Integrated Logistics and Supply Chain Management, Global Sourcing and Sustainable Competitive Advantage

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Integrated Logistics and Supply Chain Management, Global Sourcing and Sustainable Competitive Advantage

(An Empirical Study of the Automobile and Electronics Industries in Korea)

by

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DECLARATION AND STATEMENTS

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ABSTRACT

This thesis aims to explore the strategic roles of integrated logistics and supply chain management and global sourcing strategy for firms' performance, and to examine the direct and indirect relationships between integrated logistics and supply chain management, logistics performance, global sourcing performance, and further sustainable competitive advantage. This thesis adopts resource based theory to explore the relationships between a firm's specific capability and its performance and employs structural equation modelling in order to rigorously test the validation of the measurement models and examine the relationships between the construct variables. The data used were collected by postal questionnaire survey from logistics managers of 195 firms from the automobile and electronics industries based in Korea.

The empirical research shows that (1) there exists a significant positive relationship between information & planning formality and strategic planning; (2) strategic planning has a significant positive influence upon integrated logistics and SCM capability; (3) internal integration & customer relationship has a significant effect on logistics performance; (4) supplier integration and logistics integration & customer service exert significant impacts upon global sourcing performance; (5) supplier integration has a significant effect on the firm's competitive market position; (6) a superior logistics capability exerts a significant impact upon global sourcing performance and sustainable competitive advantage; (7) global sourcing capability has a significant influence on sustainable competitive advantage and competitive position in the market; and (8) competitive position in the market is significantly predicted by sustainable competitive advantage. In addition, this research presents many significant indirect effects between the constructs.

Overall, this thesis suggests that a firm should develop an integrated logistics and SCM capability in balance and make efforts to build superior logistics and/or global sourcing capabilities in order to effectively obtain and/or reinforce its competitive market position and long-term survival and success.

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LIST OF CONTENTS

CONTENTS | Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATIONS	FULL WORDS
ADF	Asymptotically Distributed Free
AGFI	Adjusted Goodness-of-Fit Index
APT	Access to Production Technology
CAIC	Consistent Akaike Information Criterion
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CPM	Competitive Position in Market
EDI	Electronic Data Interchange
EFA	Exploratory Factor Analysis
FLEX	Flexibility
GFI	Goodness-of-Fit Index
GLS	Generalised Least Squares
GSE Model	Global Sourcing Excluded Model
GSI Model	Global Sourcing Included Model
GSP	Global Sourcing Performance
IC	Information Contents
IFI	Incremental Fit Index
IICR	Internal Integration and Customer Relationship
INNO	Innovation
IOP	Industrial Organisation Paradigm
IPF	Information and Planning Formality
IS	Information Sharing
IT	Information Technology
LFC	Lower Factor Cost
LICS	Logistics Integration and Customer Service
LP	Logistics Performance
MANOVA	Multivariate Analysis of Variance
MLE	Maximum Likelihood Estimation
MS	Market Share
NFI	Normed Fit Index
OEM	Original Equipment Manufacturer
OLS	Ordinary Least Squares
PCFI	Parsimonious Comparative Index
PLM	Penetrating Local Market
PNFI	Parsimonious Normed Fit Index
PRNO	Pre-notification
QUAL	Quality
RBT	Resource-Based Theory
RELIA	Reliability
RESP	Responsiveness
RLD	Reducing Local Differences
RMSEA	Root Mean Square Error of Approximation
RMSR	Root Mean Square Residual
RTD	Reducing Time Delay
SCA	Sustainable Competitive Advantage
SCM	Supply Chain Management
SEM	Structural Equation Modelling
SGRC	Sales Growth Rate compared to Competitors
SGRM	Sales Growth Rate compared to Market
SI	Supplier Integration
SP	Strategic Planning
SPF	Strategic Planning Formality
SPP	Strategic Planning Process
SPS	Strategic Planning Sharing
TCT	Transaction Cost Theory
TLI	Tucker-Lewis Index
WLS	Weighted Least Squares

CHAPTER ONE

CHAPTER 1

INTRODUCTION

This introductory chapter is organised in the following way. The first section explains the research background and motivation. The second section addresses the main research objectives that this thesis explores. The final section illustrates the analytical steps that the current research follows.

1.1. Research Background and Motivation

One of the most critical paradigm shifts in the recent strategic management field is described by Christopher (1998) in a comment that "we are now entering the era of supply chain competition". Subsequently, supply chain management (SCM) has been recognised as a specific strategic ability for the firm to pursue sustainable competitive advantage. Amongst them, 'integration' becomes one of the most critical issues in logistics and supply chain management because to be properly effective in the contemporary competitive environment, firms must expand and extend their integrated behaviour to include customers and suppliers (Bowersox and Closs, 1996). Chow *et al.* (1995) have posited that integration is the extent to which logistics tasks and activities within the firm and across the supply chain are managed in a coordinated manner. Likewise, Ellinger *et al.* (2000) have pointed out that integration is the best way to co-ordinate diverse areas involving multi-level participants to achieve efficient and effective logistical service. Empirically, Daugherty *et al.* (1996) found that integrated firms showed more success in improved customer service, quality improvements, productivity improvements, reduced costs, improved strategic focus and cycle time reductions than did non-integrated firms.

Meanwhile, more and more firms are purchasing their various materials, supplies, parts, and services from a global arena (Fagan, 1991). Swamidass and Kotabe (1993) have addressed this by stating that sourcing is an important part of global rationalization, which is the strategy of optimizing production and distribution decisions across an international network of facilities that depend upon each other for raw materials and components. Companies have realised that global sourcing is advantageous and profitable (Monczka and Trent, 1991) and many studies (such as Kotabe and Murray, 1990; Levy, 1995; Swamidass and Kotabe, 1993) have suggested that global sourcing becomes recognised as a critical strategic tool for firms to obtain and maintain sustainable competitive advantage. However, the global sourcing strategy should be supported by an efficient and effective logistic system; in particular, integrated logistics and supply chain management can be a fundamental condition.

Against this background, it is worthwhile exploring the strategic roles of integrated logistics and supply chain management and global sourcing strategy for firms' performance, and examining direct and indirect relationships between integrated logistics and supply chain management, logistics performance, global sourcing performance, and further sustainable competitive advantage.

This thesis adopts resource based theory (RBT) to explore the relationships between a firm's specific capability and its performance, since performance can be explained primarily by the strength of a firm's resources and since RBT might constitute the basis of a unifying paradigm for strategic management research (Conner, 1991; Mahoney and Pandian, 1992 cited in Hoskisson *et al.*, 1999). Subsequently, in the current study, the integrated logistics and supply chain management and global sourcing ability are considered a firm's specific capabilities. In addition, the current study employs structural equation modelling (SEM) as a main analytical technique in order to rigorously test the validation of the measurement models and examine the relationships between the constructs mentioned above considering the direct and indirect effects together.

1.2. Research Objectives

The primary objective of this study is to examine the relationships between the integrated logistics and supply chain management, logistics performance, global sourcing performance and sustainable competitive advantage in the automobile and parts industry and the electronics industry in Korea. Three research questions associated with the objectives are presented as follows:

(1) What are the major capabilities of the integrated logistics and supply chain management?

