeting its customers' unpredictable demands rather than providing them with cost-effective products/services (Swafford *et al.*, 2006; Zhang *et al.*, 2003), the financial indicators used in such research might not be sufficient and objective enough to examine the effectiveness of supply chain flexibility from a customer-oriented perspective.

As discussed in Section 2.5, supply chain responsiveness (SCR) considers customer satisfaction rather than financial indicators as the focus of an organization's performance in supply chain management. As indicated by Zhang *et al.* (2003), supply chain flexibility facilitates filling customer orders with increasing responsiveness rather than merely improving the efficiency

and effectiveness of equipment and processes. The reconfiguration of supply chain resources according to marketing dynamics requires manufacturing firms to develop cross-functional and cross-company efforts that eliminate bottlenecks and create a level of performance that enables firms to build competitive advantage. Superior responsiveness in the supply chain can be therefore achieved whereby firms can manage in uncertain markets that are changing rapidly. This suggests a direct relationship between supply chain flexibility and supply chain responsiveness. The following hypothesis is therefore proposed:

H1: A firm's supply chain flexibility has a direct and positive impact on its responsiveness in the supply chain.

3.2 The impact of market orientation on supply chain flexibility

The culture theory of organizational effectiveness contributes insights into the role of market orientation and its direct effect on the implementation of supply chain flexibility strategies and supply chain responsiveness. As indicated by Narver *et al.* (1990), market orientation is the organization culture that most effectively and efficiently creates the necessary behaviors for the creation of superior customer value and, thus, continuous superior performance for the business. A market orientation encourages continuous learning about customers' expressed and latent needs and about competitors' capabilities and strategies across the whole supply chain. It is the implementation behavior of the firm's values and beliefs in its marketing concept (Narver and Slater, 1990). Therefore purchasing, manufacturing, and

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logistics functions must also be market oriented for the organization to have a true customer focus. This enables an organization learn faster than its competitors, improve relationships with its customers by efficiently reacting to their manifest needs and wants, thus a more flexible and responsive supply chain can be achieved.

Initial conceptualizations cast market orientation as having three dimensions: customer orientation, competitor orientation and interfunctional coordination, all of which involve behavior of generating, disseminating, and responding to market intelligence regarding sellers and buyers (e.g. Narver and Slater, 1990). However, some have advocated a two-dimensional approach, suggesting that interfunctional coordination is an intra-firm communication mechanism apart from market orientation (e.g. Day, 1994; Gatignon and Xuereb, 1997). Given that the firm's external market linking and the supply chain scenario are the major concerns in this study, the two-dimensional approach which emphasizes an organization's orientation on external supply chain members is considered to be more appropriate for this study. Consequently, we rely only on the customer and competitor dimensions.

A *customer orientation* comprises sufficient understanding of one's target buyer to be able to create superior value for them on a continuous basis (Narver and Slater, 1990). Firms with a customer orientation must always seek to add value to their offerings as required by their customers. Slater and Narver (1995) and Han *et al.* (1998) indicate that in order to respond to market dynamics efficiently, firms should understand customers' real time demands and know of their competitors' actions. Based on this market information, they

can research and develop new products and services for increased competitiveness. A similar view is offered by Gatignon and Xuereb (1997), who point out that customer orientation helps enterprises keep up with market trends, identify the market segment, evaluate the importance of the market and assess the potential growth of the market.

The implementation of supply chain flexibility is a complex strategy which involves multiple corresponding measures of flexibility in manufacturing systems(Gerwin, 1993; Sethi and Sethi, 1990). A customer orientation enables an enterprise always to keep up with market trends, and understand and learn from its customers. Further, in order to maximize their customers' value, the enterprise has to share its knowledge of customers with other supply chain partners, e.g., its suppliers and distributors for a cooperative relationship to respond to their customers' dynamic demands. Therefore, a customer orientation facilitates organizational coordination required in a flexible supply chain. This includes: (i) the development of an interconnected information network which involves a selected group of supply chain partners; (ii) the development of qualified upstream suppliers; (iii) the employment of obtained resources to design and produce innovative products with the active collaboration of suppliers; and (iv) the controlling and adjustment of material and product flows to ensure the right products are delivered to the right customer at the right time.

In brief, a customer orientation enables an organization to learn about the needs of its customers faster than its competitors and increase their control and deploy capability in response to the market's ever-changing demands, thus

improving the flexibility of its supply chain. This suggests the following hypothesis:

H2: A customer orientation has a direct and positive impact on supply chain flexibility.

Competitor orientation is the understanding of both the short term strengths and weaknesses as well as the long term strategies of current and potential competitors, so that managers may take decisions that enable the company to perform well relative to its competitors (Narver and Slater, 1990). Both customer orientation and competitor orientation include those activities associated with the generation of information about buyers and competitors and its dissemination throughout the organization (Kohli and Jaworski, 1990; Narver and Slater, 1990). It is important that this information is spread throughout the organization. By distributing this market intelligence to the entire organization, different parts of the firm can be both proactive and reactive in their responses to this information. These responses can be tailored to the enterprise's activities to satisfy the requirements of the customer as understood by the firm.

Slater (1997) suggests that firms should focus attention on new products introduction, and adjust the product mix so that they can achieve competitive advantages in the market. Jaworski and Kohli (1996) indicate that a competitor-oriented firm tends to analyze and respond to its competitors' market strategies and adopted technology, and use this information to take corresponding measures. Therefore, they are able to produce a greater variety of products and provide customers with more alternative options in compared

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to those from their competitors. Under conditions of intense competition among supply chains in today market environment, a competitor orientation encourages an organization to collect and analyze its competitors' information. Corresponding measures can be adopted in the organization's practice of supply chain management so that the organization is able to respond to its competitors' activities more promptly. For example, they may reorganize their sourcing and distribution channels, adjust their launch activity, or adjust their product mixes and volumes, through which a more flexible supply chain can be achieved. Therefore, the following hypothesis is proposed:

H3: A competitor orientation has a direct and positive impact on supply chain flexibility.

In summary, a market orientation is necessary to understanding the demands of the marketplace and establishing a coordinate relationship with supply chain partners. In the past decades, there have been ever increasing demands to cut costs, improve quality and shorten delivery times. If a firm is truly market-oriented, market intelligence regarding these demands is disseminated through the organization. In response to this market intelligence, organizations in the supply chain may respond by becoming more flexible in their approach to delivering customer value across the supply chain. Thus it is believed that firms with high levels of market orientation will also have high levels of flexibility in their supply chains.

3.3 The impact of supply chain partnership orientation on supply chain flexibility

As discussed in Section 2.4, SCPO is a manifestation of organizational culture which is unlimited, existing throughout an organization. From a supply chain perspective, SCPO enables an organization to share a clear and coherent perception with its supply chain partners with regard to their understanding of the marketplace for the common good of all. That is, it does not imply one party's acquiescence to another party's need but rather an integrated systemic perspective with which a group of partners works for the common good of all. Further, the SCPO as an organizational culture also provides norms for the organization's behavior in their arrangements of sourcing, manufacturing, and distribution.

The implementation of SCF calls for organizational coordination in the supply chain. As suggested by Cannon and Perreault Jr. (1999), both buyers and sellers may be flexible in response to changing market conditions and treat problems as joint responsibilities. Conversely, a focus on working independently to achieve individual goals is characterized by low cooperation. A higher level of supply chain partnership orientation reflects a common belief in appropriate behavior regarding cooperation among supply chain participants. This belief then improves an organization's capability in their arrangements for sourcing, manufacturing, and distribution which are also involved in a flexible supply chain. In brief, the implementation of supply chain flexibility can hardly succeed without close cooperation between each of the tactical activities of distribution flows. This suggests the hypothesis below:

H4: Supply chain partnership orientation has a direct and positive impact on supply chain flexibility.

3.4 The impact of market orientation on supply chain responsiveness

Evidence is abundant that market orientation helps companies to adapt to customer needs and respond to rival firms' moves, and thus results in superior performance (Lee and Tsai, 2005; Narver and Slater, 1990). By definition, market orientation describes such actions as listening to customers and delivering solutions on the basis of the interests and wants of the customers (Deshpandé *et al.*, 1993; Slater and Narver, 1995). Market orientation also takes into account competitors' moves by sharing information among supply chain members about competitive forces to deter market positional erosion (Day and Wensley, 1988).

A market-oriented firm follows specific and identifiable routines and processes, such as collecting, maintaining and using customer and competitor knowledge (Day and Nedungadi, 1994). An integral component of the market orientation process is how the firm shares its information across functions (Martin and Grbac, 2003). From a supply chain perspective, this process of information dissemination involves the coordination of activities not only throughout the organization's internal functions but also among the partners across the whole supply chain. Firms with more market orientation should have more knowledge about their market's needs and competitor activities, and be more likely to share this information across their supply chains with other partners. Therefore, such firms are able to revise their business strategies according to their perceived opportunities and threats more quickly and effectively. That is, the ability of market-oriented firms to promptly respond to

market change should be better than that of their competitors. This suggests the following hypotheses:

H5: A customer orientation has a direct and positive impact on supply chain responsiveness.

H6: A competitor orientation has a direct and positive impact on supply chain responsiveness.

3.5 The impact of supply chain partnership orientation on supply chain responsiveness

Finally, this study considers the effect of supply chain partnership orientation (SCPO) on supply chain responsiveness.

As discussed earlier in Section 3.2, customer orientation and competitor orientation include activities involved in acquiring information about the customers and competitors in the target market and disseminating this information throughout the business. The SCPO, however, considers the supply chain participants' coordinated efforts, typically involving multiple firms across the supply chain, to create superior value for customers. This creating of value involves a synergistic effort among all participants in the supply chain, that is, integrating and adapting the human, capital and logistical resources as necessary in their continuous efforts to create superior value for customers. Since SCPO ensures a consistent belief among supply chain partners in their joint effort, supply chain partnership oriented organizations tend to unify their individual resources and capabilities, and cooperate with both suppliers and distributors to satisfy market demand and achieve mutual goals successfully. Therefore, these organizations are able to adjust their

supply chain activities and strategies in conditions of dynamic environments more promptly and effectively. That is, the supply chain partnership orientation improves an organization's ability to respond to market change. This suggests the following hypothesis:

H7: A supply chain partnership orientation has a direct and positive impact on supply chain responsiveness.

Based on the literature review in Chapter 2, the above subsections have explained the interrelationships among supply chain flexibility, organizational culture characteristics and supply chain responsiveness. To summarize these interrelationships, a model is shown in Figure 3.2, which expresses that the SCR can be not only directly and positively affected by the increase of CUO, COO and SCPO, but also indirectly and positively affected through the mediator, i.e. SCF. This model, as well as its relevant hypotheses, will be investigated and examined at a later stage.
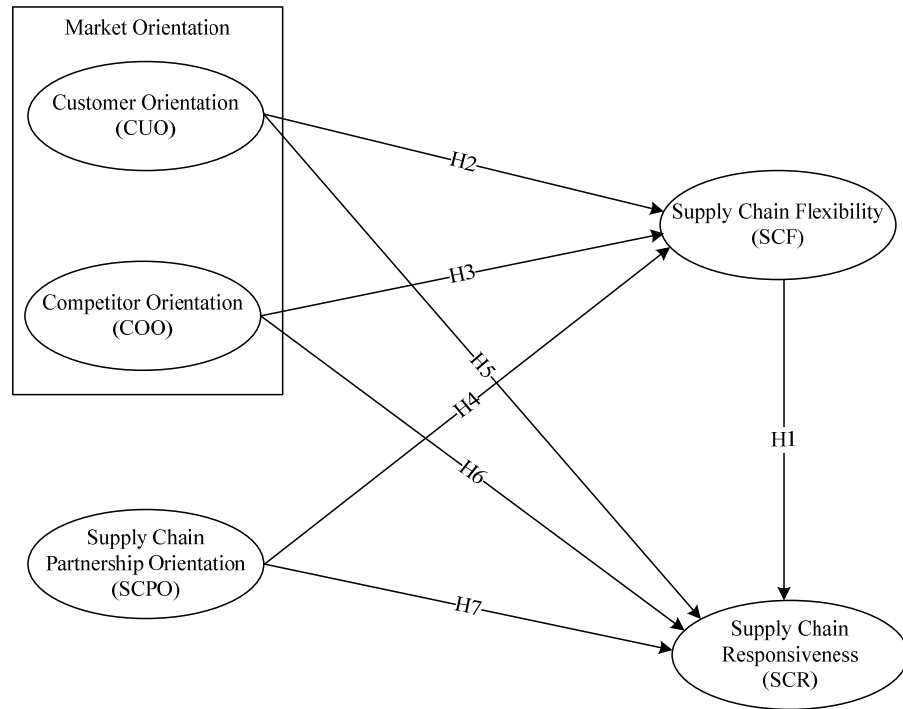
Figure 3.2 The proposed research model for supply chain-oriented flexibility

3.6 Chapter summary

This chapter has provided the theoretical justifications from which the relationship structure model was deduced. Seven research hypotheses that represent the relationships between the model constructs have been presented. In the next section, a multiple-case study will be utilized to examine the components of supply chain flexibility.

CHAPTER 4 MULTIPLE-CASE STUDY

In Chapter 2, a theoretical discussion regarding the interrelationship among the culture, behaviors and effectiveness of an organization was presented. A construct model of supply chain flexibility (SCF) was also proposed in Section 2.2.2. Since this is a new instrument with its scales as yet not established or validated, the objective of this chapter is to illustrate and examine the components of the supply chain flexibility construct through a multiple-case study. The organization of this chapter is illustrated in Figure 4.1. After an introduction of the research objectives of the multiple-case study in Section 4.1, the research design and the method used for the case study are discussed in Section 4.2. This is followed by the administration of the interviews in Section 4.3 and the empirical observations in Section 4.4. Next, the findings of the case study are presented and discussed in Sections 4.5 and 4.6. Finally, a chapter summary is provided in Section 4.7.
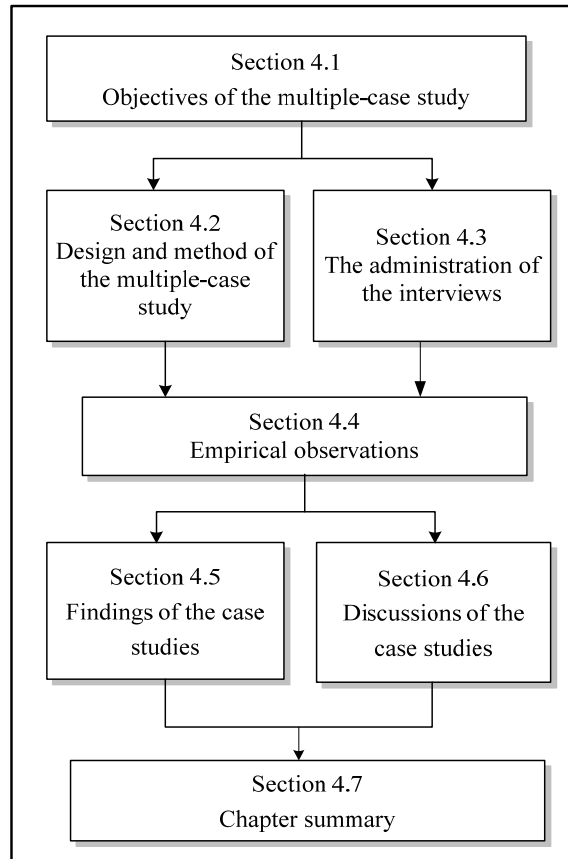
Figure 4.1 Outline of Chapter 4

4.1 Objectives of the multiple-case study

A qualitative study captures the reality of a given situation in substantial detail and is particularly useful when a natural setting or a focus on contemporary events is needed (Yin, 2003). As discussed in Section 2.2, there is a lack of a standardized and validated conceptual framework for supply chain flexibility in the existing literature. A multiple-case study approach was chosen to examine the proposed conceptual framework for supply chain flexibility before the large scale postal survey was conducted in the next stage. The specific objectives of this multiple-case study were:

1. to examine the conceptual framework of supply chain flexibility; and

2. to confirm the initial item scales for the supply chain flexibility construct.

4.2 Design and methodology of the multiple-case study

In this stage of exploratory qualitative study, interviews with the invited participants were conducted since they provided opportunities to probe beyond initial responses, resolve ambiguities, and overcome unwillingness to answer particular questions (Perreault Jr. and Leigh, 1989). Although there are no precise guidelines for the number of cases that should be included, the widest accepted range falls between two to four as the minimum and ten to 15 as the maximum (Perry, 1998). Five companies from the textile and apparel industry in China were carefully identified and invited to participate in the study.

One important criterion in selecting the sampling units was that a case study needs to cover both the phenomenon of interest and its context, thus yielding a large number of potentially relevant variables (Yin, 2003). In this regard, the companies selected for the study represented various participants in the supply chain by including a fabric manufacturer (Company E), a garment manufacturer (Company A), two trading companies (Companies C and D), and a brand company (Company B). This wide diversity in the sample increases the possibility of generalizing the results and exploring patterns within the industry. Indeed, the firms selected have met the diversity requirements in terms of supply chain flexibility, as they range from highly volatile and

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uncertain sectors (e.g., fashion apparel firms) to relatively stable ones (e.g., fabric manufacturers). The profiles of the participating companies are shown in Table 4.1.

Table 4.1 Background information on the companies in the exploratory study

	Companies				
	A	B	C	D	E
Nature of Business	Manufacturer	Brand marketer	Trading company	Trading company	Manufacturer
Product Sector	Knitwear	Knitted Underwear	Fabric and garments	Fabric and household textile products	Fabric
Turnover (2006, approx) (USD)	7 million	1 million	50 million	200 million	6 million
Geographic markets served	North America and Europe	Mainland China	Korea and Japan	U.S.	North America, Europe and Asia
Approximate number of employees	1300	100	30	50	1500

4.3 The administration of the interviews

The target interviewees were product managers, general managers, supply chain managers, and other executives who possessed proper knowledge of the entire business process under investigation. These managers were contacted by letter or telephone to explain the purpose of the research and to invite them to participate. Face-to-face interviews of approximately one to two hours in length were arranged with those who agreed to participate. The

interviews followed the in-depth interview format, in which the interviewer followed a set of developed questions (see Appendix A), but the interviews still remained fairly open-ended to allow the interviewees to give their opinions about, and insights into certain issues. The interviews were recorded on audiotape with the permission of the interviewees, and the interviewer also took hand-written notes. If any questions were not answered satisfactorily, then follow-up telephone interviews were carried out for further clarification. All of the interviewees received organized minutes of their interviews via e-mail to check for errors and to evaluate the validity of the interpretation and description. Any errors were duly corrected. In addition, secondary data were also collected by examining published information, company documents and websites. This information was used to provide background and context to the primary research data gathered from the interviews.