(2) What are the influences of manufacturing companies' integrated logistics and supply chain management upon their logistics performance, global sourcing performance and their sustainable competitive advantage?

(3) What are the impacts of the superior logistics and/or global sourcing capability on the firm's sustainable competitive advantage?

The first question concerns the characteristics of the integrated logistics and supply chain management and in addition, some critical components or conditions supporting the integration.

The second question aims to explore the effects of integrated logistics and supply chain management upon the firms' important performance areas such as logistics and global sourcing performance and their long-term competitive advantage.

The final question examines whether superior logistics and/or global sourcing capability could have significant positive influences on firms' sustainable competitive advantage.

Those three questions are presented by hypothesised relationships between latent variables and their direct and indirect relationships are explored simultaneously by the structural equation modelling technique.

1.3. Research Structure

In order to accomplish the research objectives outlined above, the current study is structured into seven chapters as presented in Figure 1.1.

Chapter one introduces the research background and motivation, research objectives and overall research structure.

Chapter two concentrates on the literature review for both theoretical and empirical studies. The primary objectives of this chapter are: (1) to provide a theoretical framework on which this research is based; (2) to define and categorise integrated logistics and supply chain management, global sourcing strategy and logistics performance; and (3) to critically investigate and summarise the effectiveness and influences of organisations' integrated logistics and supply chain management and global sourcing strategy upon their performance and strategic objectives from various existing research.

Chapter three provides a research framework and a conceptual model describing the relationships between integrated logistics and supply chain management, global sourcing strategy and firm performance including logistics and competitive advantage. Together with the conceptual model, research hypotheses regarding relationships between the latent variables are developed. In addition, the observed variables for each latent variable are examined and chosen.

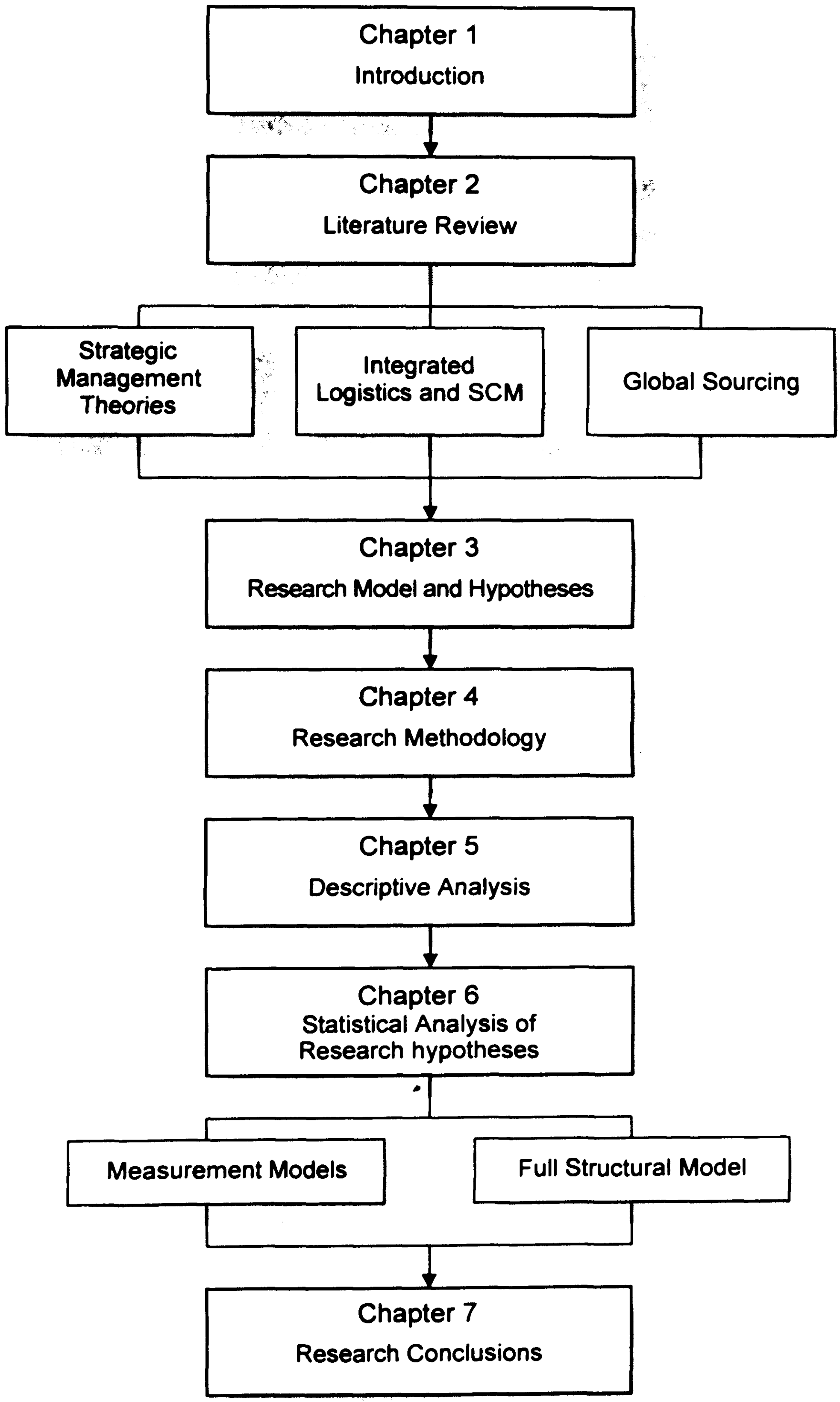
Chapter four describes the research methodology and procedures. The chapter details the research process, the data collection method, the questionnaire development process, the target industries and sampling design process, and the concepts and sub-dimensions of validity and reliability. Subsequently, structural equation modelling is introduced and relevant critical issues are discussed. In addition, a comprehensive SEM analysis process is introduced and adopted.

Chapter five presents the descriptive statistics resulting from the postal questionnaire survey in order to provide a general picture of survey participants and their responses to the questions. Descriptive analysis for the integrated logistics and supply chain management capability and three types of firm performance (logistics performance, global sourcing performance and sustainable competitive advantage) are elaborated.

Chapter Six presents data analysis and the results of the hypotheses test through the structural equation modelling. This chapter firstly deals with data preparation and item purification issues. Next the measurement models are validated using confirmatory factor analysis (CFA). Finally the hypothesised relationships between the latent variables are tested by structural equation models.

Chapter seven summarises the empirical findings and explains their implications for the relevant theory and practice. In addition, the contribution and limitation of the current research are addressed together with some considerable and meaningful issues for future study.

Figure 1.1. Structure of the Current Study



CHAPTER TWO

CHAPTER 2
LITERATURE REVIEW

This chapter concentrates on the literature review for both theoretical and empirical studies. The main aims of this chapter are: (1) to provide a theoretical framework on which this research is based; (2) to define and categorise integrated logistics and supply chain management, global sourcing strategy and logistics performance; and (3) to critically investigate and summarise the effectiveness and influences of organisations' integrated logistics and supply chain management and global sourcing strategy upon their performance and strategic objectives from various existing research. The framework of this chapter is organised in the following way. The chapter starts with a review of the strategic management theories, through which an applicable theoretical base for this study will be sought. In the second section, relevant integrated logistics and supply chain management issues are discussed in detail. Next, a deliberation of global sourcing as a strategic tool for multinational firms to achieve superior performance is followed. The final section deals with the definition of logistics performance and the measurement issues to adopt them appropriately in the current study. Specific interest in competitive advantage and sustainable competitive advantage is maintained throughout the chapter and discussed in detail throughout all the sections.

2.1. Strategic Management Theories

Bowersox and Closs (1996) have argued that to be properly effective in the contemporary competitive environment, firms must expand and extend their integrated behaviour to include customers and suppliers. This extension of integrated behaviours, through external integration, is referred to by the authors as supply chain management. Earlier, Lambert *et al.* (1978) stated that "some managers were beginning to realize that total costs could be reduced, customer service improved, and interdepartmental conflicts substantially reduced if distribution activities were more closely coordinated and centrally programmed. So these firms were beginning to develop integrated distribution systems designed to provide predetermined customer-service levels at the lowest possible total distribution costs." Chow *et al.* (1995) have posited that the concept of integration is central to logistics. In this view, integration is the extent to which logistics tasks and activities within the firm and across the supply chain are managed in a coordinated manner. Likewise, Ellinger *et al.* (2000) have pointed out that integration is the best way to co-ordinate diverse areas involving multi-level participants to achieve efficient and effective logistical service. Therefore, a firm's integrated logistics and supply chain management can be understood as its strategic behaviour to create better performance and obtain a long-term competitive position.

Concerning this issue, the present study proposes three questions as follows. (1) What are the major capabilities of the integrated logistics and supply chain management? (2) What are the influences of manufacturing companies' integrated logistics and supply chain management upon their logistics performance, global sourcing performance, and in addition their sustainable competitive advantage? And (3) what are the impacts of a firm's superior logistics capability and global sourcing strategy on the firm's sustainable competitive advantage? In order to answer these questions, firstly, the context and characteristics of integrated logistics and supply chain management should be defined; secondly, the causal relationships between the firm's strategic behaviour and its influences on firm performance should be established on a rigorous theoretical foundation; thirdly, the established causal relationships should be properly tested and validated through a comprehensive methodological process and explained with theoretical and/or practical grounds.

The current study commences with a literature review for strategic management theories to seek a logical foundation – theoretical framework; since "when undertaking any analysis, it is helpful to have a framework within which to work and from which testable hypotheses can be draw and it enables observed business behaviour to be evaluated and therefore provides better explanations of the motivations for firms' behaviour and the consequences for efficiency within a supply chain" (Hobbs, 1996). The literature review focuses on how supply chain management context could be defined and how effectively the causal influence of the firm's strategic behaviour (i.e. integrated logistics and supply chain management) u pon its performance could be established and explained by each acknowledged theory.

Through the literature review an effectively adoptable theoretical framework for the current study will be sought.

2.1.1. Transaction Cost Theory

Transaction cost theory (hereafter TCT) has its origins in Coase's (1937) article 'The Nature of the Firm', in which he defined a transaction cost as "a cost of using the price mechanism." Coase (1937) went on to answer the question of "why a firm emerges at all in a specialised exchange economy" by describing how firms usually expand until the costs of organising an extra transaction within the firm become equal to the costs of carrying out the same transaction through an exchange on the open market or the costs of organising in another firm.

Transaction cost refers to the cost of providing for some good or service through the market rather than having it provided from within the firm and includes (1) search and information costs; (2) bargaining and decision costs; and (3) policing and enforcement costs (Watkins, 2004). Williamson (1975) describes how markets and hierarchies represent alternative governance mechanisms to conduct transactions. If a price system fails to provide accurate and reliable market signals then hierarchies become a dominant mechanism (Williamson 1975, 1985). According to Williamson (1985), four key concepts inform TCT – bounded rationality, opportunism, market uncertainty and asset specificity. Bounded rationality refers to the fact that although people may plan on making a rational decision, their ability to evaluate accurately the full range of possible decision alternatives is limited. Opportunism suggests a type of behaviour where individuals attempt to realise self-interest through 'guile'. Uncertainty refers to the unforeseeable variations in price, quality, supply or demand for an intermediate product. And asset specificity refers to situations in which one partner to an exchange has invested resources specific to that exchange which would have almost no value in an alternative context. In Williamson's view (1985), the governance mechanism is determined by 'market uncertainty' and 'asset specificity'. The market develops a more efficient mechanism when the level of market uncertainty is not critical and when assets are non-specific to any single transaction. Thus, the higher the level of market uncertainty (imperfect information) and asset specificity, the greater is the rationale for the existence of firms (Mentzer *et al.*, 2004).

Using these characteristics, Ellram (1992) has argued that the relationships in the supply chain may be simple when involving the purchase of commodities. However, they can be complex when they involve specific products provided by only a limited number of suppliers or require specialized assets to produce (cited in Hoyt and Huq, 2000). Following Hoyt and Huq (2000), TCT predicts that without some degree of governance mechanism, agreements between organizations will inevitably confront risks from opportunistic behaviour. For instance, when the supplies market is competitive and asset specificity is low, the buyer can easily end the relationship if the supplier does not meet his obligations or if the resource is no longer needed. However, in the case of more specialized products requiring high investment or which have only a limited number of suppliers, the governance mechanisms will be more formalized and less flexible.

TCT provides an explanation for the existence and structure of supply chain, for instance vertical 'co-ordination'. According to Hobbs (1996), some kind of vertical co-ordination is inevitable if any production takes place; in his view it can be viewed as a continuum: at one extreme we find spot markets while at the other end there is full vertical integration; in between the two extremes there are a large number of alternative ways of co-ordinating economic activity such as strategic alliance or joint venture. He has explained that the form of vertical co-ordination is shaped by the main characteristics of transactions – (1) the degree of uncertainty surrounding the transaction; (2) the degree of asset specificity; and (3) the frequency of the transactions. Firstly, a low level of uncertainty tends to be found where there are spot market transactions. When aspects of the transaction are very uncertain, a more formal type of ve rtical co-ordination may ensue. Secondly, products which have a non-specific nature, or are produced with non-specific assets, have many alternative uses and are generally sold in a spot market. As asset specificity increases, so vertical co-ordination develops in the direction of a more formal type of supply chain management. Thirdly, transactions repeated frequently are usually carried out in the spot market. However, as Hobbs (1996) points out, as transactions become less frequent, incentives to act opportunistically and exploit any informational asymmetries may increase; therefore, the form of the vertical co-operation gravitates towards the extreme form of vertical integration. Relating firms' logistics outsourcing

TCT may provide a useful implication. Mentzer *et al.* (2004) summarised several researchers' ideas about this matter. "Firms expect to reduce total transaction costs by hiring third party logistics (3PLs) service providers (Skjoett-Larsen, 1999). When the asset specificity of logistics services is low, manufacturers outsource logistics functions (Aertsen, 1995; Williamson, 1999). When asset specificity is high and market conditions uncertain, manufacturers either internalize logistics operations or enforce detailed legal contracts with 3PLs (Hoeck, 2000; Williamson, 1975)."