After the full transcript was compiled and edited by the researchers and confirmed by the interviewers, a further review was conducted. The quality, accuracy, and correctness of the transcript contents were verified by an independent researcher. This comprehensive documentation process enhances construct validity and strengthens the grounding of theory (Yin, 2003).

4.4 Empirical observations of the case studies

Key empirical observations were made regarding the flexibility strategies adopted by the companies to respond to perceived environmental uncertainties. Table 4.2 summarizes the collected data and provides relevant examples given by the interviewees. These strategies were further categorized into four dimensions according to their corresponding processes in the supply

chain, namely sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. The activities involved consisted of raw material and component sourcing, product manufacture and assembly, warehousing and inventory tracking, order entry and management, distribution across all channels, delivery to customers, and the information systems necessary to monitor all of these activities.

Table 4.2 Summary of case study results on flexibility strategies adopted in the supply chain

Flexibility strategy	Cases involved	Example from cases	Nature of flexibility
Availability of multiple suppliers	All	"We should always be familiar with the features and advantages of each of our various suppliers so that in cases of emergent orders, we can get reliable ones immediately." (Company C) "We make inquiries to more suppliers than we need and choose two or three of them as our backup suppliers with all of the details of price, lead times, and delivery schedules set beforehand. If our primary suppliers cannot fulfil our orders on time, we can then get backups efficiently." (Company A)	Sourcing flexibility
Changeover among various suppliers	Companies A, B, D, and E	"We should always be familiar with the production capabilities of our suppliers and pay special attention to their quality. If problems are found, we can change to other suppliers." (Company D) "Cost is an important factor in selecting our suppliers. We may switch to other suppliers if the existing ones cannot provide us with competitive	Sourcing flexibility

prices." (Company A)

Adjustment of production	Companies A, B, and E	"To eliminate slack capacity in off-season or overload in peak season, production has to be well-assigned and -adjusted according to company's competency and the market demand." (Company A)	Operating system flexibility
Availability of sub-contractors	Companies A, C, and E	"We use sub-contractors if we cannot fulfil an order on time." (Company A) "Sometimes sub-contractors are also adopted to improve our efficiency of performing emergent tasks." (Company C)	Operating system flexibility
New product development	All	"We always need to provide new products to satisfy our customers. We are sensitive to fashion trends." (Company C) "Compared with our competitors, we can provide more fashionable and stylish products. Our company invests a great deal in new product development, which enables our products keep in step with fashion trends." (Company E)	Operating system flexibility
Standardized modules for multiple products	Companies A, B, and E	"We may use standardized modules of accessories (e.g., buttons, zippers, and laces), styles, or fabrics to develop more products." (Company A)	Operating system flexibility
Flexible delivery modes	Companies A, C, and E	"Sometimes we use air delivery for emergent orders, which results in an extra cost of US$2.5-3 per item of apparel." (Company A) "We prefer a connecting flight to a direct one on	Distribution flexibility

		condition that the former can meet our customer's demand for delivery time. This saves us a considerable cost." (Company C)	
Alignment of product characteristics and customer requirement	Companies A and B	"Consumers' tastes, habits and behaviour vary in different areas that affect their buying habits. Even the same individual agent or buyer can behave in different ways when buying different products. Therefore, we have to arrange various marketing and channel strategies." (Company B)	Operating system flexibility & Distribution flexibility
Technology innovation & Capability of the information system in supporting different functional departments	Companies A and C	"Newly developed technology is important for us to improve the manufacturing process and save on costs, e.g. postponement can help us save on costs and excess inventory. However, it cannot be achieved without the support of information technology and innovations in knitting and dyeing." (Company A) "Sales managers and production managers are familiar with the variation in production capability and demand among seasons. Communication and cooperation are important for an efficient organization to balance the needs for a proactive and responsive organizational structure." (Company A)	Information system flexibility
Capability of the information system in supporting various supply chain partners	Company E	"We adopted Vendor Managed Inventory (VMI) since the year before last. Therefore, we share certain information to our major suppliers so that they can take full responsibility for maintaining the agreed inventory of the material." (Company E)	Information system flexibility

4.5 Findings of the case studies

Of the four flexibility strategy dimensions, sourcing flexibility and operating system flexibility are the most widely adopted. As shown in Table 4.2, all of the companies interviewed engage in certain flexibility activities in their sourcing and operating systems. Distribution flexibility, however, seems to be less important for the companies in this case study. Information technology had great attention attached to it by the case companies since most of them have recognized the importance of information sharing in today's changing market environment.

Sourcing flexibility

Regarding sourcing flexibility, all of the companies have formed cooperative relationships with multiple suppliers, which implies that close attention is paid to the dynamics and complexity of the supply chain. As described in Table 4.2, the identified flexibility strategies by the interviewed companies in their sourcing include finding multiple suppliers, or changeover among various suppliers whenever necessary. However, because of the advantageous position that manufacturers hold in their relationships with suppliers, they tend to shift the pressure from their downstream customers to their upstream suppliers. Some of the manufacturers said that they felt confident about switching suppliers if their present ones had any cost or quality problems, and they felt at liberty to do so.

Operating system flexibility

Because of the business nature, the strategy of improving the flexibility of operating systems is more widely adopted by manufacturers and brand

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companies than it is by trading companies. The identified flexible strategies used by the interviewed companies in their operating systems include adjusting of production, finding multiple sub-contractors, developing new products more frequently, using standardized modules for multiple products, and the alignment of product characteristics.

An interesting example is the case of Company A, which behaves as both an Original Equipment Manufacturer (OEM) for several European brands and as an Original Brand Manufacturer (OBM). This company has adopted a composite strategy with regard to its operating system. For its OEM business, it has adopted a responsive and adaptive strategy. For example, it reserves a certain amount of slack capacity for rush orders or anticipated seasonal demands at the beginning of each season. For this company's OBM business, in contrast, it has adopted a much more proactive and initiative-based strategy to reduce the dynamics and complexity of the supply chain. For example, it uses more standardized modules (e.g., small buttons, zippers, and lace), styles, and fabrics in its product designs to alleviate the challenges of product line complexity. The company is also in the pilot stage of adopting a postponement strategy originally used by Benetton (Waller *et al.*, 2000) to reduce prediction errors and inventories. Moreover, because it is familiar with its self-owned brands and their markets, the company is able to implement a flexible organizational structure that balances the needs of both proactive and adaptive flexibility, reduces the risk of environmental uncertainties, and makes substantial savings in operating costs.

Distribution flexibility

Distribution flexibility was not generally regarded to be as important as sourcing and operating system flexibility by the companies in this case study. This might be because most of them, that is, A, B, C, and D, have outsourced their logistics to third-party logistics providers (3PL). Their selections of delivery mode and carriers are generally in accordance with customer demand, and they are not fully knowledgeable about how to control logistics costs and improve logistics efficiency. Nevertheless, compared with manufacturers, trading companies seem to pay more attention to this dimension. Company C, a fashion apparel trading company, is highly sensitive to logistics costs. It is familiar with its customers' different distribution centers and retail shops and carefully arranges flights for every shipment. The company prefers to use connecting flights rather than direct ones to save on costs, as long as the former are able to meet their customers' demands with regard to delivery time.

Information system flexibility

Finally, all of the case companies also paid close attention to information technology. The flexible strategies used by the interviewed companies in their information systems include the use of information technology innovation, and the development of the capability of the information system in supporting different functional departments and supply chain partners. Company A, a leading knitwear company, indicated that their postponement strategy involves technological innovations in dyeing and finishing, the rebuilding of the manufacturing process, and financial support. The application of this strategy cannot succeed without the support of information systems in both internal and external supply chain management.

For most of the other investigated companies, information flexibility was perceived to be an important enabler of supply chain flexibility. Specifically, in today's supply chain environment, information should be shared not only among different internal functional departments of a company, but also among external supply chain partners. This information sharing cannot be achieved without a flexible and robust information system.

In summary, today's volatile market environment is characterized by unpredictable dynamics in the supply chain, which can arise from upstream suppliers (e.g. reliability of material quality, lead-time of suppliers, responsiveness of suppliers), downstream customers (e.g. emergent orders, product forecast errors, product obsolescence), or industrial competitors (e.g. low entry barriers, aggressive competition). Supply chain flexibility is perceived to be an important competitive priority. This multiple-case study has investigated the flexibility strategies that supply chain participants adopt in response to various perceived environmental uncertainties.

4.6 Discussion of the case studies

Supply chain flexibility is the capability of firms to respond to unanticipated changes in their customers' needs as well as their competitors' activities (Upton, 1994; Zhang *et al.*, 2003). As study of the adoption of flexibility strategies has been an area of substantial research interest regarding how organizations respond to environmental uncertainties or risks, the development of an SCF instrument is considered to be important. However, there is a lack of valid operational measures of this construct and no research has been done towards a systematic development of it.

The results of this multiple-case study indicates that the identified flexible strategies adopted by the interviewed companies, as shown the first column of Table 4.2, can be categorized into four essential dimensions of SCF construct, namely sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. For organizations aiming at improving their supply chain flexibility, this measurement instrument can be used as a self-diagnostic tool to identify areas where specific improvement is needed, and to pinpoint aspects of a firm's SCF that require improvement. Using the findings of this case study and the literature review in Chapter 2 as foundations, a measurement model of SCF can be developed, and the relationships among the research variables can be empirically examined by a large scale mail survey.

4.7 Chapter summary

This chapter has examined the four components of supply chain flexibility construct as well as their corresponding scale items, which were identified from an in-depth literature review in Chapter 2, through a multiple-case study. In the next chapter, the research design and methodology which are adopted to examine the proposed conceptual model in this study will be discussed.

CHAPTER 5 RESEARCH METHODOLOGY

This chapter presents the research methodology chosen to address the research questions proposed in Section 1.2. A two-stage research methodology was used in this study. In the first stage, an exploratory study was conducted, which was discussed in previous Chapters 2, 3 and 4. In the second stage, a postal survey was adopted to collect data from the textile and apparel industry on the Chinese mainland to investigate the research model.

This chapter is divided into six sections, as shown in Figure 5.1. Sections 5.1 and 5.2 provide a justification of the research paradigm and methodology. Next, Sections 5.3, 5.4, and 5.5 describe the procedure of the postal survey including the sampling strategy, questionnaire design and administration, and data analysis method. Finally, a summary of the chapter is provided in Section 5.6.
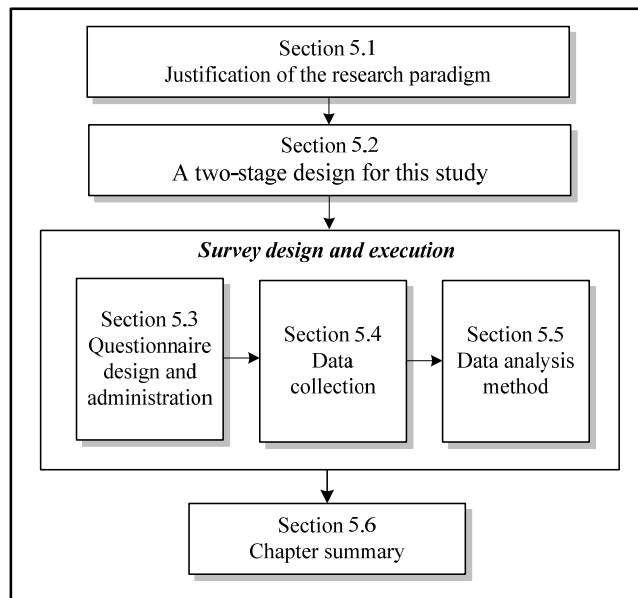
Figure 5.1 Outline of Chapter 5

5.1 Justification of the research paradigm

A paradigm is an overall approach underlying a methodology either explicitly or implicitly (Perry *et al.*, 1999). Paradigms can be models, intellectual frameworks, or frames of reference, with which researchers can affiliate themselves. While the methodology is concerned with the practicalities of how we come to know, the paradigm is the philosophy of knowledge of how we come to know. In the area of business research, four paradigms, namely *critical theory*, *constructivism*, *realism*, and *positivism* have competed for acceptance as the paradigm of choice (Guba *et al.*, 2005). In this study, the underlying paradigm can be classified as a combination of *realism* and *positivism*.

Realism postulates that there is a real world independent of researchers waiting to be discovered, although there may be many different perceptions of it (Kerlinger, 1986). Research governed by this paradigm involves searching, although necessarily imperfectly, for an understanding of a common reality (Perry *et al.*, 1999). For this study, to investigate how enterprises carry out flexibility strategies in their supply chain management, a multiple-case study involving five companies was therefore decided upon, which was discussed in Chapter 4.

Next, a conceptual model with seven hypotheses was established in Chapter 3 on the basis of a comprehensive literature review in Chapter 2. The testing of this conceptual model and its seven hypotheses are covered by the positivist paradigm. The positivist perspective is the traditional scientific approach whereby results are derived through deductive testing and driven by immutable laws. Under the positivist paradigm, researchers focus on facts and

search for direct causes and effects, remaining external to the events being examined. Positivists believe that the context of phenomena does not influence the results because it is irrelevant or is controlled. The positivist paradigm was adopted for this study to examine the relationships among market orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness. A proposed conceptual model which explains the relationships of these issues was tested through a questionnaire survey.

In summary, the primary objective of this research was to address the gaps in the current body of knowledge on supply chain flexibility through examining the practice of organizations in the textile and clothing industry, thus bringing depth to some pre-existing theories for the purpose of resolving the research problem. A combination of realist and positivist research paradigms was therefore adopted.

5.2 The two-stage design for this study

After justifying the paradigm for this thesis, an appropriate research design was needed to ensure that the information and data collected would answer the research questions and could be collected economically. A research design is a framework or blueprint for conducting research and specifies the procedures necessary to obtain the information needed to structure and solve the research problem (Malhotra and Peterson, 2002). The most common research designs include exploratory, descriptive, and causal (Malhotra and Peterson, 2002; Tull and Hawkins, 1990). In this study, Stage one involved *descriptive* and *exploratory* research, and Stage two *descriptive* and *causal*.

Each of these types of research played a distinct and complementary role in this study.

Exploratory research was used to investigate the background information for the research questions, to clarify the problems and to generate hypotheses. Generally, exploratory research is flexible, unstructured and qualitative (Aaker *et al.*, 2001). In this study, exploratory research included the literature review and a multiple-case study, both of which were used to gain insights into the research problem and to indentify and examine the components of the supply chain flexibility construct.

Descriptive research was adopted in both Stages one and two to describe the characteristics of supply chain phenomena. For example, the flexibility strategies adopted by the investigated companies were identified and are described in the multiple-case study of the first stage in Section 4.4. In the second stage, details of the large scale survey are described in Section 5.4, as well as evaluation results of the reliability and validity of the measurement scales in Section 6.2.

However, descriptive research can hardly establish a direct cause-and-effect relationship, if any, between research variables, and *causal* research had to be conducted for this purpose (Malhotra and Peterson, 2002). That is, the causal research was used to provide evidence of a relationship or an association between the research variables. It created a situation where conditions were cautiously controlled so that the independent variables could be measured to test a hypothesis about a dependent variable (Zikmund, 2000). While there was no manipulation of variables in this study because an

experiment could not be conducted, the data gathered through the survey was modeled using structural equation modeling (SEM) to explain how the variables were related. A more complete description of this study of SEM is discussed in Section 5.5.

In brief, for this study, an exploratory study in the form of a literature review and a multiple-case study was conducted and is described in Chapters 2 and 4. An understanding of the background and research issues under investigation was then developed. This was followed by descriptive and causal research in Stage two, in which a questionnaire survey was designed and which is described in the following sections of this chapter. The testing results of the seven hypotheses will be reported in Chapter 6.

5.3 Questionnaire design

After the first stage of the research, a questionnaire was designed to serve a number of functions by translating the research objectives into a series of questions. The questionnaire design for this study followed a formal schedule so that the collected data was consistent and could be analyzed in a uniform and coherent manner (Malhotra and Peterson, 2002). First, a set of questions was devised to elicit the required information. Second, care was taken to make the questions easily comprehensible to motivate respondents to cooperate and complete the questionnaire. Finally, survey administration and data processing was facilitated through pre-coding the questions and using a standard response format (Lorelle Frazer and Lawley, 2000; Malhotra and Peterson, 2002). The questionnaire developed and used in this study is presented in Appendix B.

5.3.1 Specifying the data needed and defining concepts and measurements

The first step in the questionnaire design was to determine the information needed in order to achieve the research objectives. In this study, the research questions and research objectives were proposed in Section 1.7. An in-depth literature review was conducted in Chapter 2 to identify information relating to the research questions. A research model, which involves seven hypotheses, was developed in Chapter 3 to provide a framework for the questionnaire design.

Before the measurement process could be initiated, concepts relevant to the research questions had to be identified. A conceptual definition states the central idea or essence of a concept or construct through assigning theoretical or abstract meanings (Sekaran, 2000; Tull and Hawkins, 1990). It aids the process of thinking by subsuming a number of events under one heading (Tull and Hawkins, 1990). For this study, each construct of research interest was conceptualized by a formal definition, as summarized in Table 5.1.