Prior to the mid-1980s, over nearly three decades, TCT had offered an acceptable explanation of governance mechanisms in the supply chain. Recently, however, the usefulness of TCT is doubted by some authors. Ghoshal and Moran (1996) have argued that TCT is unable to explain many current day markets where institutional environments and exchange practices are more developed. They have criticised the assumption and logic of Williamson's conception of TCT and asserted that firms are not mere substitutes for markets: "They possess unique advantages for governing certain kinds of economic activities through a logic that is very different from that of a market" and TCT is "bad for practice because it fails to recognize this difference". Concerning supply chain management issues, Monczka *et al.* (1998) established empirically that successful strategic alliances could maintain higher levels of commitment, trust and coordination, and interdependence. This view may lead to an assertion that trust and collaboration were growing more common in supply chain relationships because of their ability to reduce uncertainty. Similarly, Mentzer *et al.* (2004) amongst others argue that TCT does not explain the growth in long-term, committed, strategic partnerships (arrangements that provide final assembly, packaging, and distribution activities) between buyers and sellers. This idea suggests that long-term relationships, based on a win-win philosophy, are gradually superseding the adversarial relationships of the past that were explained by TCT.

TCT represents one possible approach to generally understand the existence and structure of logistics and supply chain management based on the characteristics of transaction (i.e. bounded rationality, opportunism, market uncertainty and asset specificity). In addition, TCT could imply one motivation of supply chain management – minimisation of transaction cost. However, it could not sufficiently explain current supply chain relationship phenomena. In addition, although TCT provides an explanation of the reasons for and structure of supply chain management, it could not effectively present how logistics and supply chain management can influence the firm's performance and its competitive advantage indexes such as quality, flexibility or innovation. In particular, a critical problem with TCT is that "measurement of transaction costs has not kept pace with theoretical developments" (Hobbs, 1996).

2.1.2. Industrial Organisation Paradigm – Porter's Generic Strategies

The industrial organisation paradigm (hereafter IOP) posits that firms competing within the same industry are homogeneous in terms of the strategically relevant resources they control and the strategies they follow. Furthermore, it assumes that if resource heterogeneity arises in an industry or group, it will be very short lived because of the mobility of the resources that firms use to implement their strategies (Barney, 1991). Grounded in this assumption, the IOP has asserted that a firm decides its strategic behaviour based on the external market environments (Gagnon, 1999; Lynch *et al.*, 2000), and the firm's adaptation to the characteristics of its market is the major determinant of firm performance (Truss, 2001 cited in Jung, 2003). Porter (1981) states that industry structure determines conduct (strategy), which then determines collective performance. This means that conduct can be ignored and performance can be explained by industry structure. This industrial organisation focused paradigm has been trusted over long periods amongst many business researchers. Porter (1980) proposed an analytical framework that aids understanding of the structure of industry. In his view, a firm's market position and strategy are influenced by the combined effects of five market forces: (1) the threat of new entrants; (2) rivalry within the industry; (3) buyer power; (4) supplier power; and (5) the threat of substitution. The ability of a firm to win competitive advantage is chiefly dependent on how well it manages to position and differentiate itself in an industry. Porter identified three generic strategies shown in Figure 2.1: (1) cost leadership; (2) differentiation; and (3) focus. A firm may aim for superior performance after careful consideration of these market forces with the objective of either selecting an attractive industry or developing a strong competitive position within an industry. This can be achieved through a cost leadership strategy or a differentiation strategy (Lynch *et al.*, 2000)[1].

Figure 2.1. Porter's Generic Strategy

		Source of Competitive Advantage	
		Low cost	Differentiation
Competitive Scope	Industry-wide	Cost Leadership	Differentiation
	Single Segment	Focus	

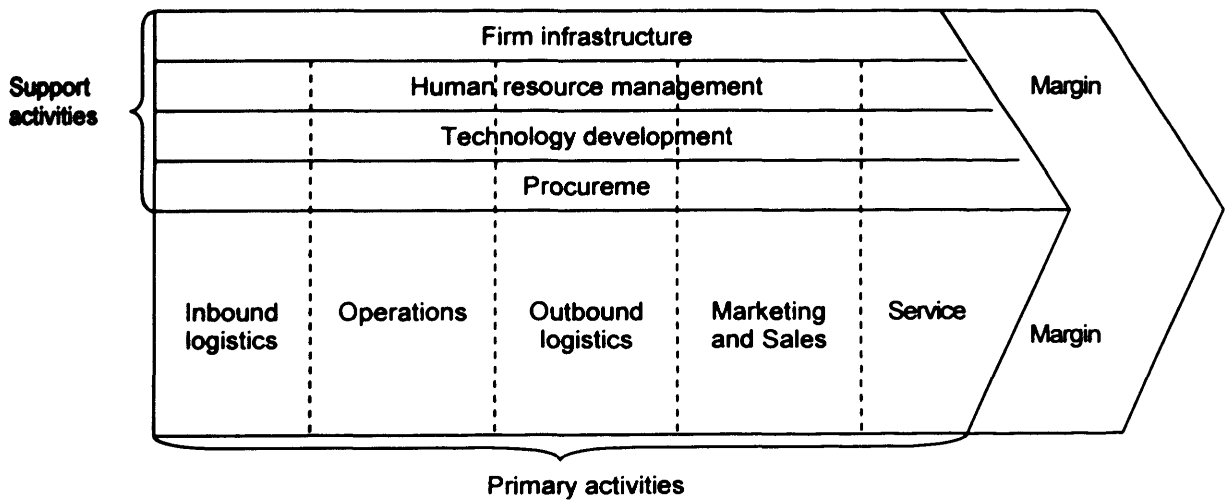
Source: Grant, 1998

Relating to supply chain management issues, Porter (1985) has pointed out that vertical linkages reflect interdependencies between a firm's activities and the value chains of suppliers and distributors. Where the 'value chain' concept widely introduced by Porter (1985) is explained as follows: "Competitive advantage cannot be understood by looking at a firm as a whole. It stems from the many discrete activities a firm performs in designing, producing, marketing, delivering, and supporting its product. Each of these activities can contribute to a firm's relative cost position and create a basis for differentiation. The value chain disaggregates a firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation. A firm gains competitive advantage by performing these strategically important activities more cheaply or better than its competitors." Figure 2.2 illustrates the value chain. Value chain

[1] Concerning Porter's typology there has been a controversial issue of whether a firm can pursue more than one generic competitive strategy. Porter views cost leadership and differentiation as mutually exclusive strategies – A firm that attempts to pursue both is 'stuck in the middle'. However, although Porter argued that commitment and support are diluted when more than one strategy is pursued, some empirical evidence suggests that successful firms are both low-cost producers and sell differentiated goods (Schnaars, 1991 cited in Chow *et al.*, 1994). For instance, the principle and methods of total quality management have exploded the myth that there is a trade-off between high quality and low cost (Grant, 1998).

activities can be classified into two main types – primary activities (inbound logistics, operations, outbound logistics, marketing and sales, and service) and support activities (infrastructure, human resource management, technology development and procurement). These support activities can be seen as integrating functions that cut across the firm's various primary activities. Therefore, effective logistics and supply chain management can create 'value' for the firm's customers and its competitive advantage by coordinating and jointly optimizing the inbound (suppliers) and outbound (customers) supply chain. In addition, as marketing, sales, and manufacturing with logistics has a more integrated nature, it can lower costs and/or enhance differentiation.

Figure 2.2. The value chain



Source: Porter, 1985

The influence of the industrial organisational paradigm on research into strategy was pivotal; in addition, it made the methodology of strategy research much more 'scientific' (Hoskisson *et al.*, 1999). However, from the middle of the 1980s, IOP began to be doubted due to its inability to explain how firms achieve different levels of performance even when they compete within the same industry and furthermore use the same strategy (Barney, 1991; Lynch *et al.*, 2000; Russo and

Fouts, 1997). The dissatisfaction with this 'industry explanation' assisted the rapid rise of the resource-based theory (Fahy and Hooley, 2002).

2.1.3. Resource-Based Theory

In Porter's generic strategy approach, firms respond to external competitive market forces. In contrast, the resource-based theory (hereafter RBT) involves capabilities or resources that are internal to the organisation. RBT was first propounded by Penrose in the late 1950s, reintroduced by Wernerfelt in the 1980s, and went on to became a dominant framework in the 1990s (Hoskisson *et al.*, 1999). Penrose (1959) viewed the firm as a collection of productive resources. She described resources as the tangible objects a firm buys, leases, or produces for its own use, and the people hired on terms that make them effectively part of the firm (Hoskisson *et al.*, 1999). Similarly, Wernerfelt (1984) has noted that "firms are bundles of resources that can be employed to influence performance." A firm's resources are defined as tangible (e.g. plants, equipment, raw materials, distribution centres, and logistics networks of these plants and distribution centres) and/or intangible (e.g. relationships, corporate culture, management skills, logistics expertise, and customer loyalty) assets which are tied semi-permanently to the firm. An illustrative example of an intangible resource is knowledge. Firms have different technological and organizational knowledge bases, which affect how resources are used to create products/services. The firm builds up a collective memory of past problems and solutions and develops behavioural rules and standard operating procedures to use when confronting changes in the environment (Mentzer *et al.*, 2004).

The central premise of RBT addresses the key question of why firms differ and how firms manage to achieve and maintain competitive advantage (Hoskisson *et al.*, 1999). Here, sustainable competitive advantage is different from competitive advantage. Competitive advantage is often defined as a positional advantage gained by a firm which, in contrast to the competition, provides customers with the lowest cost or perceived uniqueness (Porter, 1985). However, competitive advantages can often be rapidly lost by competitors in a relatively short time. Therefore, in order to be strategically relevant, competitive advantages should be sustained (Porter, 1985).

Sustainable competitive advantage is defined as a competitive advantage that is not easily replicable or eliminable, can be maintained over a certain period of time and is the origin of a firm's sustainable superior performance. Therefore economic rents only have importance in so far as they can be sustained over time and transformed into superior performance. Barney (1991) distinguished two concepts as follows: "A firm is said to have a competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors. In contrast, a firm is said to have a sustained competitive advantage when it is implementing a value creating strategy not simultaneously being implemented by any current or potential competitors and when these other firms are unable to duplicate the benefits of this strategy. Whether or not a competitive advantage is sustained depends upon the possibility of competitive duplication."

Concerning sustainable competitive advantage, RBT assumes that firms within an industry are heterogeneous with respect to the strategic resources they control and that such resources are not completely mobile across firms. This leads to a conclusion that heterogeneity can be long lasting (Barney, 1991). Likewise, Rumelt (1984) has shown that firms may start as homogeneous, but with 'isolating mechanisms', they become so differentiated that their resources cannot be fully imitated. Barney (1991) proposed four criteria to assess the economic implications of the resources: (1) value; (2) rareness; (3) inimitability; and (4) substitutability. Barney (1991) explained those four criteria as follows. "Firstly, 'value' refers to the extent to which the firm's combination of resources fits with the external environment so that the firm is able to exploit opportunities and/or neutralise threats in the competitive environment. Secondly, 'rareness' means the physical or perceived physical rareness of the resources in the factor market. Thirdly, 'inimitability' is the continuation of imperfect factor markets via information asymmetry such that resources cannot be obtained or recreated by other firms without a cost disadvantage. Finally, firms should consider whether they are 'substitutable' by competitors." According to Mentzer *et al.* (2004), heterogeneity of resources acts as a source of competitive advantage for firms since they are not completely imitable for competing firms. It has been argued that these barriers to imitation explain not only a firm's ability to sustain rents but also the differences amongst firms within an industry.

Related to supply chain management, RBT provides a useful explanation about the driving forces and their effects. Through a critical literature review, Mentzer *et al.* (2004) explained supply chain relationship as follows: "As RBT argues, capabilities within a network of firms often complement firms' internal resources (Langlois, 1992). Consequently, firms engage in collaborative relationships to add value or reduce cost in inter-firm exchanges (Anderson, 1995). Buchanan (1992) found that the best performing categories from the perspective of a buying firm were not those in which the firm held power over the suppliers, but rather those in which the firm and suppliers were mutually dependent to serve their ultimate customers better. Under such circumstances, a firm is more likely to work with suppliers that deliver value (Cannon and Homburg, 2001)." Accordingly, Bowersox *et al.* (2000) see the objective of integrated logistics, both inside and outside a firm within a supply chain, as being to enhance end-customer value. According to RBT, long-term relationships grounded on a win-win philosophy with a core group of suppliers may lead to a greater sustainable competitive advantage than relationships founded on the principles of a bid-buy system (Hoyt and Huq, 2000). According to Dyer and Singh (1998), RBT research has suggested that collaboration based on trust enables firms to acquire resources, which are valuable, rare, hard to imitate and which have no readily available substitute. In the RBT model, a sustainable competitive advantage can be gained when the relationship entails high levels of trust which support responsiveness and a willingness to take on greater levels of risk (Hoyt and Huq, 2000). Therefore, from an RBT viewpoint, logistics and supply chain management can be understood as a critical capability of the firm, which makes it differ from its competitors and effectively achieve and maintain competitive advantage.

In summary, TCT provide an explanation about the motivations and structure of logistics and supply chain management; however it could not sufficiently explain current supply chain relationship phenomena, especially in the case of supply chain management based on long-term collaboration presented by various authors (Dyer and Singh, 1998; Hoyt and Huq, 2000 Mentzer *et al.*, 2004; Monczka *et al.*, 1998). In addition, TCT could not practically presents how logistics and supply chain management can influence on the firm's performance and its competitive advantage. Porter's generic strategy offers a base for vertical integration of supply chain using 'value chain' concept. However, it can not clearly explain the performance differences amongst 'homogenous' firms competing within the same industry using the same strategy. On the contrary, resource based theory seems to be an effective tool to explain logistics and supply chain management issues and analyse the relationships between firms' integrated supply chain management and their sustainable competitive advantage. This recognition is in line with the assertion that the strategic management discipline has moved from a 'market-based' to a 'resource-based' view of competition: High performance can be explained primarily by the strength of a firm's resources, and not by the strength of its market position. Conner (1991) and Mahoney and Pandian (1992) concluded that RBV might constitute the basis of a unifying paradigm for strategic management research (Hoskisson *et al.*, 1999). For those reasons mentioned above, the current study will adopt a resource based theoretical framework. This theoretical framework will be discussed in detail in the next chapter.