Table 5.1 Formal definitions of constructs

Construct	Definition
Customer orientation	The sufficient understanding of one's target buyers to be able to create superior value for customers continuously (Narver and Slater, 1990)
Competitor orientation	The understanding of both the short term strengths and weaknesses as well as the long term strategies of current and potential competitors,

Construct	Definition
	so that managers make decisions that enable them to perform well relative to their competitors (Narver and Slater, 1990)
Supply chain partnership orientation	The perception of the joint efforts of both the supplier and distributor to achieve mutual and individual goals successfully (Cannon and Perreault Jr, 1999)
Supply chain flexibility	The capability of an organization to respond to internal and external changes to gain or maintain competitive advantage.
1) *Sourcing flexibility*	The availability of resources of qualified materials and services, and the ability of effective purchasing processes to respond to changing requirements (Lummus *et al.*, 2003; Swafford *et al.*, 2006)
2) *Operating system flexibility*	The ability to exploit the uses of obtained resources and provide a range of products and services effectively to respond to changing requirements (D'Souza and Williams, 2000; Koste *et al.*, 2004; Sethi and Sethi, 1990)
3) *Distribution flexibility*	The ability to exploit the uses of logistic resources and effectively adapt the process of controlling the flow and storage of materials, components, finished goods, and services to their destination in response to dynamic marketplace conditions (Duclos *et al.*, 2003; Swafford *et al.*, 2006)
4) *Information system flexibility*	The accommodation of the organization's information system, especially in situations of unexpected disturbance (Duclos *et al.*, 2003; Lee, 2000; Swafford *et al.*, 2006)

Construct	Definition
Supply chain responsiveness	The capability of the organization to provide customers with timely and prompt service (Gunasekaran *et al.*, 2004; Lai *et al.*, 2002).

5.3.2 Control variables

To fully account for the differences among organizations, some necessary control variables were included in this research to characterize the firms being analyzed in this study.

First, compared with functional products which have long product life cycles and stable demand, innovative products have a shorter lifecycle and high forecasting errors (Fisher, 1997; Lee, 2002). For example, in fast-fashion or high-fashion industries, product ranges and styles are constantly renewed; in basic apparel industry, however, there is less product variety and low obsolescence. The ability of a firm's supply chain to respond to market demands might be influenced by the demand predictability. That is, with the increase of the predictability of end consumers' demand, the probability that a manufacturer makes a sufficiently accurate production plan will increase, which might lead to a decline in the need for a prompt supply chain. Consequently, the predictability of customer demand was specified as a control variable in this study.

Next, larger firms may be in a better position to achieve a responsive supply chain due to their relative bargaining power, experience in supply chain management, and available resource base. Therefore, firm size was also included in the research model to control for these extraneous effects.

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5.3.3 Initial instrument development

The proposed conceptual framework of this study, which is presented in Figure 2.2, illustrates the relationships among market orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness. A literature review was conducted in Chapter 2 within the domain of the construct to generate sample items. A substantial part of the measures of market orientation, supply chain partnership orientation and supply chain responsiveness were replicated and modified from existing studies. Their initial item measures and related references are presented in Table 5.2. The measures of supply chain flexibility, however, were newly developed for this study. Therefore, a preliminary study was needed to purify and validate the instrument. The preliminary study on the SCF construct is discussed in the next section.

Table 5.2 Initial item measures of the research constructs and their related references

Construct	Item measures and related references
Customer orientation (CUO)	1. Business objectives are driven by customer satisfaction (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990) 2. A good understanding of our customers' needs and a right prediction of the fashion trend (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990) 3. Systematic measurement of customer satisfaction (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)

Construct	Item measures and related references
	4. Close attention to after-sales service (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)
Competitor orientation *(COO)*	1. Information sharing among sales people about competitors' strategies and activities (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)
	2. Discussions among top managers about competitors' strategies and activities (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)
	3. Ability to effectively respond to competitive actions (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)
	4. Targeting of opportunities for competitive advantages. (Deshpandé and Farley, 1998; Hsieh *et al.*, 2008; Narver and Slater, 1990)
Supply chain partnership *orientation* *(SCPO)*	1. Belief in supply chain partners' ability to respond with understanding when we share our problems. (Min, 2001)
	2. Belief in supply chain partners' joint responsibility in the whole chain. (Min and Mentzer, 2004; Siguaw *et al.*, 1998)
	3. Never taking advantage of a strong bargaining position in the supply chain. (Min and Mentzer, 2004; Siguaw *et al.*, 1998)
	4. Being willing to make cooperative changes with supply chain partners. (Min and Mentzer, 2004; Siguaw *et al.*, 1998)
	5. Belief in working together with supply chain partners to be successful. (Min and Mentzer, 2004; Siguaw *et al.*, 1998)

Construct		Item measures and related references
Supply chain flexibility (SCF)	*Sourcing flexibility (SF)*	1. Number of available suppliers (Swafford *et al.*, 2006) 2. Range of products and services provided by major suppliers (Swafford *et al.*, 2006) 3. Range of suppliers that provide major materials/components/products (Lummus *et al.*, 2003; Swafford *et al.*, 2006) 4. Ability to add and remove suppliers (Lummus *et al.*, 2003; Swafford *et al.*, 2006)
	Operating system flexibility (OSF)	1. Range of new products or services the firm can develop every year (Koste *et al.*, 2004; Sethi and Sethi, 1990) 2. Ability to change the output volumes (Koste *et al.*, 2004; Sethi and Sethi, 1990) 3. Ability to change the product and service mix (Koste *et al.*, 2004; Sethi and Sethi, 1990) 4. Ability to adjust manufacturing facilities and processes (Gupta and Somers, 1996; Koste *et al.*, 2004)
	Distribution flexibility (DF)	1. Number of warehouses, loading capacity, and other distribution facilities (Swafford *et al.*, 2006) 2. Ability to add or remove carriers or other distributors (Swafford *et al.*, 2006) 3. Ability to change warehouse space, loading capacity and other distribution facilities (Swafford *et al.*, 2006) 4. Ability to change delivery modes (Swafford *et al.*, 2006)
	Information system flexibility (ISF)	1. Range of information technology the firm adopts in supply chain management (Lee, 2000; Lee and Whang, 2000) 2. Capability of the information system in supporting different functional departments (Lee, 2000; Lee and Whang, 2000) 3. Capability of the information system in supporting

Construct	Item measures and related references
	different partners in the supply chain (Lee, 2000; Lee and Whang, 2000)
Supply chain responsiveness (SCR)	1. Promptly responding to customers' enquiries (e.g. responding to their enquiries about varieties, specifications, price, sales conditions, delivery, special packing) (Lai *et al.*, 2002; Parasuraman *et al.*, 1988; Pitt *et al.*, 1995) 2. Providing advance notice to customers about exactly when products/services will be ready (e.g. providing the estimated time of arrival via telephone/fax/email; advising estimated time to change B/L to D/O) (Lai *et al.*, 2002; Parasuraman *et al.*, 1988; Pitt *et al.*, 1995) 3. Being willing to help customers (e.g. by giving advice on delivery schedules or packaging, tracking and tracing status of operation/shipping) (Lai *et al.*, 2002; Parasuraman *et al.*, 1988; Pitt *et al.*, 1995) 4. Responding in a timely fashion to customers' requests (e.g. providing prompt delivery, special orders, transshipment arrangements) (Lai *et al.*, 2002; Parasuraman *et al.*, 1988; Pitt *et al.*, 1995)
Firm size (SIZE)	1. The number of employees (Blau, 1970)
Predictability of customers' demand (PRED)	2. Margin of error in product forecasting (Patnayakuni et al., 2006; Wang et al., 2006)

5.3.4 Preliminary study on supply chain flexibility construct

The 18 initial item measures of SCF with their related references are also summarized in Table 5.2. Given the identification of a theoretical domain of SCF, formal conversion of the construct definitions into measurable scales can be undertaken. Experts and potential respondents were invited to review

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the measuring items for potential problems resulting from ambiguous or poorly defined scale operationalizations (Churchill, 1979). Seven experts, two academics in the supply chain field and five industry practitioners were invited to give a critical review regarding the completeness, understandability, terminology, and ambiguity of the items in the instrument.

In addition, a sorting procedure similar to that of Segars and Grover (1998) was also adopted to examine whether the items used to operationalize the construct actually measure what they are supposed to measure (Churchill, 1979). This procedure can provide a powerful means of confirming the underlying structure of complex variables and establishing their validity. Since it was a new instrument that was being used to measure SCF with its scales being neither well established nor validated, this process is essential. Descriptions of the hypothesized constructs as well as a random listing of the 18 items developed for SCF were provided to another three academic and four industry participants. All of the 18 items were recast in the form of single sentences and were provided on one page separated from the construct descriptions. The construct descriptions consisted of a single paragraph and were presented on a single page. The instructions, which were provided on the cover sheet, asked the respondent to read the construct descriptions and group items carefully according to four dimensions of SCF as defined in Section 2.2. The respondents were also encouraged to indicate the indeterminable matches, comment on the importance of the research issues and the ambiguity or lack of clarity in the wording of scale items, and suggest changes.

The item placement ratios assess content validity of the generated items and reliability of the proposed constructs (Moore and Benbasat, 1991). The responses were computed for each construct regarding the frequencies with which each item was correctly associated and matched with its intended construct, as shown in Table 5.3. The results of all constructs exceeded the recommended level of 70% and the overall placement ratio of items within the target constructs reached 89% (SF=91%; OSF=89%; DF=89%; ISF=90%), which confirmed the adequacy of the developed scale items in capturing the pre-specified factors. Consequently, no further analysis was deemed necessary for item refinement or development, and conceptual definitions from the literature were employed as measures of their associated constructs.

Table 5.3 The results of sorting the measurement items

	SF	OSF	DF	ISF
Respondent 1	5	5	4	3
Respondent 2	4	4	5	3
Respondent 3	5	5	4	2
Respondent 4	5	5	4	3
Respondent 5	4	4	5	2
Respondent 6	5	4	4	3
Respondent 7	4	4	5	3
Total score	32 (91%)	31 (89%)	31 (89%)	19 (90%)

Notes: The number in each cell represents the number of items which was correctly sorted into the corresponding constructs

5.3.5 Questionnaire translation and pilot test

After refining the items, the questionnaire, administered in Chinese, was double translated to ensure that the meanings of all items in the Chinese version of the questionnaire were the same as in the English version for which scales were heavily drawn from the literature. A few changes to the scales were made in order to match the Chinese context. A pilot test was carried out to further test and refine the measurement items before large-scale data collection. The pilot test was conducted with 35 practitioners in the field through a convenient sample, five from part-time MBA students in the Hong Kong Polytechnic University who were full-time practitioners in the field of supply chain management in the textile and clothing industry, and another 30 from senior executives within the supply chain function of textile and clothing manufacturers in China. The respondents were asked to indicate on a seven-point scale the extent to which they agreed with the items. In addition, each respondent was also encouraged to provide suggestions for improving the content and the format of the questionnaire. The pilot test resulted in some minor modifications to the wording and several minor editorial issues related to the format of the questionnaire.

5.4 Data collection of main survey

Subsequent to the development of the final questionnaire, a large scale survey was conducted. This section describes how the data from this survey were collected.

The *Directory of Chinese Enterprises* (China Community Net, 2007), issued by the Ministry of Commerce of the People's Republic of China, was

used in this study to identify suitable companies for targeting. Companies under the categories of garment, knitting textile and crocheted textile, chemical fiber, fur and leather, home textile and apparel, yarn and thread were included in the survey. The target respondents of this study were senior staff within the supply chain function of the firms, with titles such as senior executive, vice president, director of supply chain or operations, general manager, plant manager, or product manager. These top managers were targeted because of their knowledge of the operation and strategic management of the supply chain.

The final survey questionnaire was mailed to the managers of the target firms. Each person was mailed a personalized cover letter to ask for their participation in this study, together with a copy of the self-administered written questionnaire, and a pre-addressed postage-paid return envelope. To increase the response rate and to encourage accurate responses, each potential participant was promised a copy of the survey results. A second survey package was sent out to those non-respondents one month after the first mailing. In cases where a survey package was returned because of undeliverable address, a replacement firm was selected. A total of 1330 questionnaires were mailed, and 207 were returned, with 156 of them from the first mailing and 51 from the second one. 15 of them were not useable because of significant data being missing or incompleteness. The remaining 192 responses represented 14.44% of the mailed questionnaires.

One way of examining non-response bias is to test for statistically significant differences between the early (those responding to the first mailing)

and late (responding to the second mailing) waves of returned questionnaires (Armstrong and Overton, 1977) . For this study, a *t*-test was performed to examine any differences in all scale items between the two groups. The results showed no significant differences at the 5% level for all constructs, suggesting that non-response bias was negligible.

The profiles of the respondents and their companies are displayed in Table 5.4 and Table 5.5.

Table 5.4 Management level of respondents

	Frequency	Percentage
Executive and senior manager [a]	18	8.9
Middle manager	153	75.7
Professional	31	15.4

Notes: [a] The executives and senior managers include senior executive, vice president, general manager, or other high-ranking executives; the middle managers include plant manager, director of supply chain management, director of operations etc; professionals refers to supply chain manager, operations manager , product manager etc.

Table 5.5 Profile of the respondent companies

	Frequency	Percentage
Number of employees		
Below 200	69	34.2
200-500	64	31.7
501-1000	25	12.4
1001-2500	21	10.4
Over 2500	18	8.9

Unknown	5	2.5

Average annual sales turnover in the past 3 years (RMB):

Below 5 million	14	6.9
5-<10 million	40	19.8
10-<50 million	60	29.7
50-<100 million	42	20.8
Over 100 million	41	20.3
Unknown	5	2.5

5.5 Justification of data analysis method

The selection of an appropriate statistical analysis technique should take into consideration the research problem, objectives, characteristics of the data, and the underlying properties of statistical techniques (Malhotra and Peterson, 2002). Structural equation modeling (SEM) provides a method of testing hypotheses about relationships among latent and observed variables by estimating a set of separate multiple regression equations simultaneously (Hair *et al.*, 1998). In addition, SEM techniques allow researchers to examine the measurement and structural properties of a theoretical model. For the study of multiple dependence relationships among research variables such as those investigated in this study, SEM techniques are particularly appropriate and were therefore adopted for data analysis.

Before conducting the structural equation modeling to ensure the fit between the collected data and the theoretical factor structure, all constructs other than SCF were examined for their reliability and validity using the PLS

Graph version 3.0. Specifically, to capture the dimensions of the second-order construct SCF, AMOS (Arbuckle, 2007) was used to perform confirmatory factor analysis of the measurement items. Using AMOS for confirmatory factor analysis provides a rigorous assessment of the fit between collected data and the theoretical factor structure, and satisfies the minimum requirements of assessing the measurement properties of the unidimensionality, convergent validity, and discriminant validity (Bagozzi, 1980). Details of the data validation are discussed in Section 6.2.

Next, PLS Graph version 3.0, was chosen and used for hypothesis testing. Compared with AMOS, which is generally recommended for confirmatory analysis and requires a more stringent adherence to distributional assumptions (Jöreskog, 1993; Rai *et al.*, 2006), PLS is more suitable for predictive research models where the emphasis is on theory development (Chin, 1998; Chin *et al.*, 2003). Given that there have been few empirical studies in this area and little prior theory, PLS was suitable for the research purposes of this study and was preferred for testing the structural model.

Further, PLS allows latent constructs to be modeled as either formative or reflective indicators . Reflective indicators reflect an unmeasured latent construct which is deemed to exist before it is measured, and overlap in meaning so that they correlate moderately strongly. Formative indicators, on the other hand, are used to form a superordinate construct where the indicators are independent "causes" of the construct being measured with little correlation between them, and all need to be present in order to adequately specify the measured construct (Baxter, 2009; Chin 1998).

In this research, the three exogenous construct – customer orientation, competitor orientation, and supply chain partnership orientation – were operationalized as formative constructs. As AMOS attempts to account for all the covariance among its measures, the inclusion of formative measures may becomes problematic. PLS follows a components-based strategy and thus does not depend on having multivariate normal distributions, interval scales, or a large sample size. With the consideration of the nature of the measurement models involved in the study, PLS was preferred technique for testing the structural model. More complete descriptions of the data analysis are presented in Section 6.3 in the next chapter.

5.6 Chapter summary

This chapter has justified the research design and method of this study from the perspective of philosophical paradigms. A detailed procedure of the two-stage methodology adopted in this study has been described and the design of the questionnaire design, survey and sampling strategy, and data analysis method reported. In the next chapter, the empirical evidence from the quantitative questionnaire survey will be given.

CHAPTER 6 DATA ANALYSIS

After clarifying the research methodology in the previous chapter, this next chapter reports the results of the analysis of the collected data. This chapter consists of four sections, as summarized in Figure 6.1. A preliminary examination of the collected data is described in Section 6.1, which includes the procedures used for data cleaning and screening, and descriptive data analysis. Section 6.2 presents the results for scale development and validation. Specifically, the measurement model for SCF is examined and evaluated in AMOS in Section 6.2.3. Next, the seven hypotheses are examined in their order of presentation from Chapter 3 using partial least squares analyses in Section 6.3. Finally, a summary of the chapter is presented in Section 6.4.
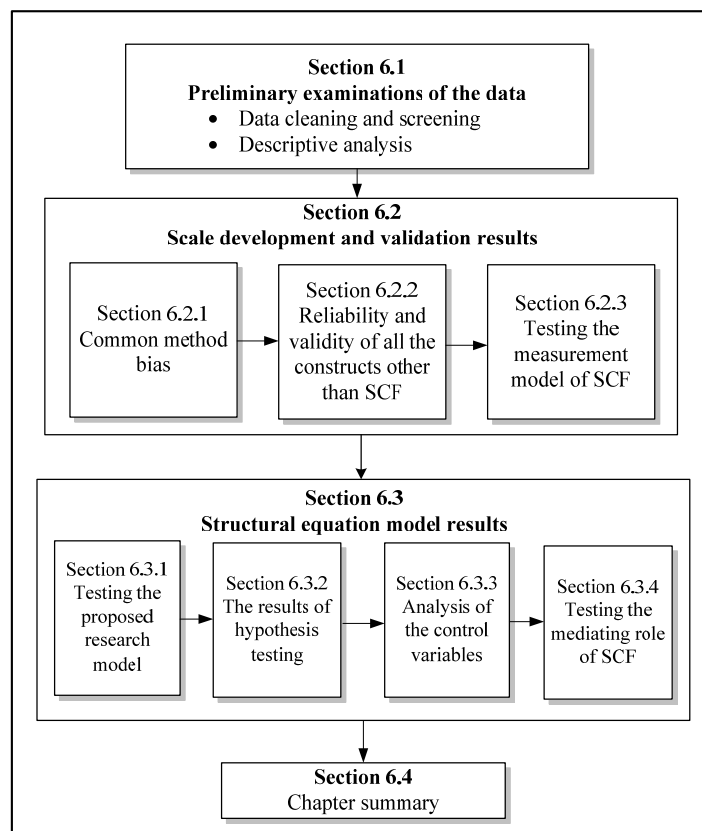
Figure 6.1 Outline of Chapter 6

6.1 Preliminary examination of the collected survey data

After collecting the data from the respondents, a number of procedures were implemented to convert the collected raw data into a computer-readable form for statistical data analysis. This section considers data preparation before the collected data were analyzed. First, data cleaning and screening were conducted to ensure the collected data were legitimate for further analysis. Next, the descriptive data analysis was completed to provide a briefing of the information contained in the sample of scores (Hair *et al.*, 1998; Malhotra and Peterson, 2002).