2.2. Integrated Logistics and Supply Chain Management

Integration can be seen as one of the most critical issues in contemporary logistics and supply chain management because to be properly effective in the modern competitive environment, firms must widen their integrated behaviour to take in both customers and suppliers (Bowersox and Closs, 1996). The first part introduces the definitions and evolutionary processes of logistics and supply chain management. The second part presents the terminology and typology of integrated logistics and supply chain management and its influence on firm performance by investigating existing empirical research. In the third part, the concepts and empirical studies of information capability and strategic planning capability are introduced as main antecedents for the integrated logistics and supply chain management.

2.2.1. Definition and Evolution of Logistics and Supply Chain Management

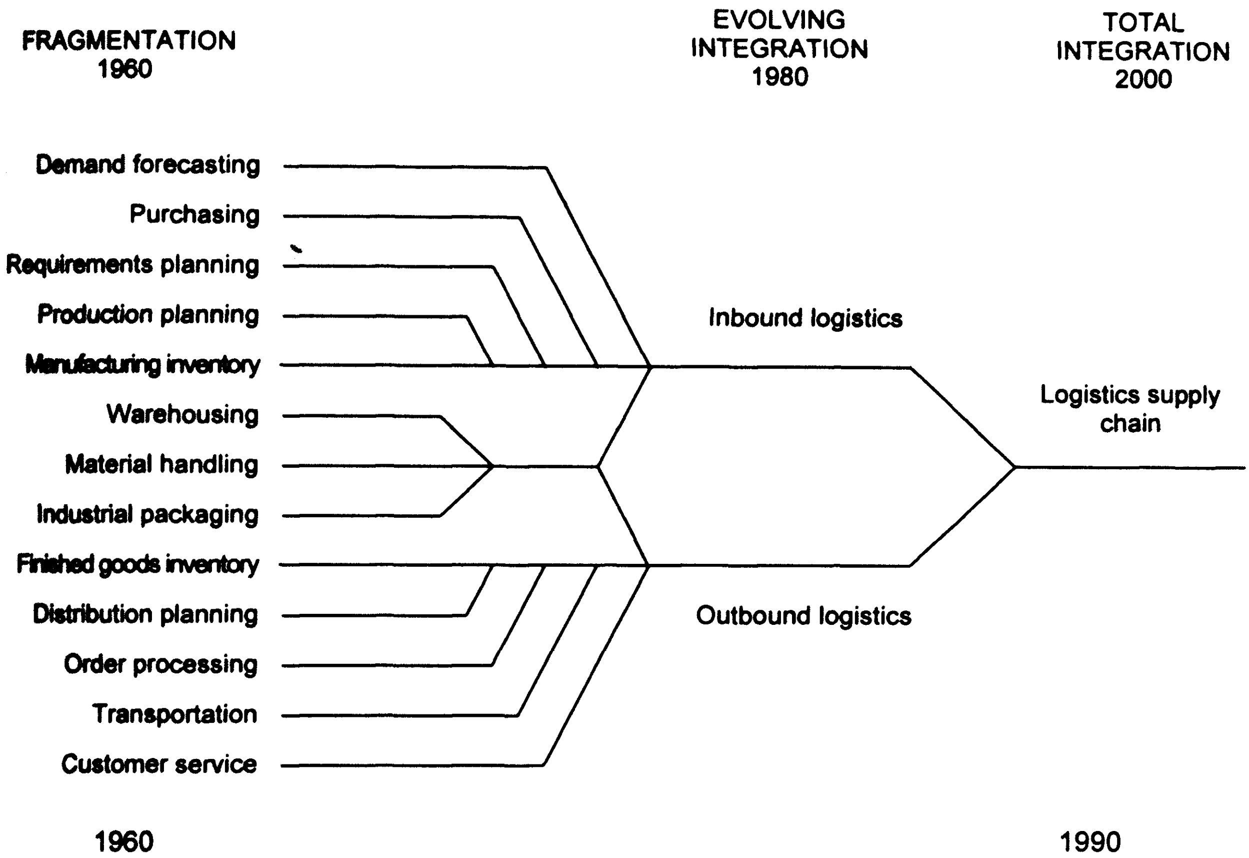
1) Logistics

Logistics, which was first used as a military term during the Napoleonic Wars, refers to the technique of moving and quartering armies (Lysons and Gillingham, 2003). Major Chauncey B. Baker (1905) stated that "the branch of the art of war pertaining to the movement and supply of armies is called logistics" (Johnson *et al.*, 1999). Logistics was much studied in a military context during both World Wars. The Second World War in particular saw greater movement of troops and supplies than in any other historical period. Over the following years, the appliance of logistics has become increasingly relevant within the business arena (Lummus *et al.*, 2001).

Many researchers have focused on the functional integration of logistics processes or channels. As cited in Lummus *et al.* (2001), Cavinato (1982) defined logistics as the management of all inbound and outbound materials, parts, suppliers, and finished goods. In Cavinato's view, logistics relates to the integrated management of purchasing, transportation, and storage on a functional basis. On a channel basis, logistics is composed of the management of the pre-production, in-production, and post-production channels. Therefore, the term logistics should be set apart from physical distribution as the latter conventionally refers to only the post-production channel. According to Gattorna (1994), logistics is "the process of strategically managing the acquisition, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channels in such a way that current and future profitability is maximised through the cost-effective fulfilment of orders". Wendling (1998) has stated that logistics is the total management of the key operational functions in the supply chain – procurement, production and distribution. Procurement involves purchasing and product development while the production function involves manufacturing and assembling and the distribution function relates to warehousing, inventory, transport and delivery (cited in Lysons and Gillingham, 2003). As cited in Lummus *et al.*, (2001), Cox *et al.* (1998) defined logistics in both the business and the military contexts. In the business context, logistics can be viewed as the art and science of obtaining, producing, and distributing materials and product in the proper place and in proper quantities while in the military sense, logistics obviously includes the movement of personnel. Crompton and Jessop (2001) defined logistics succinctly as the process of managing both the movement and storage of goods and materials from the source to the point of ultimate consumption and the associated information flow. Other authors have stressed the demand side of logistics. As cited in Lysons (2000), Burgh (1994) has shown that logistics systems entail the integration of procurement, transportation, inventory management and warehouse activities to provide the most cost-effective means of meeting internal and external customer requirements.

The definition of logistics used by Coyle *et al.* (2003) may be summarised as the process of (1) anticipating customer needs and wants; (2) acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants; (3) optimising the goods or service producing network to fulfil customer requests; and (4) utilising the network to fulfil customer requests in a timely way. Some logistics related institutes also have defined the term, logistics. The Council of Logistics Management (1998) defined logistics as "the process of planning, implementing, and controlling the efficient, effective flow and storage of goods, services and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements". This definition includes inbound, outbound, internal and external movements and return of materials for environmental purposes. The UK Institute of Logistics and Transport (1998) defined logistics more simply as "the time-related positioning of resources or the strategic management of the total supply chain". Coyle *et al.* (2003) have explained that integrated logistics management has developed through three stages. The first step started in the 1960s with the development of the physical distribution concept and focused upon the outbound side of the firm's logistics system. During the 1980s, influenced by the deregulation of transportation and financial institutions and international or global sourcing of materials and supplies, the integrated logistics management concept began to involve inbound logistics systems as shown in Figure 2.3. Supply chain management became fashionable during the 1990s and can be viewed as a pipeline for the efficient and effective flow of products/materials, services, information, and financials from the supplier's suppliers through the various intermediate organisations/companies out to the customer's customer or the system of connected logistics networks between the original vendors and the final consumer.

Figure 2.3. Integrated Logistics Management



Source: Centre for Supply Chain Research, Penn State University, cited in Coyle *et al.*, 2003

2) Supply Chain Management

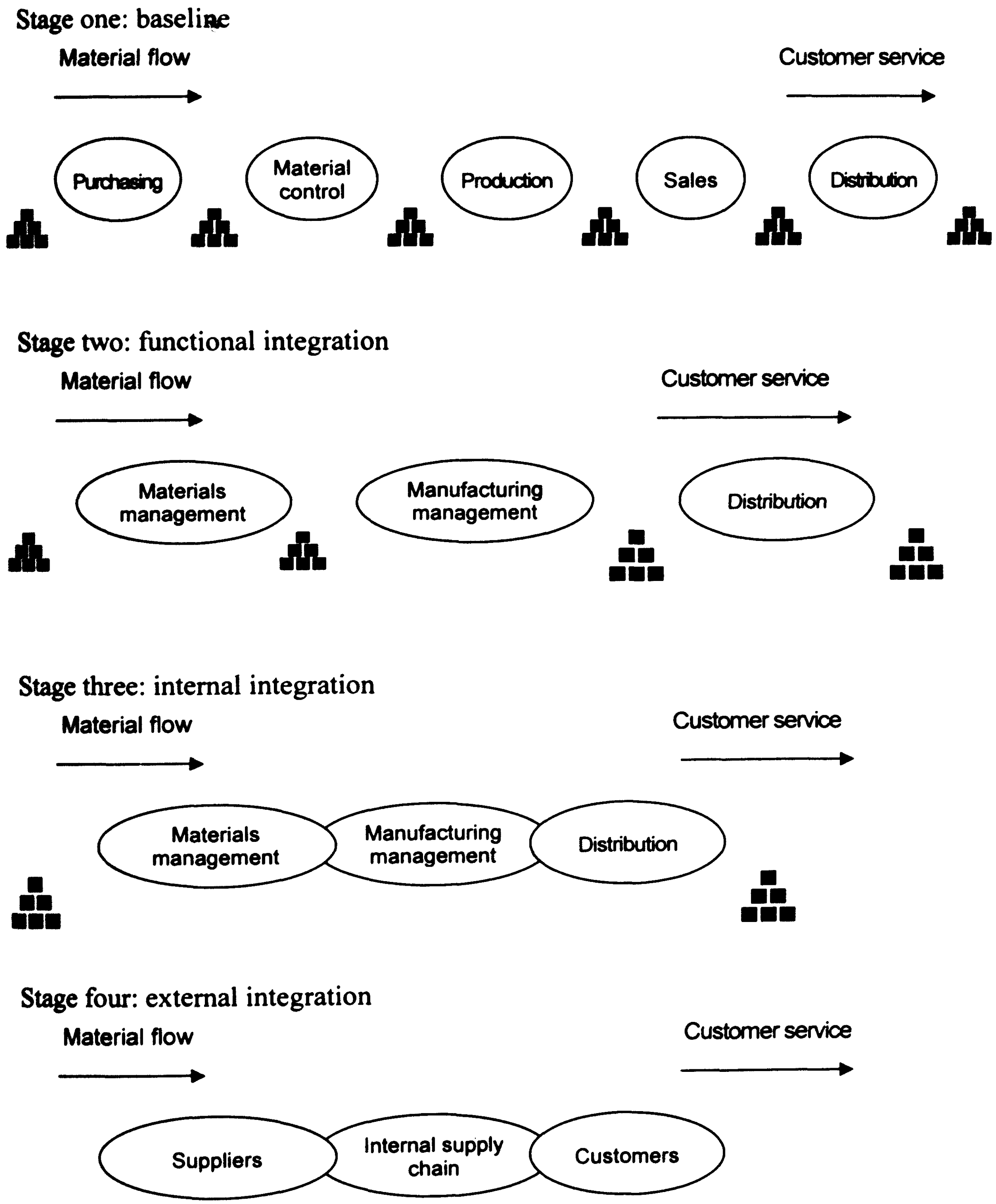
Supply chain management (SCM) is a relatively new concept that does not yet have a clear and general definition. Tyndall *et al.* (1998) have pointed out that although the term is popular, both in academia and practice there is still much considerable confusion about its meaning. Some authors view SCM in operational terms as involving the flow of materials and products, others view it as a management philosophy, and some portray it in terms of a management process (Mentzer *et al.*, 2001). Cooper and Ellram (1993) have pointed out that researchers have sometimes even conceptualized SCM differently within the same article: as a form of integrated system between vertical integration and separate identities on the one hand, and as a management philosophy on the other hand. Mentzer *et al.* (2001) classified the definitions of SCM into three categories: a management philosophy, the implementation of a management philosophy, and a set of management processes.

In this study the definitions of SCM are summarized into two categories, namely: *a management philosophy and an integrated logistics management system.* Concerning the first category, Cooper and Ellram (1993) defined the supply chain management as "an integrating philosophy to manage the total flow of a distribution channel from supplier to ultimate customer." Giunipero and Brand (1996) have defined supply chain management as "a strategic management tool used to enhance overall customer satisfaction that is intended to improve a firm's competitiveness and profitability." Likewise, Cooper *et al.* (1997b) have stated that "SCM is an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user." Therefore, in their view, SCM is a group of beliefs in which each firm in the supply chain directly affects the performance of all the other supply chain members, as well as ultimately, overall supply chain performance. Mentzer *et al.* (2001) emphasized the importance of embracing the SCM philosophy within a firm and called it supply chain orientation (SCO). SCO can be seen as an implementation of SCM philosophy in individual firms in a supply chain while SCM is the total of all the overt management actions performed to implement the SCM philosophy across firms within the supply chain. They defined SCM as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole". Svensson (2002) has stated that "SCM might be seen as a business philosophy that strives to integrate the dependent activities, actors, and resources into marketing channels between the points of origin and consumption". Therefore, SCM involves different kinds of dependencies in, between and across companies in marketing channels.