6.1.1 Editing the completed questionnaire and data cleaning and screening

This initial step required an examination of raw data for completeness, inconsistency, respondent eligibility, and accuracy (Churchill, 1979; Malhotra and Peterson, 2002). Editing was conducted by the researcher for completeness of the questionnaire and eligibility of the respondents before inputting the data into the computer. As mentioned in Section 5.4, among the 207 returned questionnaires, 15 were not useable and were discarded because of significant data being missing or incompleteness.

Next, the process of cleaning and screening the data was conducted to ensure that the data set was complete and accurate by coding, transcribing or entering the data into a computer database, cleaning the data for accuracy and accounting for missing responses.

Accuracy of data input

Screening of the data sets was conducted through an examination of basic descriptive statistics or frequency distributions. A frequency test using SPSS was run for every variable to detect any outliner responses. Values that were out of range or improperly coded were thus detected. Two cases with 'illegal' responses were noted and corrected by checking back to the original questionnaires.

Missing data

The next step of preliminary analysis was the treatment of missing data. In this study, the listwise deletion method was preferred to other methods such as imputation because alternative methods change the raw data in an arbitrary way to retain the cases. An advantage of listwise deletion is that all analyses are conducted with the same cases (Tabachnick and Fidell, 2001). In contrast, the method of imputation of missing value with an estimated score (mean) has the advantage of simplicity, but is not sensitive to subjects' patterns of scores on other variables (Tabachnick and Fidell, 2001). Therefore, deletion of cases with missing responses was preferred in this study. This resulted in 15 cases out of 207 collected questionnaires being deleted.

Distribution normality

The basic assumption about the data being used for SEM is that all data have a multivariate normal distribution (Byrne, 2001; Hulland *et al.*, 1996). Multivariate normality includes not only the distributions of individual variables but also the distributions of combinations of variables. This assumption is necessary in order to allow significance testing using the T test and F test. For example, model estimation and testing are usually based on the

validity of this assumption, and lack of normality will adversely affect goodness-of-fit indices and standard errors (Byrne, 2001; Hair *et al.*, 1998; Hulland *et al.*, 1996).

For this study, skew and kurtosis were tested to examine the normal distribution of variables. A distribution is said to be normal when the values of skewness and kurtosis are equal to zero (Tabachnick and Fidell, 2001). However, this is rather an uncommon occurrence in the social sciences (Pallant, 2001). Although there are few clear guidelines about how much non-normality leads to problematic results, some researchers suggest that data sets with absolute values of univariate skewness indices greater than 3.0 should be described as 'extremely' skewed (Tabachnick and Fidell, 2001). However, there appears less consensus about kurtosis and a conservative compromise seems to be that absolute values of the kurtosis index greater than 10.0 may suggest a problem and values greater than 20.0 may indicate a more serious one (Hoyle, 1995).

In this study, all variables were tested at a univariate and multivariate level using SPSS. At the univariate level, of the 34 observed variables in the proposed models, none had exceeded this threshold of skewness and kurtosis, as shown in the Table 6.1. These figures show the data is distributed within an acceptable range of normality. Moreover, the use of maximum likelihood estimation (ML) in this study moderated its effects if it did exist (Anderson and Gerbing, 1988; Diamantopoulos and Siguaw, 2000). The ML estimation was adopted in this study since it performs well in generating reliable statistical results with good robustness to violation of normality. It has been

the most commonly used approach in SEM, and is also appropriate for this study.

Table 6.1 Assessment of univariate and multivariate normality

Variable	min	max	skew	c.r.	kurtosis	c.r.
COO4	1	7	-1.095	-6.352	1.434	5.159
COO3	1	7	-0.753	-4.367	0.245	0.710
COO2	1	7	-1.027	-5.961	.536	1.554
COO1	1	7	-1.134	-6.578	1.692	4.908
Multivariate					12.967	13.301
CUO4	1	7	-1.485	-8.619	2.133	6.187
CUO3	2	7	-0.929	-5.392	1.304	3.783
CUO2	1	7	-1.279	-7.419	1.704	4.943
CUO1	1	7	-1.380	-8.010	1.927	5.589
Multivariate					15.325	15.719
SCPO1	2	7	-0.862	-4.874	.039	.109
SCPO2	1	7	-0.833	-4.714	.498	1.409
SCPO5	2	7	-1.009	-5.705	.591	1.671
SCPO3	1	7	-0.455	-2.573	-0.470	-1.330
SCPO4	2	7	-0.743	-4.204	0.305	0.864
Multivariate					10.300	8.529
SF1	1	7	-1.768	-9.999	3.413	9.654
SF2	1	7	-1.149	-6.499	1.252	3.540
SF3	1	7	-0.879	-4.975	0.032	0.090
SF4	1	7	-0.707	-3.998	-0.197	-0.558
Multivariate					15.498	15.498
OSF1	1	7	-0.793	-4.604	0.070	0.202
OSF2	1	7	-0.810	-4.701	0.280	0.812
OSF3	1	7	-0.749	-4.344	0.052	0.150
OSF4	1	7	-0.298	-1.728	-0.665	-1.929
Multivariate					10.800	11.078
DF4	1	7	-0.631	-3.571	-0.310	-0.877
DF3	1	7	-0.544	-3.076	-0.156	-0.441

DF2	1	7	-0.716	-4.052	-0.134	-0.379
DF1	1	7	-0.743	-4.201	0.199	0.563
Multivariate					11.354	11.354
ISF3	1	7	-0.736	-4.165	-0.520	-1.472
ISF1	1	7	-0.153	-0.863	-1.059	-2.995
ISF2	1	7	-0.249	-1.406	-0.892	-2.522
Multivariate					2.116	2.676
SCR4	2	7	-1.325	-7.496	2.206	6.238
SCR3	1	7	-1.850	-10.463	4.763	13.472
SCR2	1	7	-1.653	-9.349	3.986	11.274
SCR1	1	7	-1.725	-9.759	3.629	10.264
Multivariate					36.285	36.285
SIZE	1	7	-0.158	0.179	-0.940	0.355
PRED	1	7	-0.921	0.175	0.219	0.349

6.1.2 Descriptive analysis

Descriptive statistics such as minimum, maximum, means, standard deviation, and variance were obtained for all interval-scaled independent and dependent variables. The results are summarized in Table 6.2 below.

Table 6.2 Summary of descriptive statistics for all variables

Construct	Variable	Variable Description	Range	Min.	Max.	Mean	Std. Dev.	Variance
Customer Orientation (CUO)	CUO1	Having customer-driven business objectives	6	1	7	5.95	1.208	1.460
	CUO2	Having good understanding of customers' needs and a right prediction of the fashion trend	6	1	7	5.66	1.256	1.578
	CUO3	Measuring customer satisfaction systematically	5	2	7	5.79	1.031	1.064

	CUO4	Giving close attention to after-sales service	6	1	7	5.87	1.237	1.529
Competitor Orientation (COO)	COO1	Distributing information about competitors' strategies and activities among sales people	6	1	7	5.39	1.205	1.452
	COO2	Discussing competitors' strategies and activities in top management team	6	1	7	5.24	1.520	2.311
	COO3	Having ability to respond to competitive actions effectively	6	1	7	5.17	1.386	1.922
	COO4	Targeting opportunities for competitive advantages.	6	1	7	5.83	1.084	1.176
Supply Chain Partnership Orientation (SCPO)	SCPO 1	Believing that supply chain partners will respond with understanding when we share our problems	6	1	7	6.02	1.174	1.377
	SCPO 2	Believing in supply chain partners joint responsibility in the whole chain	6	1	7	5.14	1.382	1.911
	SCPO 3	Never taking advantage of a strong bargaining position in the supply chain	6	1	7	4.82	1.538	2.366
	SCPO 4	Being willing to make cooperative changes with supply chain partners	5	2	7	5.44	1.119	1.253
	SCPO 5	Believing in working together with supply chain partners to be successful	4	1	7	5.92	1.021	1.043
Sourcing Flexibility (SF)	SF1	Number of suppliers available	6	1	7	5.84	1.256	1.577
	SF2	Range of products and services provided by suppliers	6	1	7	5.38	1.374	1.888

	SF3	Range of suppliers that provide major materials and components	6	1	7	5.22	1.543	2.380
	SF4	Ability to add and remove suppliers	6	1	7	4.88	1.505	2.264
Operating system Flexibility (OSF)	OSF1	Range of new products or services the firm can develop every year	6	1	7	5.40	1.347	1.814
	OSF2	Ability to change the output volumes	6	1	7	5.22	1.436	2.062
	OSF3	Ability to change the product and service mix	6	1	7	5.10	1.483	2.199
	OSF4	Ability to adjust manufacturing facilities and processes	6	1	7	4.62	1.560	2.435
Distribution Flexibility (DF)	DF1	Number of warehouses, loading capacity, and other distribution facilities	6	1	7	5.16	1.457	2.124
	DF2	Ability to add or remove carriers or other distributors	6	1	7	5.29	1.375	1.889
	DF3	Ability to change warehouse space, loading capacity and other distribution facilities	6	1	7	4.72	1.484	2.204
	DF4	Ability to change delivery modes	6	1	7	4.82	1.530	2.339
Information System Flexibility (ISF)	ISF1	Information technology used in the supply chain management	6	1	7	4.32	1.820	3.312
	ISF2	Availability of information across internal functional departments	6	1	7	4.22	1.691	2.861
	ISF3	Availability of information across different partners in the supply chain	6	1	7	4.87	1.732	2.998
Supply Chain	SCR1	Promptly responding to customers' enquiries	6	1	7	5.94	1.240	1.539

Responsiveness (SCR)	SCR2	Providing advance notice to customers of exactly when products/services will be ready	6	1	7	5.86	1.176	1.384
	SCR3	Willingness to help customers	6	1	7	6.07	1.012	1.024
	SCR4	Timely response to customers' requests	5	2	7	6.10	0.972	0.945
Firm Size	SIZE	The annual sales revenue of the firm	6	1	7	3.35	1.365	1.863
Predictability of customers demand	PRED	Margin of error in product forecasting	6	1	7	5.23	1.233	1.521

Among all of the descriptive statistics, the means for information system flexibility (ISF) (4.22 to 4.87) were somewhat low compared to other constructs. As shown in Table 6.2, none of the indicators for ISF has a mean above 5.0. However, the scores were tightly packed around the mean, indicating that most respondents have a similar perception. The low means for ISF scales indicate that the operational processes in the investigated companies were not supported by their information systems particularly well. In contrast, the means for supply chain responsiveness (SCR) (5.98 to 6.10) seems higher than other constructs, indicating that the investigated companies generally felt confident about their overall supply chain performance.

The large range of score for each variable of more than 4.0 suggests a greater variation or dispersion in the process. However, as the range is only based on the maximum and minimum scores, it is often inferior to other measures of variation like the standard deviation, which is based on the value

of every score. In this case, all of the standard deviations were less than 2.0. This small amount of variation indicates that most respondents have a rather similar perspective on their supply chain management.

In brief, descriptive analysis has been used to summarize the information contained in the sample of scores. The mean, median and mode measures were used to determine the score in the data set around which all the other scores were clustered. Range, variance, and standard deviation were used to determine the extent of spread of the data. In this study, means and standard deviations were similar in that both of them had a small range, indicating the closely aligned perspectives of respondents.

6.2 Scale development and validation results

Before testing the full model in relation to the research propositions, all multi-item scales used in this study were tested for reliability and validity.

6.2.1 Common method bias

As with all self-reported data, there is a potential for common method bias, which means the actual phenomenon under investigation becomes harder to differentiate from measurement artifacts (Naresh *et al.*, 2006). The common method bias might be caused by multiple sources such as social desirability, scale length, and response selection (Naresh *et al.*, 2006; Podsakoff *et al.*, 2003). Following Podsakoff and Organ (1986), statistical analyses to assess the severity of common method bias were conducted. First, a Harmon on-factor test (Malhotra *et al.*, 2006) was conducted on the five conceptually crucial variables in the theoretical model including CUO, COO, SCPO, SCF, and SCR. Results from this test showed that five factors are present and the

most covariance explained by one factor is 26.502 percent, suggesting that common method biases are not a likely contaminant of the results. Next, following Podsakoff *et al.* (2003) and Liang (2007), a further statistical approach in PLS was taken. A common method factor, whose indicators included all the principal construct's indicators, was introduced in the model to calculate each indicator's variances substantively explained by the principal construct and by the method (Liang *et al.*, 2007). As summarized in Appendix C, the results demonstrate that the average substantively explained variance of the indicators is 0.58, which was substantially greater than the average method-based variance of 0.009. Further, most method factor loadings are insignificant[1]. Therefore, it can be concluded that common method bias is unlikely to be a serious concern for this study.

6.2.2 Reliability and validity of all constructs other than SCF in the models

Reliability of the indicators of each latent variable was tested using the methods and criteria proposed by Hair *et al.* (1998). Since the measurement model of SCF was newly developed in this study, as mentioned earlier, its validation will be further discussed in Section 6.2.3. In this current section, the discussion of reliability and validity is focused on all the other constructs in the research model.

For each separate item, reliability was evaluated by item-total correlation and Cronbach's coefficient alpha. As suggested by Hair *et al.*

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[1] According to Williams *et al.* (2003) and Liang *et al.* (2007), the squared values of the method factor loadings can be interpreted as the percentage of indicator variance caused by method, while the squared values of substantive constructs can be interpreted as the percentage of indicator variance caused by substantive constructs. Therefore, when the method factor loadings are insignificant and the indicator's substantive variances are substantially greater than their method variances, we can conclude that common method bias is unlikely to be a serious concern.

(1998), the item-total correlations should exceed 0.5. Also, a Cronbach's coefficient alpha larger than 0.6 suggests acceptable reliability for exploratory research, while a coefficient showing good reliability is above 0.7 in more usual settings. The results of the reliability tests are shown in Table 6.3. The Cronbach's alpha of all the 4 latent variables is above 0.6 and all the item-total correlations are above 0.5, indicating acceptable reliability of these variables.

Table 6.3 Reliability test of the scales

Item number	Item-total Correlation	Cronbach's alpha
Customer Orientation		0.823
CUO1	.571	
CUO2	.677	
CUO3	.566	
CUO4	.792	
Competitor Orientation		0.812
COO1	.562	
COO2	.730	
COO3	.691	
COO4	.549	
Supply Chain Partnership Orientation		0.768
SCPO1	.512	
SCPO2	.508	
SCPO3	.547	
SCPO4	.668	
SCPO5	.509	
Supply Chain Responsiveness		0.861
SCR1	.785	
SCR 2	.786	
SCR 3	.772	
SCR 4	.686	

In addition, two more model-based estimates of reliability have been examined in this study, namely the composite reliability and the average variance extracted (AVE) estimate (Bollen, 1989). The composite reliability measures the internal consistency of a set of measures, while the average variance extracted estimates reflect the overall amount of variance in the indicators accounted for by the latent construct. The composite reliability ρ_c is given by:

$$\rho_c = \frac{\left(\sum \lambda_i\right)^2}{\left(\sum \lambda_i\right)^2 + \sum (1 - \lambda_i^2)}$$

The average variance extracted estimate, $\rho_{vc(\eta)}$, is given by:

$$\rho_{vc(\eta)} = \frac{\sum \lambda_i^2}{\sum \lambda_i^2 + \sum \varepsilon_i}$$

Where λ_i is the standardized factor loadings for the factor, and ε_i is the measurement error of the factor (Fornell and Larcker, 1981).

Both composite reliability and the AVE can be generated automatically using the bootstrap technique by PLS-Graph. As shown in Table 6.3, all of the scales had composite reliabilities greater than the satisfactory value of 0.70. The AVE for each construct, as shown in Table 6.4, was above the acceptance value of 0.50 (Fornell and Larcker, 1981).

Table 6.4 Bootstrap outputs of PLS

	Original Sample Estimate	Mean of Subsamples	Standard Error	T-Statistic	AVE	Composite Reliability
CUO					0.702	0.904
CUO1	0.7727	0.7696	0.0537	14.3821		
CUO2	0.8608	0.8576	0.0264	32.5558		
CUO3	0.8201	0.8096	0.0518	15.8352		
CUO4	0.89	0.8852	0.0233	38.2511		
COO					0.592	0.853
COO1	0.6865	0.6793	0.0661	10.3806		
COO2	0.8286	0.8286	0.0306	27.0567		
COO3	0.8185	0.8175	0.0443	18.4904		
COO4	0.7331	0.7333	0.0427	17.1605		
SCPO					0.523	0.797
SCPO1	0.6759	0.6737	0.0654	10.3301		
SCPO2	0.5877	0.5774	0.1027	5.7245		
SCPO3	0.5831	0.5649	0.0794	7.3409		
SCPO4	0.725	0.7121	0.0658	11.0209		
SCPO5	0.7467	0.7482	0.0503	14.8373		
SCR					0.727	0.914
SCR1	0.8904	0.8918	0.021	42.4722		
SCR2	0.9034	0.8988	0.0239	37.8699		
SCR3	0.8677	0.8671	0.028	30.9759		
SCR4	0.7398	0.73	0.079	9.3704		

Convergent validity is the extent to which a measure of some characteristic correlates or converges with other measures of the same construct (Aaker *et al.*, 2001). In this study, convergent validity is supported when measurement items load with a significant t-value on their latent constructs, that is, the t-values of the outer order loadings are above 1.96 (Gefen and Straub, 2005). Essentially, the t-values of the loadings are equivalent to t-values in least-square regressions. Each measurement item is

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explained by the linear regression of its latent construct and its measurement error. Table 6.4 summarizes the outputs of the bootstrap, which was used to generate the t-values in PLS. The significant t-statistics for all measurement items indicates the convergent validity of the model.

Discriminant validity estimates the degree to which a measure does not correlate or converge with other constructs from which it is supposed to be different. According to the criteria suggested by Gefen *et al.* (2005), discriminant validity is shown when two conditions are satisfied:

First, the correlation of the latent variable scores with the measurement items shows an appropriate pattern of loadings. That is, the measurement items load highly on their theoretically assigned factor and not highly on other factors. Following the steps suggested by Gefen *et al.* (2005), the correlation was calculated and presented in Table 6.5. The discriminant validity was checked by comparing the lowest correlation for a particular item and any other items within the factor (within factor correlation) to the correlations of that item and all items outside of the factor (between factor correlations). If the former correlation is less than the latter, then a violation occurs. Following this criterion, the correlation matrix in Table 6.5 was examined and no violation was found.

Table 6.5 The correlation table

	CUO	COO	SCPO	SCR
CUO1	0.72	0.42	0.42	0.42
CUO2	0.83	0.51	0.31	0.37
CUO3	0.83	0.47	0.27	0.46
CUO4	0.82	0.54	0.31	0.38

	CUO	COO	SCPO	SCR
COO1	0.38	0.68	0.20	0.34
COO2	0.54	0.86	0.22	0.35
COO3	0.42	0.83	0.22	0.31
COO4	0.47	0.72	0.36	0.37
SCPO1	0.39	0.33	0.66	0.36
SCPO2	0.15	0.10	0.62	0.21
SCPO3	0.17	0.17	0.62	0.23
SCPO4	0.28	0.24	0.73	0.30
SCPO5	0.33	0.23	0.76	0.38
SCR1	0.39	0.38	0.40	0.87
SCR2	0.44	0.42	0.35	0.90
SCR3	0.41	0.34	0.36	0.87
SCR4	0.28	0.33	0.35	0.73

The second condition is that PLS requires an appropriate AVE estimate for each latent construct. As a rule of thumb, the square root of the AVE of each construct should be larger than the correlation of the specific construct with any of the other constructs in the model (Chin, 1998) and should be greater than 0.50 (Fornell and Larcker, 1981). Therefore, the square roots of AVE of each construct (shown in Table 6.4) were compared with the correlation between this construct and any other construct in the model (shown in Table 6.6), and all the square roots are much larger than the construct correlation.

As both of the two requirements are satisfied, it can be safely claimed that there is good discriminant validity between the factors (Campbell and Fiske, 1959; Koufteros *et al.*, 1998; Zhang *et al.*, 2003).

Table 6.6 Inter-correlations among study variables

	CUO	COO	SCPO	SCR	SCF

CUO	1				
COO	0.63	1			
SCPO	0.367	0.272	1		
SCR	0.487	0.438	0.458	1	
SCF	0.389	0.512	0.407	0.456	1

6.2.3 Evaluation of measurement model of supply chain flexibility

After the reliability and validity of all the other constructs have been discussed, this section considers of the measurement model of SCF. In Section 2.2, SCF has been identified as a second-order construct which consists of four dimensions. Given the theory-driven approach to construct development, the analytical framework of confirmatory factor analysis (CFA) (Jöreskog, 1993) provides an efficient means of assessing the consistency of measurement among scale items and the pre-specified measurement model with its associated network of theoretical concepts. In this regard, CFA was adopted to test and validate a measurement scale for SCF.

6.2.3.1 Criteria for measurement model evaluation

A series of measures of fit were used in this study to assess model fit. One of the most basic and widely used measures of absolute fit is the likelihood ratio measured with Chi-square χ^2 (Hair *et al.*, 1998). The χ^2 statistical value is a good global test of a model's ability to reproduce the sample variance/covariance matrix. The ratio of the Chi-square statistic to degrees of freedom (χ^2/df) is a measure of absolute fit and model parsimony complexity in SEM literature. A value as low as 1.0 or as high as 3.0 indicates a reasonable fit (Kline, 2005), such a range was adopted in this research.

Another measure of absolute fit is the *root mean square residual* (RMR) (Hair *et al.*, 1998), that is, the mean of residuals between observed and estimated input matrices. In this research, an RMR value equal to or less than 0.05 was considered to suggest that the model fit the data well (Hulland *et al.*, 1996). A related measure is RMSEA, which represents *model fit per degree of freedom*. RMSEA values of 0.08 or less suggest an acceptable root mean square error of approximation and thus indicate good model fit (Baumgartner and Homburg, 1996; Byrne, 2001).

Another measure of absolute fit is the *goodness-of-fit index* (GFI) (Hair *et al.*, 1998), which indicates the population of the observed covariances explained by the model-implied covariance (Bollen, 1989). Values close to 0.9 or above indicate satisfactory model fit (Hair *et al.*, 1998; Hulland *et al.*, 1996). A related index is the *adjusted goodness of fit index* (AGFI) which indicates a built-in adjustment for model complexity. That is, it takes into account the degrees of freedom available for testing the model. A recommended cut off level is 0.8 or close to 0.9 (Hair *et al.*, 1998; Hulland *et al.*, 1996).

Finally, two incremental fit indices are reported in this research, namely, *Bentler-Bonnet normed fit index* (NFI), and *Bentler comparative fit index* (CFI). These measures are used to indicate the proportion in the improvement of the overall fit of the proposed model relative to a null model (Baumgartner and Homburg, 1996; Byrd, 2000; Hair *et al.*, 1998). NFI values above 0.80 and close to 0.90 indicate acceptable fit (Baumgartner and Homburg, 1996). The *comparative fit index* (CFI) estimates the comparative

differences in no-entrality between the proposed and baseline models (Baumgartner and Homburg, 1996). In this research, CFI values equal to or above than 0.9 were considered to indicate satisfactory fit, and between 0.8 and 0.9 to suggest at least acceptable fit (Baumgartner and Homburg, 1996; Byrd, 2000; Hair *et al.*, 1998).

6.2.3.2 Model fits of alternative models

As developed, each of the item clusters in SF, OSF, DF, and ISF in Table 5.2 represents a priori measurement model of the theoretical construct of SCF. Five alternative measurement models of SCF, as shown in Figure 6.2, were examined by AMOS 16.0 (Arbuckle, 2007) to compare their model fit. The AMOS software package was chosen because of its user friendliness, that is, its graphical user interface and its ability to import data directly from SPSS. Further, it is capable of testing and evaluating a second-order measurement model through a series of fit indices (Arbuckle, 2007; Byrne, 2001).

Based on the existing literature and the proposed conceptualization of the SCF construct, a measurement model in which the four first-order factors were loaded onto a second-order factor of SCF was developed and tagged as Model 5 in Figure 6.2 (Xia and Lee, 2003). The other four models were: (1) a null model in which all measures were uncorrelated to each other, (2) a model in which all measures were loaded onto a single first-order factor, (3) a model in which the measures were loaded onto four uncorrelated first-order factors, and (4) a model in which the measures were loaded onto four correlated first-order factors (Xia and Lee, 2003). These four models were tagged as Model 1 to Model 4 respectively.

(1) Model 1: Null

(2) Model 2: One first-order factor

(3) Model 3: Four uncorrelated first-order factors of SCF

(4) Model 4: First-order factors model of SCF

(5) Model 5: A second-order factor with four first-order factors of SCF
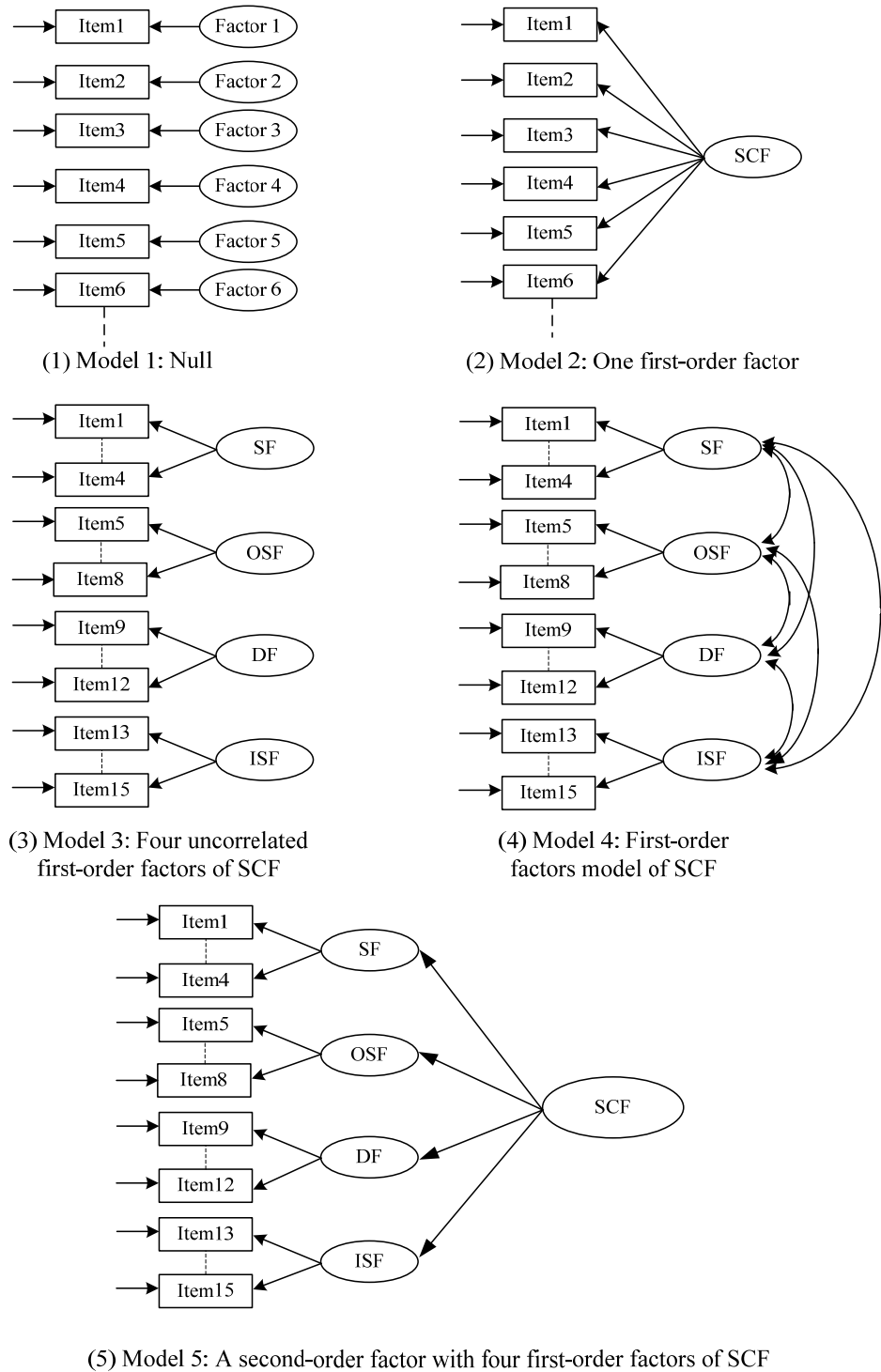
Figure 6.2 Alternative models tested in the confirmatory factor analysis

Table 6.7 shows the model fit results of these five alternative models for SCF. Models 1, 2, and 3 were not acceptable because most of their

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goodness-of-fit indices failed to meet the threshold criteria. In contrast, Models 4 and 5 were acceptable because most of their fit indices met the threshold criteria or were at the margin of the threshold.

Table 6.7 Model fit test of alternative models (n=192)

Criteria	Threshold	Model 1: Null	Model 2: One first-order factor	Model 3: four uncorrelated first-order factors	Model 4: First-order factor model of SCF	Model 5: A second-order factor with four first-order factors
χ^2		0	578.181	261.771	144.797	154.371
d.f.		0	90	90	84	86
χ^2/d.f.	(<3.0)	0	6.424	2.909	1.724	1.795
CFI	(>0.9)	1	0.568	.848	0.946	0.947
GFI	(>0.9)	0.488	0.680	.837	0.911	0.924
AGFI	(>0.8)	0.415	0.579	.783	0.872	0.886
RMR	(<0.1)	0.59	0.043	.016	0.004	0.004
RMSEA	(<0.1)	0.216	0.169	.100	0.062	0.056

6.2.3.3 Reliability of SCF

Reliability tests and item-to-total correlation analysis were conducted to examine the measurement items of the four proposed dimensions of the SCF construct. The results provided in Table 6.8 suggest a reasonable fit of the latent factors to the data. Cronbach's alpha (Hair *et al.*, 1998) for all four factors, i.e., sub-dimensions, are greater than 0.70 and the item loadings on the factors are all acceptable, i.e. >0.30.

Table 6.8 Results from confirmatory factor analysis model for SF, OSF, DF, and ISF

Measurement models	Number of indicators	Cronbach's alpha	Range of standardized loadings	CFI	GFI	AGFI	RMR	RMSEA	χ^2 (d.f., prob.)
SF	4	0.70	0.50-0.74	1.000	0.989	0.946	0.000	0.075	4.137 (2, p > 0.05)
OSF	4	0.80	0.56-0.80	1.000	0.995	0.976	0.001	0.000	1.864 (2, p > 0.05)
DF	4	0.79	0.58-0.89	0.997	0.992	9.961	0.001	0.049	2.911 (2, p > 0.05)
ISF [a]	3	0.80	0.57-0.85	0.967	0.962	0.919	0.001	0.075	25.948 (13, p<0.05)

Notes: [a] This model is saturated because the number of indicators is 3. Therefore, fit indices are not available. Fit indices for this factor were produced from a two-factor model including SF and ISF.

6.2.3.4 Convergent validity

As mentioned earlier in Section 6.2.2, convergent validity refers to the extent to which a measure of some characteristic correlates or converges with other measures of the same construct (Aaker *et al.*, 2001). In CFA, the measurement items are restricted to have significant factor loading on their respective dimensions in SCF. Each dimension was analyzed individually in this study. As shown in Table 6.8, all factor loadings for these dimensions are significant. A series of goodness-of-fit indices, that is CFI>0.9, GFI>0.9, AGFI>0.9, RMR<0.1, and RMSEA<0.1 also provide evidence of convergent validity. Therefore, the convergent validity of the scale items was well established (Hair *et al.*, 1998).

6.2.3.5 Discriminant validity

Discriminant validity represents the degree to which a dimension in a theoretical system differs from other dimensions in the same system (Churchill, 1979). In this study, a series of pairwise CFAs were conducted to assess the discriminant validity of the dimensions of SCF constructs using χ^2 differences (Anderson *et al.*, 1987). According to Phillips and Bagozzi (1986), discriminant validity is empirically achieved when the correlations between any two dimensions are significantly different from 1.0. Such evidence can be obtained through forcing measurement items of each pair of factors (dimensions of SCF) into a single underlying factor, leading to a significant deterioration of model fit relative to a two-factor model (Anderson, 1987; Bagozzi, 1980). All possible pairs of dimensions within the theoretical system of SCF were conducted and Table 6.9 reports the results of the 6 pairwise tests of the factors. The χ^2 differences of all possible pairs of dimensions within the theoretical system of SCF were all significant at p=0.001, supporting the presence of discriminant validity between the pairs of factors (Bagozzi, 1980).

Table 6.9 Discriminant validity checks: χ^2 differences

Factors	SF	OSF	DF	ISF
SF				
OSF	103.42			
DF	158.575	199.776		
ISF	83.964	190.722	204.395	

6.2.3.6 Testing first-order and second-order models

In the previous discussion in Section 2.2, SF, OSF, DF and ISF are specified as a priori factors of SCF. In the first-order model, these four factors are correlated measures for SCF. Alternatively, SCF may be operationalized as a second-order model where the four dimensions are governed by a higher order factor, i.e., SCF. The results of first-order and second-order model estimation are shown in Figure 6.3 and Figure 6.4. These two measurement models were also checked to ensure that parameter estimates exhibit the correct sign and size, and are consistent with underlying theory (Byrne, 2001).

The first-order model for testing the existence of SCF implies that SF, OSF, DS, and ISF are correlated but not governed by a common latent factor. The goodness-of-fit measure determines the degree to which the data fit the model (Byrne, 2001). The Chi-square (χ^2) statistic, which is 144.797, is significant at the level of 0.05. All the fit indices suggest a sound fit for the first-order model. The goodness-of-fit in terms of CMIN/df (1.724) is less than 3, and both GFI and CFI are higher than 0.9 as recommended by Jöreskog (1993). Both the RMR and RMSEA are below 0.1, also suggesting an acceptable fit of the model to data. As a whole, the four proposed factors fit the data well and the test results support the first-order model of SCF.

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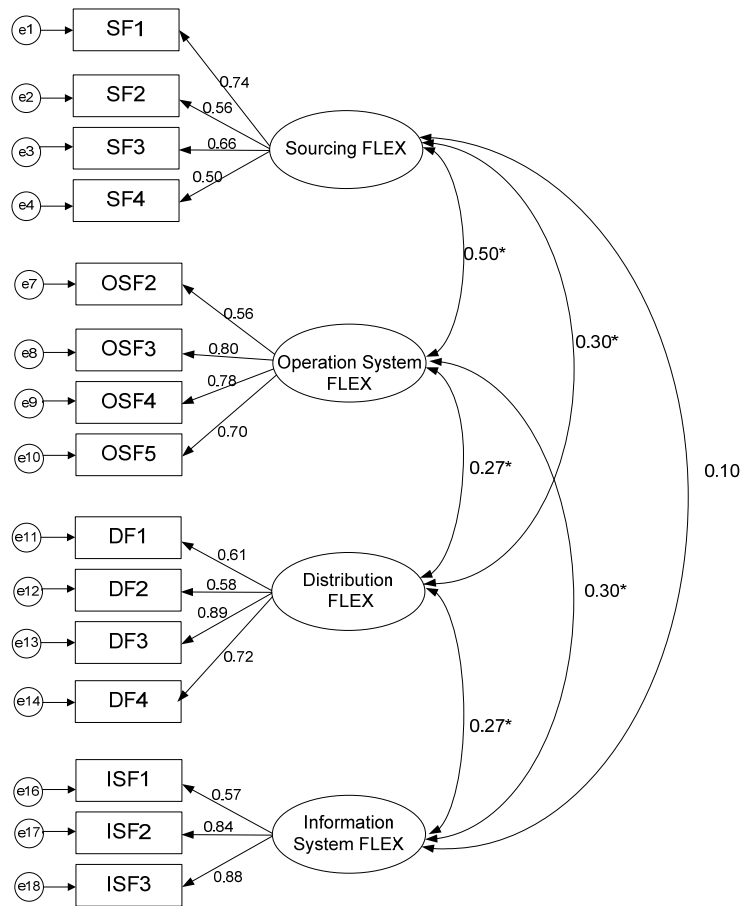
* Significant at p < 0.01 level

$\chi^2 = 144.797$	df = 84	p = 0.000
RMR = 0.004	GFI= 0.911	AGFI = 0.872
CFI = 0.946	RMSEA = 0.062	

Figure 6.3 First-order model of SCF

$\chi^2 = 154.371$ df = 86   p = 0.000
RMR = 0.004   GFI= 0.924   AGFI = 0.886
CFI = 0.947   RMSEA = 0.056
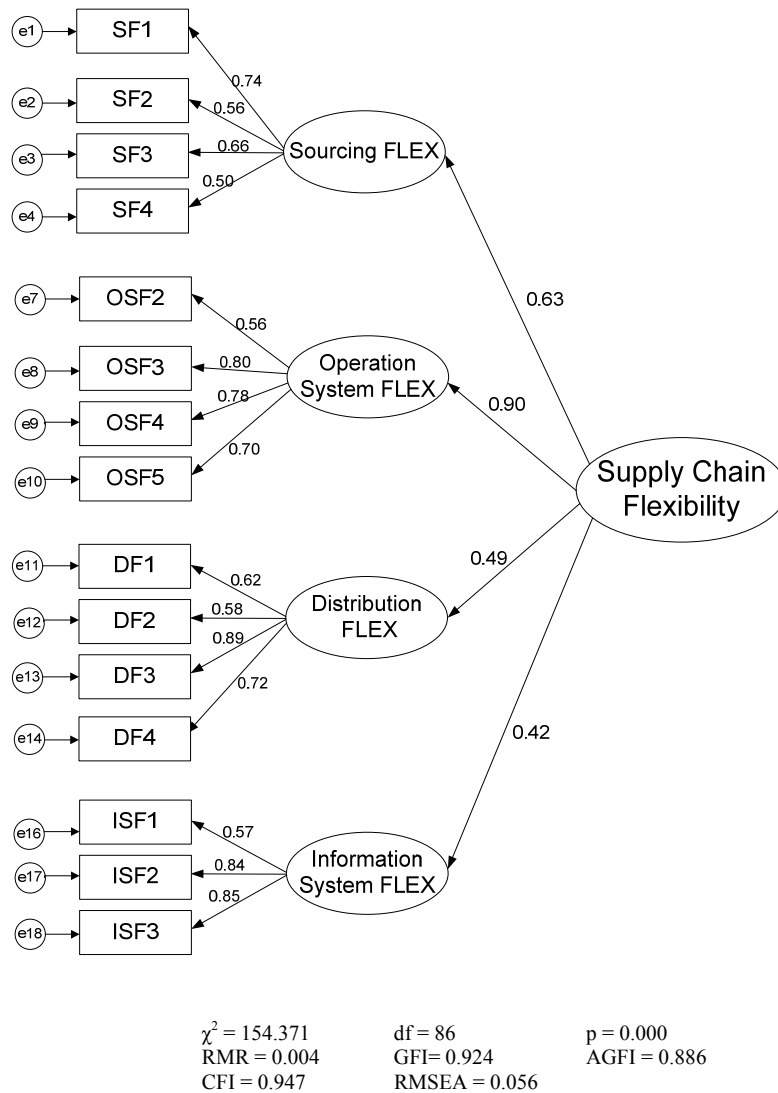
Figure 6.4 Second-order structural model results

Compared with the first-order model, the second-order model is more restrictive and provides more information about the relationship between the high-order SCF construct and the lower-order factors in the form of path coefficients rather than in the form of correlations. As shown in Figure 6.4, the test of the second-order model implies that a high order latent factor, that is the overall trait of SCF, governs the correlations among SF, OSF, DF and ISF. The χ^2 statistics is 154.371 at 86 degree of freedom. The fit indices GFI and

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CFI are well above 0.9 and RMSEA is below 0.1. The second-order loadings on SCF are 0.63 for SF, 0.90 for OSF, 0.49 for DF, and 0.42 for ISF.

An examination of the second-order model of SCF reveals that all the λ coefficient estimates of SF, OSF, DF, and ISF, which describe the relationships or paths of the four dimensions of SCF, are significant. All the path loadings between SCF and its underlying first-order dimensions are of a high magnitude. Consequently, the proposal that SCF can be conceptualized as a multidimensional measure consisting of SF, OSF, DF, and ISF is tenable.

6.3 Structural equation model results

After confirming the measurement model of SCF and the other constructs, PLS was used to assess the structural model. A bootstrapping procedure was conducted to estimate the significance of the path coefficients and the weights of the dimensions of constructs. The proposed hypotheses were then examined by checking the size, the sign, and the significance of the path coefficients and the weights of the dimensions of the constructs respectively. This approach is consistent with recommended practices for estimating the significance of path coefficients and indicator loadings (Lohmoller, 1988) and has been used in prior business studies (Chin, 2000; Klein *et al.*, 2007). All statistical tests in this study were assessed at a 5 percent level of significance using one-tailed t-tests because all of the proposed hypotheses were unidirectional in nature.

6.3.1 Testing the proposed research model

Results of the analysis for the structural model are presented in Table 6.9 and Figure 6.5. The statistical significance of weights can be used to

determine the relative importance of indicators in forming a latent construct (Chin *et al.*, 2003). As shown in the Figure 6.5, all of the indicators for SCF show significant formative weights. In terms of the structural model, the results provide support for the proposed research model. As suggested by Chin and Gopal (1995), the PLS method does not directly provide significance tests and confidence interval estimates of path coefficients in the research model. The primary assessment of predictive validity is the R^2 and the value of the structural paths. R^2 values are interpreted in the same manner as those obtained from multiple regression analysis. They indicate the amount of variance in the construct that is explained by the path model. The results indicate that the model explained 37.7 percent of the variance in supply chain responsiveness. Similarly, 33.9 percent of the variance in supply chain flexibility was explained by market orientation and supply chain partnership orientation.

The magnitude and significance of the path coefficients provides additional evidence of the proposed research model. Five of the specified paths between constructs in the research model presented significant path coefficients. These results confirm the proposed hypotheses 1, 3, 4, 5, and 7, as summarized in Table 6.10. That is, supply chain flexibility has a significant, positive, and direct impact on supply chain responsiveness (H1); both competitor orientation and supply chain partnership orientation have a significant, direct and positive impact on supply chain flexibility (H3 & H4); and that both customer orientation and supply chain partnership orientation have a significant, direct and positive impact on supply chain responsiveness (H5 & H7).

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Table 6.10 Path Coefficients of the research model

Path/hypothesis	Path Coefficient	t value	Result
Supply chain flexibility → Supply chain responsiveness (H1)	0.199	7.20**	Supported
Customer orientation → Supply chain flexibility (H2)	0.017	0.253	*Rejected*
Competitor orientation → Supply chain flexibility (H3)	0.422	5.53**	Supported
Supply chain partnership orientation → Supply chain flexibility (H4)	0.286	3.85**	Supported
Customer orientation → Supply chain responsiveness (H5)	0.250	2.61**	Supported
Competitor orientation → Supply chain responsiveness (H6)	0.112	1.01	*Rejected*
Supply chain partnership orientation →Supply chain responsiveness (H7)	0.257	3.54**	Supported

Note: ** = p<0.01 in one-tailed tests
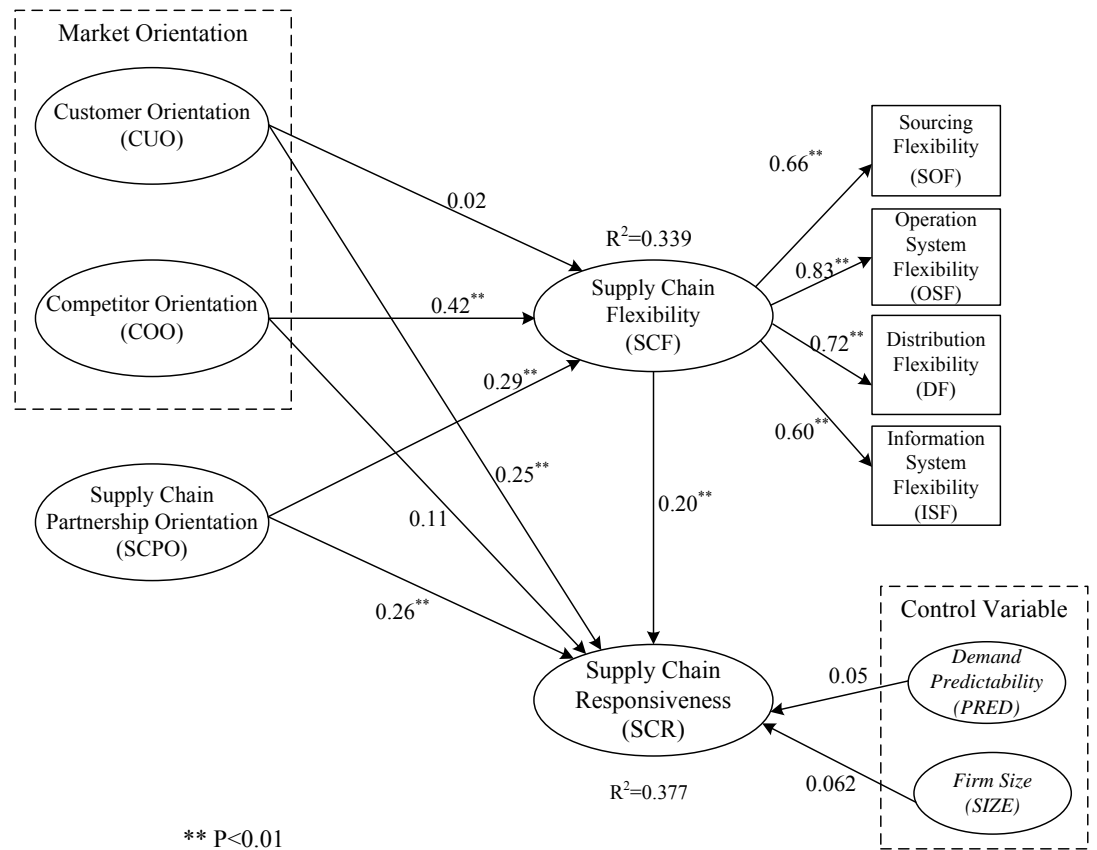
Figure 6.5 Results of the path analysis

6.3.2 The results of hypothesis testing

The results of hypothesis testing are summarized below.

Hypothesis 1, supported: The path from supply chain flexibility to supply chain responsiveness (path = 0.199, t=7.20, p<0.01) is positive and significant. The literature suggests an overall positive relationship between a firm's ability to manage various production resources and its profitability (Avittathur and Swamidass, 2007) or its overall performance (Gupta and Somers, 1996; Vickery *et al.*, 1999). On the basis of the composition and configuration of a firm's available resources, real flexibility options can be generated in supplier selection, product introduction, distribution channels development, etc. These options allow managers to take appropriate

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organizational actions according to various outcomes, which facilitate an organization's reacting quickly and cost effectively to changing market requirements.

Further, the findings of this study suggest that the flexibility of an organization's supply chain in responding to internal and external changes increases the promptness of its supply chain in responding to dynamic customer demand.

Hypothesis 3, supported: The path from competitor orientation to supply chain flexibility (path = 0.422, t=5.53, p<0.01) is positive and significant, which supports the statement that an increase in the level of competitor orientation increases the level of supply chain flexibility. As theorized, strongly competitor-oriented firms are sensitive to their competitors' market strategies and activities and capable of adapting to explicit changes in the external environment. Rather than decreasing product cost, they can create and sustain superior competitive advantage through producing a greater variety of products and providing customers with more alternative options. These behaviors are likely to improve the overall flexibility of its supply chain.

Hypothesis 4, supported: The path from supply chain partnership orientation to supply chain flexibility (path = 0.286, t=3.85, p<0.01) is positive and significant. The findings of this study confirm the conclusion of the literature that the adoption of supply chain flexibility requires a clear and coherent perception of the company's coordinating relationship among supply chain partners. Integration, coordination, and communication across the supply chain are essential for success regardless of how many different firms are

involved and which firms own the assets (Day, 1994). That means the higher the level of an organization's supply chain partnership orientation, the greater the possible flexibility of the organization's supply chain.

Hypothesis 5, supported: The path from customer orientation to supply chain responsiveness (path = 0.250, t=2.61, p<0.01) is positive and significant. Confirming the literature, this result suggests that the more customer-oriented a firm is, the more knowledge the firm will have about its customers. This knowledge enables the firm to purposefully change its behavior in a timely fashion in the presence of external stimuli (Bernardes and Hanna, 2009) and thus achieve competitive advantage.

Hypothesis 7, supported: The path from supply chain partnership orientation to supply chain responsiveness (path = 0.257, t=3.54, p<0.01) is positive and significant. This result confirms that firms with SCPO share mutual beliefs and values with supply chain partners with regard to their joint effort. This, in turn, facilitates the ability to respond to market demand promptly.

Hypothesis 2, rejected: Contrary to our expectation, however, there existed no empirical evidence of a positive, direct relationship between customer orientation and supply chain flexibility (path = 0.017, t = 0.253, *ns*). A possible source of this insignificant link lies in that the implementation of supply chain flexibility is more driven by external competitors' or supply chain partners' activities rather than customer demand. Given the severe challenges and fierce competition faced by China' textile and clothing industry, most enterprises find themselves in a battle with other big exporters

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in the pursuit of market share. Meanwhile, increasing liberalization of trade will lead to more intensive competition among domestic enterprises. This current development status in the China's textile and clothing industry compels its member enterprises to enhance their flexibility so that they can be more responsive to market demand than their competitors, and survive the intense competition. In other words, the capability of supply chain flexibility is not for thriving but for survival. To confirm this assumption, future research is also needed, especially that approaching different industries and research contexts.

Hypothesis 6, rejected: The path from competitor orientation to supply chain responsiveness is not significant (path = 0.112, t = 1.01, ns), failing to confirm that competitor orientation directly affects an organization's supply chain responsiveness. Nevertheless, the test results of the mediated paths in Table 6.11 will show that supply chain flexibility acts as a mediator of competitor orientation on supply chain responsiveness. That is, competitor orientation does impact on the responsiveness of the supply chain, though not directly, but rather through other mediators like the organization's behavior such as its supply chain flexibility.

6.3.3 Analysis of the control variables

With regard to the two control variables included in the model, neither firm size or demand predictability are significantly (path = 0.05 and 0.062 respectively) related to supply chain responsiveness, indicating that the non-spurious relationship between the cause (i.e. the CUO, COO, SCPO and SCF in this study) and effect variables (i.e. SCR) were supported.

6.3.4 Testing the mediating role of SCF

An emergent consensus in structural equations modeling is that researchers should compare rival models, not just test a proposed model (Morgan and Hunt, 1994). Since the proposed research model of this study considers the mediating role of supply chain flexibility, the mediation effect was tested through a comparison of the proposed research model with two competing models as below.

First, the research model was compared with a full mediation model which permits no direct path from the three independent variables (CUO, COO, and SCPO) to the outcome (SCR). In this competing model, as illustrated in Figure 6.6, all of the three antecedents influence their outcomes only through the key mediator SCF. Since the models are nested, they can be compared statistically by PLS (Chin *et al.*, 2003). The R^2 statistics for the supply chain responsiveness in the original proposed model was 0.377 as compared to 0.208 in this rival model. The effect of the excluded links (CUO$\rightarrow$SCR, COO$\rightarrow$SCR, and SCPO$\rightarrow$SCR) in the computing full mediation model is assessed through the f^2 statistic and the pseudo F statistic. [2] Based on the results of the two competing models for the sample, f^2 was 0.27 and Pseudo F (1,186) statistic was 52.9, which was significant. The results indicate that the reduced variance explained by excluding the direct paths from CUO, COO, and SCPO to SCR significantly reduced the variance explained in the

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[2] The magnitude and significance of the difference in the R^2 of these two models reflect the difference in the explanation of the dependent variable by the exclusion of the direct link. The significance of the path is assessed using a procedure similar to that employed to test nested models in stepwise linear regression. The f^2 statistic is computed based on the R^2 difference; and the significance of the f^2 is assessed based on a pseudo F test. The formula for computing f^2 is (R^2 partial mediation – R^2 full mediation)/(1 – R^2 partial mediation). The pseudo F statistics is calculated using the formula f^2*(n-k-1), with 1, (n-k) degrees of freedom where n is the sample size and the k is the number of constructions in the model (Chin *et al.*, 2003).

dependent variable. Therefore, it can be concluded that the proposed research model better explains the relationship among the constructs than the competing model.
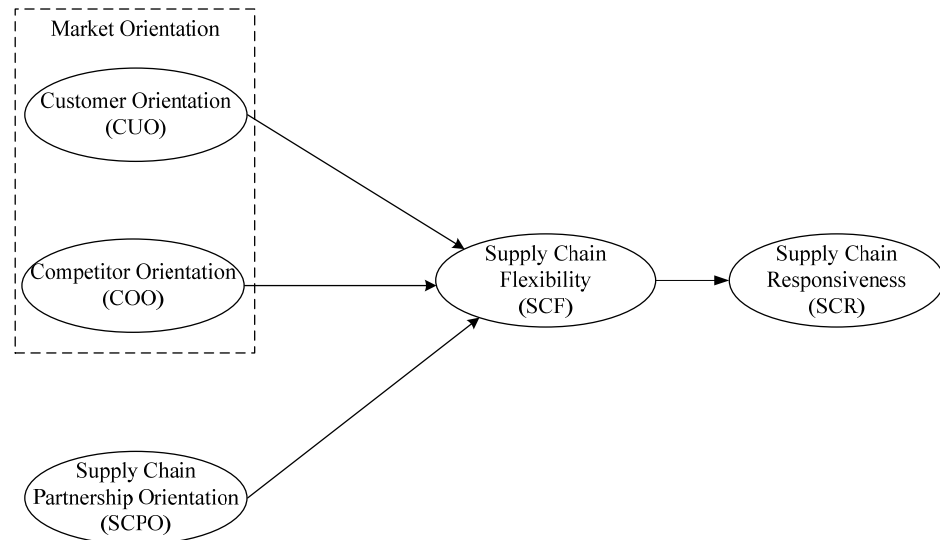
Figure 6.6 Rival model

In addition to comparing the partial mediation model (proposed model) with full mediation one (rival model), a mediation analysis technique was adopted to assess the extent to which SCF (mediator, designated m) mediates the relationship between an organization's culture characteristics, that is CUO, COO and SCPO (independent variables, designated iv) and SCR (dependent variable, designated dv). The analysis is based on the path coefficients and the standard errors of the direct paths between iv, dv, and m, which are produced by PLS analysis (Hoyle and Kenny, 1999; Rai et al., 2006; Subramani, 2004). The results of the analyses of paths in the model are in Table 6.10. The z-statistics for the path COO→SCF→SCR and SCPO→SCF→SCR are 2.658

and 2.940 respectively, [3] which are significant; while the one for CUO→SCF→SCR is insignificant. The significant z-statistics provide evidence for the mediation role of SCF between the COO and SCR, and between SCPO and SCR.

Table 6.11 Analysis of the significance of mediated paths

Mediated Path	Graphical Representation	Path	z statistics
CUO→SCF→SCR		0.005	0.258
COO→SCF→SCR		0.082	2.658[**]
SCPO→SCF→SCR		0.101	2.940[**]

Note: [**] = P<0.01

These two tests for mediation are complementary (Subramani, 2004). The comparison of nested models highlights the additional explanatory power of incorporating three direct paths in addition to the indirect paths between constructs. The analysis of individual mediated paths provided detailed

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[3] An approximation for the standard error of the mediated path is calculated using the formula $\sqrt{b^2 s_a^2 + a^2 s_b^2 + s_a^2 s_b^2}$, where a and b are the path coefficient of the path from iv→m and m→dv, and s_a and s_b are the corresponding standard deviations (Hoyle and Kenny, 1999).

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information on the magnitude and significance of individual indirect paths underlying the overall indirect effect.

6.4 Chapter summary

This chapter has reported the results of the data analysis for the major part of this study. A large scale mail survey was conducted to examine the main research model. The data was coded, screened, and cleaned before further statistical analysis. Structural equation modeling was used to test the main research model, which was proposed during the literature review and exploratory research. A two-step data analysis was adopted to analyze the collected data. First, the constructs involved in the research model were validated in PLS or AMOS to assess the quality of the measurement items. Next, the structural model was examined in PLS.

Table 6.12 summarizes the results of testing the research hypotheses to address the research issues. Five out of the seven proposed hypotheses were supported by these results, although the path from the level of customer orientation to supply chain flexibility, and the path from the level of competitor orientation to supply chain responsiveness were not supported.

Table 6.12 Summary of findings for research issues and hypotheses

Research issues	Corresponding research hypotheses	Result
What key properties define the supply chain flexibility	Supply chain flexibility can be conceptualized as a multi-dimensional measure consisting of sourcing flexibility, operating system	confirmed through SEM

construct?	flexibility, distribution flexibility, and information system flexibility.	
What are the consequences of supply chain flexibility?	**H1**: A firm's supply chain flexibility has a direct and positive impact on its responsiveness in the supply chain.	supported
To what extent does the supply chain flexibility mediate the impact of organization's culture characteristics on the degree of its supply chain responsiveness?	**H2**: A customer orientation has a direct and positive impact on supply chain flexibility.	*Rejected*
	H3: A competitor orientation has a direct and positive impact on supply chain flexibility.	supported
	H4: A supply chain partnership orientation has a direct and positive impact on supply chain flexibility.	supported
	H5: A customer orientation has a direct and positive impact on supply chain responsiveness.	supported
	H6: A competitor orientation has a direct and positive impact on supply chain responsiveness.	*Rejected*
	H7: A supply chain partnership orientation has a direct and positive impact on supply chain responsiveness	supported

Source: analysis of survey data collected for this study.

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The implications of the results of the data analysis will be discussed in the next and final chapter.

CHAPTER 7 CONCLUSIONS AND IMPLICATIONS

This study was designed to address the research problem:

What are the factors that affect a firm's adoption of supply chain flexibility strategies and what are the impacts of these strategies as a competitive weapon on the responsiveness of the supply chain beyond the boundaries of an individual firm? To solve this problem, a comprehensive review of extant literature relating to the research problem was conducted, and theoretical gaps were identified in Chapter 2. On the basis of this literature review, an integrative research model which conceptualizes flexibility from a supply chain perspective was proposed in Chapter 3 and was tested in Chapter 6.

This final chapter discusses the outcomes generated in response to the research problem. An outline of this chapter with section numbers and their interrelationships is depicted in Figure 7.1 below. Section 7.1 gives details of the conclusions regarding the research problems. The theoretical and managerial implications are presented in Sections 7.2 and 7.3, with the limitations of the study discussed in Section 7.4. Next, areas for future research are indicated in Section 7.5. Finally, the concluding remarks and the chapter summary are provided in Section 7.6.
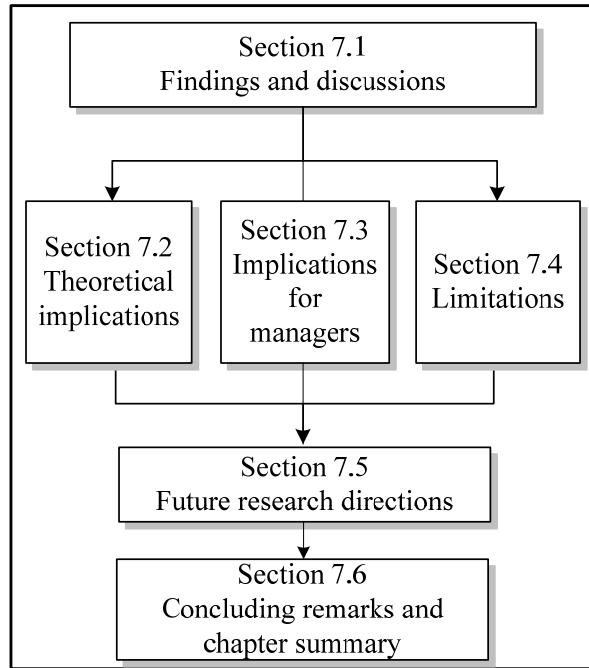
Figure 7.1 Outline of Chapter 7

7.1 Findings and discussion

Today's global market calls for a simultaneous response of companies to both domestic and international dynamics, and an ability to compete with other companies on the bases of cost, time and quality. A market-oriented company should not deal with customer relationships at arm's length. It must understand what kinds of products its customers want, because it is in a customer responsive era. In a supply chain context, companies always seek to develop co-operative relationships with those who are able to respond consistently to their special needs. Textile and clothing manufacturers must rethink their supply chain strategies to be flexible so that they can respond to their customers' various demands in the most efficient way. It is thus timely to develop a theoretical model which involves various business units; that is, a

model that can integrate the concern of flexibility into business strategy for operating within the supply chain environment. It was a concern about the lack of readily available literature on flexibility management practices in the textile and clothing industry, particularly on supply chain management in China that drove this study. This research tries to explore how the textile and clothing manufacturers are attempting to integrate their orientation of market and supply chain partnerships into their supply chain strategies.

In this study, four research objectives were proposed in Section 1.2 to investigate the interrelationship among market orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness. Consistent with the culture theory of organizational effectiveness, the evidence of this study indicates that two organizational culture characteristics, namely customer orientation and supply chain partnership orientation, are positively associated with the responsiveness of an organization's supply chain. This result confirms that a firm in the supply chain should posses a thorough understanding of its customers and cooperate with its supply chain members. Further, this knowledge should be used to form mutual beliefs and values among supply chain partners to support a purposeful and timely behavior change in the presence of market changes. To lend further coherence to the conceptual model of this study, it was also proposed that supply chain flexibility mediates the effect of organizational culture on supply chain responsiveness. The mediation of an organization's implementation of flexibility strategy is useful to explain the variability in the level of supply chain responsiveness even across those organizations embedded with similar culture characteristics, that is, the market orientation and supply chain

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partnership orientation in this research. The findings of the measurement model of SCF and the structural model are discussed below.

7.1.1 The measurement model of supply chain flexibility

In the scale development, a structural measurement model for supply chain flexibility was developed in Section 2.2 based on previous research and practice. The measurement items in the instrument were classified into four dimensions, namely sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. The instrument measuring the construct was empirically validated and assessed in Section 6.2.3. The results of the data analysis show an adequate fit of the proposed measurement instrument, and the construct validity and reliability of the instrument have been established with the systematic and scientific procedures adopted in this study.

In the measurement model testing, both the first- and second-order models provide an acceptable fit. As depicted in Figure 6.3, in the first-order model testing, SF, OSF, DF and ISF are all positively highly correlated. In essence, as supply chain is a multi-dimensional concept that constitutes multiple key processes including sourcing, manufacturing, and distribution, the concept of supply chain flexibility is also a manifestation of the flexibility of these key processes and their interactions. Moreover, as the importance of information systems in supply chain management has been widely understood, this study highlights the importance of information system flexibility in supply chain flexibility. With the consideration of the importance of information systems in facilitating the dissemination of information across the supply

chain, an interaction among ISF and the other three dimensions in the proposed conceptual framework of SCF was expected. However, a non-significant relationship was found between ISF and SF. This counter-intuitive finding could simply be an outcome of our respondents, or it could indicate that the information sharing with supply chain partners takes place more within the operating system or with downstream distributors instead of with upstream suppliers. To facilitate the information flow in the entire supply chain, it is essential for an organization to set up an efficient and robust information system linking up both up- and down-stream members.

Some important results were gained from an outlook on each dimension of the measurement model. As illustrated in Figure 6.4, within sourcing flexibility, the key determinant is SF1, namely the number of available suppliers. With consideration of this result, firms that aim at a higher level of flexibility should develop more potential suppliers than their competitors. In cases of unexpected environmental disturbance, these firms can be expected to adjust their partnerships with various suppliers and achieve better responsiveness. The key determinants of operating system flexibility in this study are OSF3 and OSF4, namely a firm's ability to change the output volumes, and the ability to change the product and service mix. The results suggest that those firms with a greater ability to adjust production volume and variety will more easily meet customers' changing demands. Likewise, the ability of a firm to adjust its logistics infrastructure, i.e. DF3, is an important indicator of distribution flexibility, which implies that the ability of controlling the logistics resources will increase the agility of the supply chain in a dynamic market environment. Finally, within information system flexibility,

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the ability of IT systems to support information sharing across different functional departments and across different supply chain partners, that is, ISF2 and ISF3, are perceived as most important. This suggests that a flexible information system should support not only the firm's singular process management but also information sharing across multiple functions and supply chain partners. An integrated information system provides better support for decision making, especially in today's dynamic and fragmented marketplace.

In the model test of SCF and analysis illustrated in Figure 6.3, the four proposed estimated parameters are all significant. The fit indices suggest that the proposed model fits the data adequately. The four dimensions are governed by a higher order factor, which was termed supply chain flexibility in this study. The implication is that an organization's supply chain flexibility is a multifaceted interactive synergy instead of a singular process. The existence of the second-order model suggests that SCF should be well-rounded with SF, OSF, DF, and ISF. For those managers in supply chain management, a balanced focus on these different aspects should always be kept in mind to achieve a higher level of flexibility.

7.1.2 The theoretical model of supply chain flexibility and responsiveness

For the structural model test applied in Chapter 6, the results of the statistical analysis of this mail survey indicated that the data fit the main model well. Five hypotheses were confirmed, though two were not confirmed through the results of PLS analysis. As discussed in Section 6.3, competitor orientation and supply chain partnership orientation enable supply chain

flexibility, which in turn yields sustained gains in the responsiveness of the supply chain.

Existing studies suggest that market orientation, as one of the key elements in an organization's culture, can be reflected in activities and behaviors of an organization, which results in the improvement of a business (Deshpande, Farley *et al.*, 1993). In the context of supply chain management, customer orientation and competitor orientation were perceived as two dimensions of market orientation and were examined as such in this study. Regarding the first dimension, i.e. customer orientation, its direct impact on the improvement of supply chain responsiveness was well supported in this study. With regard to competitor orientation, the results of this research provide evidence that it enables superior supply chain responsiveness indirectly through its effect on an organization's supply chain flexibility.

Supply chain partnership orientation suggests a coherent understanding of the cooperative relationship across the supply chain partners. As suggested by the results of this empirical study, a higher level of SCPO improves the supply chain responsiveness both directly and indirectly through the SCF. That is, an SCPO encourages a common perception of cooperation across the whole supply chain; this coherent set of values and beliefs in turn enables an organization be more sensitive to unexpected changes in the supply chain, thus improving the capability of the supply chain to respond to customers' changing demands. Besides, a common perception of cooperation facilitates consistent activities and behaviors in the implementation of supply chain

flexibility strategies across the supply chain partners, thus improving the efficiency of the whole chain in response to customers' demands.

The findings of this research have significant implications both theoretically and practically for the management of supply chains, which will be discussed in the following sections 7.2 and 7.3.

7.2 Theoretical implications

The role of market orientation in affecting an organization's performance is well discussed in the organizational literature. What is less understood is its role in a supply chain context. Specifically, its interactions with other constructions in the supply chain, e.g. supply chain flexibility in this study, have been seldom investigated. Four key aspects of this study represent a contribution to the theory of supply chain management.

First, this study sheds light on the implementation of flexibility strategies from a supply chain perspective, which involves both upstream suppliers and downstream distributors responding to changes in the market. These considerations extend the confinements of a single firm applied by previous research to the whole supply chain context. The finding that supply chain flexibility plays a significant role indicates that it is not just the manufacturing system within an organization, but also multiple departments and processes that are involved in improving the responsiveness of the supply chain. Therefore, a systematic perspective used to develop an SCF scale and investigate its relationship with other organizational issues in this study contributes to a better understanding of supply chain management.

Second, the results of the data analysis underline how an organization's culture characteristics add value to a supply chain through improved capability for flexibility, and enhance the firms' ability to respond to customers. Empirical evidence that supply chain flexibility mediates the link between market orientation and supply chain responsiveness is offered in this study. For researchers in supply chain and marketing areas, the results of this study will enrich their understanding of the relationships between supply chain flexibility and supply chain responsiveness.

Third, the instrument of a set of multi-item scales for the measurement of SCF is intended to be generally applicable to a wide variety of industries and settings. The lack of a theoretical base and the wide array of measures used by implementation researchers without adequate theoretical justification have been identified as major causes of this incomplete state of knowledge in flexibility (Beach *et al.*, 2000; Stevenson and Spring, 2007; Toni and Tonchia, 1998). A well-defined measurement model and measurement instrument with high degrees of validity and reliability is a prerequisite for further empirical study of this area. This study explores the nature of supply chain flexibility and has developed a conceptual model for this construct with four dimensions, namely sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility. The integration of these various notions provides a more succinct picture of supply chain flexibility, which enriches theory building in the area and facilitates further supply chain management research so as to test useable hypotheses and communicate the results effectively.

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Finally, this study examines the role of market orientation in a channel setting in which suppliers, distributors, and consumers interact. Expanding the domain of market orientation research beyond the marketing discipline and the boundary of individual firms is an important step in the progression of market orientation theory development. Applying the market orientation concept to different contexts, e.g. a supply chain perspective as in this study, facilitates the discovery of potential limitations and fosters the expansion of theoretical development of market orientation.

7.3 Implications for managers

For those managers in supply chain practice, this study contributes in three ways:

First, the findings of this study demonstrate that supply chain flexibility fosters responsiveness to customers' enquiries and requirements, and the ability to meet their various demands. In an environment of intense competition, managers should always keep in mind that better supply chain responsiveness represents a larger market share (Gunasekaran *et al.*, 2008). Therefore, the implementation of flexibility should be considered important in the supply chain management of an organization.

Further, the results of this study indicate that the implementation of SCF is facilitated by a firm's strong competitor orientation and supply chain partnership orientation. Consequently, managers can improve the flexibility of their supply chain through recognizing the potential synergy between an orientation to their competitors and their supply chain partners, and

determining proper mechanisms within their firms to bring these elements to an effective level.

Finally, the existence of a second-order model for SCF suggests that an organization's supply chain flexibility is a multi-faceted interactive synergy instead of being a singular process. Therefore, a balanced focus on these different aspects (i.e. sourcing flexibility, operating system flexibility, distribution flexibility, and information system flexibility) should always be kept in mind to achieve a higher level of supply chain flexibility. The identified conceptual framework for supply chain flexibility can assist operations managers in viewing and deploying the internal setup of their plants. It can also be used as a self-diagnostic tool to identify areas where specific improvement is needed, and to pinpoint aspects of a firms' SCF that require improvement.

7.4 Limitations

This study has several limitations. First, the scope of this study is limited. Although an extended literature review on supply chain flexibility and market orientation was conducted, it was not possible to cover all the related scope of extant studies in different disciplines. Given the focus and purpose of this study, the scope of the research was somewhat narrowed down to the phenomenon called flexibility, market orientation, partnership orientation and responsiveness in supply chain management as uniquely defined in this study. After all, different stakeholders, e.g., practitioners, researchers, and general audiences, may not agree on the appropriate scope of the research on flexibility and market orientation in a supply chain context.

Second, the unit of analysis of this study is a focal firm rather than a specific supply chain. That is, this study examines the implementation of supply chain flexibility across different supply chains for a given product line, namely the textile and clothing industry in China. This unit of analysis has enabled us to focus on organization-wide patterns of market orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness. However, future qualitative or quantitative studies which collect data from different members in a specific supply chain might also be conducted, and more informative results might be obtained.

Third, the sample of respondents is from the Chinese textile and apparel industry with one respondent per participating company. Consequently, it offers a self-reported, one-dimensional focus. The study results could be different if the data collected and perceptions captured were from other industries and settings. As such, the model and relationships should be further examined in other industrial sectors which involve a broader representation of firms.

7.5 Future research

Future studies should collect new data to confirm both the supply chain flexibility measures and the structural model results. This would provide further evidence for the validity and reliability of the SCF instruments, and it would speed the diffusion of standard instruments among the academic community (Zhang *et al.*, 2003). Following this study, a wide scope of future research merits further attention:

First, a series of studies are still needed to further refine, validate, and test the proposed instrument across different industries and settings. With these measures of SCF further refined, research in supply chain management can progress into many new areas with a higher probability of producing results for building and confirming theories.

Second, since this study did not find the existence of a causal relationship between customer orientation and supply chain flexibility, and between competitor orientation and supply chain responsiveness, which were contrary to the researcher's expectation, future research could be conducted to further examine these relationships. Specifically, research in other industries with different supply chain characteristics might find more meaningful results.

Third, interesting findings might be obtained from studies that explore supply chain flexibility in other settings. For example, further qualitative or quantitative research which collects data from different members in a specific supply chain could be conducted, as mentioned in the last section. This would help to validate the proposed framework and improve its generalizability.

Finally, new approaches to managing flexibility are expected on the basis of a critical investigation and review, which will further enrich both the theoretical and managerial development of this area.

7.6 Concluding remarks and chapter summary

This chapter concludes the thesis by providing a general conclusion and discussion of each hypothesis, discussing the theoretical and managerial implications of the study, stating its limitations and suggesting future directions of research into the practices of supply chain flexibility.

Overall in this research, a mediation model was developed to examine the theoretical linkages between customer orientation, competitor orientation, supply chain partnership orientation, supply chain flexibility, and supply chain responsiveness. The results suggest that the implementation of supply chain flexibility strategies requires coordination in an organization's arrangement for its flexibility in sourcing, manufacturing, distribution and in its information system. Moreover, supply chain flexibility can be enhanced through an organization's particular cultural characteristics, that is competitor orientation and supply chain partnership orientation. In turn, supply chain flexibility enhances the ability of the organization's supply chain to promptly respond to customer demand.

APPENDIX A: THE INTERVIEW PROTOCOL FOR THE

MULTIPLE-CASE STUDY

> Note: Before the interview, the research objectives, the information wanted from the interviews, and an explanation of the relevant concepts were presented to each informant.

- Please describe your industry sector and the role of your company in it.

- Please describe the following processes in your company: purchasing planning, purchasing, production, delivery, supply base management, distribution management.

- How do you describe the relationship between your company and your suppliers?

- Please indicate the uncertainties in the management of your supply chain. Which ones concern you most?

- What measures have been taken to deal with sourcing uncertainties? What are the effects of these measures? Will your company cooperate with your suppliers to deal with those uncertainties? How?

- How do you describe the relationship between your company and your distributors or clients?

- What measures have been taken to deal with marketing uncertainties? What are the effects of these measures? Will your

company cooperate with your distributors/customers to deal with those uncertainties? How?

- How do you describe the influences of the current uncertainties on the design of your operating systems?

- What measures have been taken to deal with uncertainties in your operating system? What are the effects of these measures? Will the different operations departments in your company cooperate to deal with these uncertainties? How?

- According to your experience and understanding of supply chains, what is a flexible supply chain? What measures other than the aforementioned have you taken to achieve such "flexibility"?

- How would you perceive the effect of the introduction of a flexibility strategy on supply chain performance?

APPENDIX B: QUESTIONNAIRE FOR THE MAIN STUDY SURVEY

尊敬的供应链管理者：

感谢您对本研究的支持。本问卷的目的是研究柔性供应链管理在企业管理中的应用，以及该应用对于提高企业的市场响应能力和竞争力所产生的效果。

阁下所提供的所有资料，将会绝对保密，并只会用于学术研究。如果您有任何问题，请随时通过电话 135-3775- 或电子邮件 candace.yi 与我联系。请

问卷填写方法

在适当的格子内加上(√)，或在预留的横线上填写适当的资料，或根据指示留下您的个人资料。

再次谢谢您的支持！顺祝商祺！

易莹
香港理工大学
纺织与制衣学系 博士生

Part A: 企业基本信息

A1. 贵公司的产品主要有：（多选，请在符合处画"√"表示）
☐₁ 衬衫　　　　　☐₂休闲服　　　　☐₃女士时装
☐₄ 女士正装（礼服）☐₅男士西装　　☐₆针织衫　　　　☐₇其他
_____

A2. 贵公司的主要市场（占销售收入百分比，请用具体数字注明）：
内地市场_____%　　　东南亚_____%　　　美国_____%

欧洲_____%　　　　日本_____%　　　其他_____%

A3. 贵公司过去三年中平均年销售收入（单位：人民币；请在符合处画"√"表示）
☐₁ 低于500万　　　☐₂ 500-1000万　　　☐₃ 1001万至5000万
☐₄ 5001万至1亿　　☐₅ 超过1亿

A4. 贵公司的员工人数：
☐₁ <200　　☐₂ 200-500　　☐₃ 501-1000　　☐₄ 1001-2500　　☐₅ >2500

Part B:

注：本问卷中用"我们"，"公司"均用来指代"我们公司"，即答卷人所在公司。请用1～7来表述您对以下陈述的同意程度（其中1为完全不赞同，4为中立，7为完全赞同）

1 公司的市场定位

完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	
1	2	3	4	5	6	7	我们公司的战略目标是提高客户满意度
1	2	3	4	5	6	7	我们了解客户的喜好和需求，对市场流行趋势做出合理预测和判断。
1	2	3	4	5	6	7	我们会对客户满意度进行全面的自我评价
1	2	3	4	5	6	7	我们重视售后服务
1	2	3	4	5	6	7	公司的销售人员会共享并相互探讨主要竞争对手的基本情况及行

						动。
1	2	3	4	5	6	7	公司高层管理人员会针对竞争对手的战略进行研究探讨
1	2	3	4	5	6	7	对于竞争对手的行动，公司能做出迅速有效的响应
1	2	3	4	5	6	7	公司善于在目标市场中发掘自己的竞争优势。

2. 与"供应链"合作伙伴的关系

注：这里的"供应链"是指生产及流通过程中，共同致力于将产品或服务提供给最终消费者的上游与下游企业，所形成的网链结构。"供应链合作伙伴"包括且不限于：供货商、生产商、代理分销商、物流配送企业等等。

请用 1～7 来表述您对以下陈述的同意程度（其中 1 为完全不赞同，4 为中立，7 为完全赞同）

完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	
1	2	3	4	5	6	7	当我们向供应链伙伴反映所遇到的困难时，对方会站在理解的立场进行回应。
1	2	3	4	5	6	7	我们认为供应链伙伴之间应该是一种连带责任关系。
1	2	3	4	5	6	7	在我们与供应链伙伴的合作中，双方均不会借机在议价中占据强势地位（压价）。
1	2	3	4	5	6	7	在我们与供应链伙伴的合作中，双方都愿意为对方做出适当的调整和改变。
1	2	3	4	5	6	7	在供应链合作中，所有的伙伴都必须共同努力以获得成功。

3、供应链管理

完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	3.1 关于采购
1	2	3	4	5	6	7	我们拥有多家可选择的供应商。
1	2	3	4	5	6	7	公司最主要的供应商（前两位）为我们提供了多种原材料/组件/产品及服务。
1	2	3	4	5	6	7	公司最主要的原材料/组件/产品 （前两位）是由多家供应商同时提供的。
1	2	3	4	5	6	7	公司可以比较容易地找到新的供应商，或减少我们现有的供应商。
							3.2 关于生产

完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	
1	2	3	4	5	6	7	与其他竞争对手相比，我们每年可开发更多的新产品/服务。
1	2	3	4	5	6	7	公司可较容易地调整自身产能（数量）。
1	2	3	4	5	6	7	公司可较容易地进行产品结构调整，提供不同产品组合。
1	2	3	4	5	6	7	公司可较容易的对生产设备与生产流程进行改造。
完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	**3.3 关于物流配送**
1	2	3	4	5	6	7	公司有很多可供选择的仓库、运力和其他物流设施。
1	2	3	4	5	6	7	公司可以比较容易地找到新的运输商和配送商，或减少我们现有的运输商和配送商。
1	2	3	4	5	6	7	公司（或公司的配送商）可较容易地改变仓库容量、运力和其他物流设施。
1	2	3	4	5	6	7	公司（或公司的配送商）可较容易地改变送货方式。
							3.4 关于企业信息管理
1	2	3	4	5	6	7	我们采用多种信息技术（例如 ERP, VMI,CRM 等）来进行供应链管理。
1	2	3	4	5	6	7	我们的信息平台可以支持公司不同部门（如采购、生产、运输部门）的信息共享。
1	2	3	4	5	6	7	我们的信息平台可以支持与其它供应链伙伴（如供应商、送货商、客户）的信息共享。

4. 供应链整体情况

完全不赞同	不赞同	略不赞同	无意见	略赞同	赞同	完全赞同	
1	2	3	4	5	6	7	我们在回应客户询盘时及时、迅速（如：对方关于品种、花色、价格、销售条件、发货、特殊包装等等的询问）。
1	2	3	4	5	6	7	我们会让客户提前知道产品和服务完成的准确时间（如：电话/传真/email 通知客户准确的送达时间；B/L 换 D/O 的预计时间)。
1	2	3	4	5	6	7	我们乐意为客户提供帮助（如：对于包装、运输提出建议；帮助他们追溯和查询产品的状态和信息等等）。
1	2	3	4	5	6	7	我们能及时满足客户的不同要求（如：即期交货、特殊订单中转运输、等等）。

							5. 客户需求预测能力
1	2	3	4	5	6	7	总体来说，我们对每一季的市场需求能做出较为准确的预测。

Part C: 答卷人基本信息

C1 您的职位 _____

C2 在供应链/生产管理领域的工作年份：_____ 年

C3 在贵公司的工作年份：_____ 年

--完，谢谢合作！--

Dear supply chain professional:

Thank you for your agreeing to participate in our research regarding the adoption of flexible practice and their affect on organization's ability to respond and compete in today's changing market environments.

All information collected with this survey will be kept strictly confidential and will only be used for academic research purpose. If you have any questions regarding to this survey, please feel free to contact me at (86)135-3775-   or by email at candace.yi.

Survey instructions

Please provide the most suitable answer(s) for each question by putting a (√) in the grid, or filling the data in the given space, or follow instructions to provide your personal information.

Thank you very much for your participation in this study.

Sincerely,

Candace YI Ying

PhD Candidate

Institute of Textile and Clothing

The Hong Kong Polytechnic University

Part A: Description of respondent firm

A1. What the sector(s) is/are your firm in? (Multi-optional)
 ☐₁ Fiber   ☐₂ Yarn   ☐   ₃Fabric
 ☐₄ Garment   ☐₅Accessory   ☐ ₆ others (Please
 specify:)

A2. Your major market:
 Mainland China_____%   SE Asia_____%   USA____%

 Europe_____%   Japan_____%   Others (Please specify:
 _____%)

A3. Your company's average annual sales turnover in the past 3 years (RMB):
 ☐₁ < 5Million   ☐₂ >5 and < 10 Million   ☐ ₃>10 and <50
 Million
 ☐₄ >50 and < 100 Million   ☐₅ >100Million

A4. Number of employees:
 ☐₁<200   ☐₂ 201~500   ☐₃501~1000
 ☐₄ 1001~2500   ☐₅>2500

Part B: Construct Questions

Note: Please specify your level of agreement with all of the questions according to the following scale.

Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree Or Disagree	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

Customer orientation	
1 2 3 4 5 6 7	Our business objectives are driven by customer satisfaction.
1 2 3 4 5 6 7	We have a good understanding of our customers' needs and a right prediction of the fashion trend.
1 2 3 4 5 6 7	We measure customer satisfaction systematically.
1 2 3 4 5 6 7	We give close attention to after-sales service.
Competitor orientation	

1	2	3	4	5	6	7	Our sales people share information about our competitors' strategies and activities.
1	2	3	4	5	6	7	The top management team discusses competitors' strategies and activities.
1	2	3	4	5	6	7	We can effectively respond to competitive actions that threaten us.
1	2	3	4	5	6	7	We target customers where we have an opportunity for competitive advantage.

Supply chain partnership orientation

1	2	3	4	5	6	7	When we share our problems with our supply chain partners, they will respond us with understanding.
1	2	3	4	5	6	7	We believe joint responsibility among supply chain partners in the whole chain.
1	2	3	4	5	6	7	In our supply chain collaboration, no party would take advantage of a strong bargain position in the supply chain.
1	2	3	4	5	6	7	In our supply chain collaboration, both sides are willing to make cooperative changes with supply chain partners.
1	2	3	4	5	6	7	In our supply chain collaboration, all parties must work together to be successful.

Sourcing flexibility

1	2	3	4	5	6	7	There are a number of available suppliers.
1	2	3	4	5	6	7	Our major supplier (top 2) provide us a number of various materials/components/products and services.
1	2	3	4	5	6	7	Our major materials/components/products (top 2) are provided by a number of suppliers.
1	2	3	4	5	6	7	It is easy for our firm to add new suppliers or remove current ones.

Operating system flexibility

1	2	3	4	5	6	7	Compared with other competitors, our firms can develop a larger number of new products/services every year.
1	2	3	4	5	6	7	It is easy for our firm to change the output volumes of our products.
1	2	3	4	5	6	7	It is easy for our firm to change the mix of our products/service.
1	2	3	4	5	6	7	It is easy for our firm to adjust the manufacturing facilities and

							process.

Distribution flexibility

1	2	3	4	5	6	7	There are a number of available warehouses, loading capacity, and other distribution facilities.
1	2	3	4	5	6	7	It is easy for our firm to add new carriers and other distributors, or remove current ones
1	2	3	4	5	6	7	It is easy for us/our distributors to change warehouse space, loading capacity and other distribution facilities.
1	2	3	4	5	6	7	It is easy for us/our distributors to change delivery modes.

Information system flexibility

1	2	3	4	5	6	7	Multiple information technology is adopted in our supply chain management (e.g. ERP, VMI, CRM).
1	2	3	4	5	6	7	Our information system is capable of supporting different functional departments in our firm.
1	2	3	4	5	6	7	Our information system is capable of supporting different partners in our supply chain.

Supply chain responsiveness

1	2	3	4	5	6	7	We are prompt when responding to customer's enquiry (e.g. respond to their inquiry about varieties, specifications, price, sales conditions, delivery, special packing)
1	2	3	4	5	6	7	We notice customers in advance about the exact time when products/services will be ready (e.g. inform the estimated time of arrival via telephone/fax/email; advise estimated time to change B/L to D/O).
1	2	3	4	5	6	7	We are always willing to help our customers (e.g. give advice on delivery schedule or package, track and trace status of operation/shipping)
1	2	3	4	5	6	7	We timely response to customers' requests (e.g. prompt delivery, special orders, transshipment arrangement).

Predictability of customers demand

1	2	3	4	5	6	7	Generally speaking, we can forecast our customers demand with

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						little error.

Part C: Informant information

C1 Your title   _____
C2 Years of experience on supply chain: _____years
C3 Years of experience in the current company: _____years

APPENDIX C: COMMON METHOD BIAS ANALYSIS

Construct	Indicator	Substantive Factor Loadings (R1)	$R1^2$	Method Factor loadings (R2)	$R2^2$
Customer orientation	CUO1	0.778**	0.605	0.000	0.000
	CUO2	0.796**	0.634	0.067	0.004
	CUO3	0.839**	0.704	-0.025	0.001
	CUO4	0.932**	0.869	-0.041	0.002
Competitor orientation	COO1	0.792**	0.627	-0.088	0.008
	COO2	0.841**	0.707	-0.006	0.000
	COO3	0.871**	0.759	-0.080	0.006
	COO4	0.559**	0.312	0.187	0.035
Supply chain partnership orientation	SCPO1	0.481**	0.231	0.221	0.049
	SCPO2	0.717**	0.514	-0.154*	0.024
	SCPO3	0.723**	0.523	-0.124*	0.015
	SCPO4	0.832**	0.692	-0.092	0.008
	SCPO5	0.608**	0.370	0.144*	0.021
Sourcing flexibility	SF1	0.798**	0.637	-0.033	0.001
	SF2	0.681**	0.464	0.112	0.013
	SF3	0.807**	0.651	-0.100	0.010
	SF4	0.651**	0.424	0.024	0.001
Operating system flexibility	OSF1	0.684**	0.468	0.054	0.003
	OSF2	0.82**	0.672	0.047	0.002
	OSF3	0.824**	0.679	-0.007	0.000
	OSF4	0.827**	0.684	-0.097	0.009
Distribution flexibility	DF1	0.601**	0.361	0.164	0.027
	DF2	0.669**	0.448	0.087	0.008
	DF3	0.930**	0.865	-0.117	0.014
	DF4	0.876**	0.767	-0.100	0.010
Information system flexibility	ISF1	0.528**	0.279	0.031	0.001
	ISF2	0.618**	0.382	0.034	0.001
	ISF3	0.559**	0.312	0.050	0.003
Supply chain	SCR1	0.766**	0.587	-0.034	0.001

responsiveness	SCR2	0.900[**]	0.810	-0.038	0.001
	SCR3	0.891[**]	0.794	0.018	0.000
	SCR4	0.850[**]	0.723	0.047	0.002
Average		**0.752**	**0.580**	**0.005**	**0.009**

[*]P<0.05; [**]P<0.01

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