Regarding the second category, Towill *et al.* (1992) have defined a supply chain as "a system, the constituent parts of which include material suppliers, production facilities, distribution services and customers linked together via the forward flow of materials and the feedback flow of information." This definition describes the full business spectrum from international supply chains down to activities such as independent manufacturing processes, all going on under one roof, but operating as a number of independent cost centres. According to Cooper and Ellram (1993), SCM is an approach whereby the entire network, from the supplier to the ultimate customer, is analyzed and managed in order to achieve the best outcome for the system as a whole. As cited in Rainbird (2004), the International Centre for Competitive Excellence (1994) defined SCM as "the integration of business processes from end-user through original suppliers that provide products, services and information and add value for customers". Lummus and Alber (1997) defined the supply chain as "the network of entities through which material flows." Such entities would include suppliers, carriers, manufacturing sites, distribution centres, retailers, and customers. The Supply Chain Council (1997) defined the supply chain as follows. "The supply chain – a term increasingly used by logistics professionals – encompasses every effort involved in producing and delivering a final product, from the supplier's supplier to the customer's customer. Four basic processes – plan, source, make, deliver – broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer".

Lummus and Vokurka (1999) summarised the definitions of SCM as "all the activities involved in delivering a product from raw material through to the customer, including sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, delivery to the customer, and the information systems necessary to monitor all of these activities". According to Chandrashekar and Schary (1999), the SCM concept emphasizes the integration of functional activities across organizational boundaries. It transcends market transactions to close relationships among partners in a value creating network. Lummus *et al.* (2001) defined SCM to include the logistical flows, the customer order management and production processes and the information flows needed to monitor all the activities at the supply chain nodes. Christopher (1998) defined SCM as "the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole." In his opinion, a supply chain could more accurately be defined as a network of connected and interdependent organisations working together mutually and co-operatively to control, to manage and to improve the flow of materials and information from suppliers to end users.

Figure 2.4. Achieving an Integrated Supply Chain



Source: Stevens, 1989

Stevens (1989) has proposed an evolutionary process of supply chain integration as shown in Figure 2.4. In the first stage we see each business function works in complete isolation from the other business functions. In the second stage, companies recognise the need for a certain degree of integration between adjacent functions, for instance distribution and inventory management or purchasing and materials control. The third stage necessitates the establishment and implementation of an 'end-to-end' planning framework. Finally, stage four represents true supply chain integration where the linkage and co-ordination concept achieved in stage three is extended upstream to suppliers and downstream to customers.

So, what is the difference between logistics management and supply chain management? Christopher (1998) has stated that the concept of supply chain management, whilst relatively new, is in reality no more than a development of the logic of logistics. Similarly, Ballou (1999) has mentioned that business logistics management is also popularly referred to as supply chain management. Simchi-Levi *et al.* (2000) pointed to logistics as a synonym for SCM. In contrast to the views explained above, Johnson and Wood (1996) have argued that SCM is somewhat larger than logistics. Cooper *et al.* (1997b) have asserted that SCM is not just another name for logistics. In their opinion, it incorporates elements that are not usually part of a definition of logistics, such as information systems integration and coordination of planning and control activities. Bowersox *et al.* (1999) have commented that the scope of what is involved in a supply chain is clearly broader than logistics. Mangan (2000) has stated that "logistics is a subset of SCM and that the two terms are not synonymous." Lambert *et al.* (1998a, 1998b) have asserted that whereas SCM may be viewed as logistics outside the firm to include customers and suppliers, logistics always focuses on supply chain orientation, from point-of-origin to point-of-consumption. Larson and Rogers (1998) have pointed out that, in essence, logistics assumes the existence of cooperation amongst buyers, suppliers and service providers. However, SCM considers other additional behavioural dimensions between actors, such as conflict, dependence and power.

Table 2.1 presents the definitions of logistics, integrated logistics and supply chain management used by the author. In the present study, the concept is not that logistics is synonymous with SCM but that logistics is a subset of SCM since the concept of logistics mainly focuses on the functional cooperation between inbound logistics, manufacturing and the distribution channel while the concept of SCM places emphasis not only on the integration of the whole logistics process but also on the control and coordination between channel actors based on an integrative philosophy. However, the concept of 'integrated logistics management' has many overlapping features with that of SCM, because both concepts focus more on the integration and coordination between buyers, suppliers and service providers. The present study adopts a synthesised concept of 'integrated logistics and supply chain management' in order to collect and categorise its relevant capabilities and characterisations from the existing studies in which, in many cases, these concepts are not clearly distinguished.

Table 2.1. Definition of Logistics, Integrated Logistics and SCM

Terminology	Definition
Logistics	A cooperative process of obtaining, producing and distributing materials and products from the source to the consumption and associated information flow.
Integrated Logistics	An integration of functional logistics activities across organisational boundaries emphasizing cooperation between buyers, suppliers and service providers.
Supply Chain Management	An integrative philosophy to manage the total flow of a distribution network from supplier to the ultimate user and to coordinate behavioural dimensions between channel members in order to achieve the best outcome for the whole system.

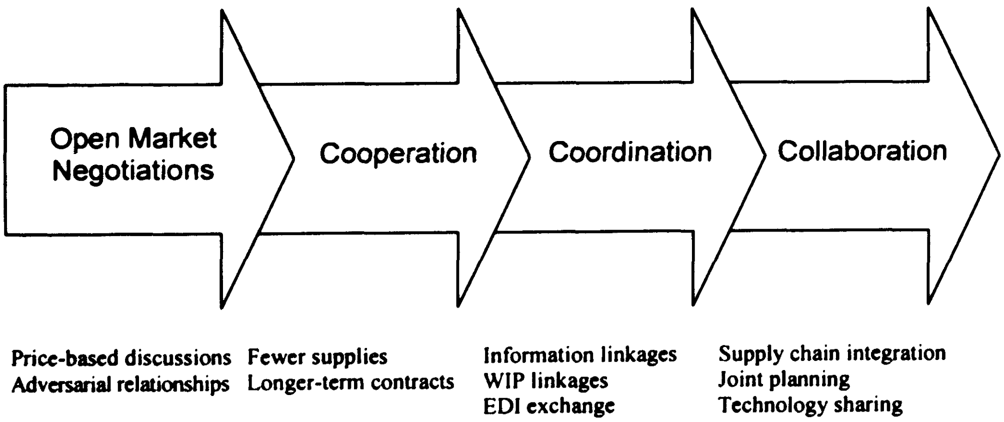
Source: Author

2.2.2. Integrated Logistics and Supply Chain Management as a Core Competency

1) Terminology and Typology of Integrated Logistics and SCM

Researchers identified several terminologies to express the types and degrees of integration such as interaction, cooperation, coordination and collaboration. Kahn and Mentzer (1996, 1998) identified two interdepartmental integration characterisations, namely, interaction and collaboration. In this conception, interaction is information flow via communication and is usually mandatory, formal and perhaps rather tangible, which means it can be easily tracked. Collaboration, on the other hand, refers to working together in a team environment using shared goals and is a concept which cannot be mandated, programmed, or formalised, thus making it more difficult to monitor. Kemppainen and Vepsäläinen (2003) have stated that collaboration refers not only to the development of dyadic buyer-supplier relationships, but also to bringing about real time information sharing within the supply chain. Spekman *et al.* (1998) have explained the key transition from open-market negotiations to collaboration. Figure 2.5 describes the necessary linear transition from the stage of being an important supplier to becoming a supply chain partner. Cooperation is the starting point for SCM and has become a necessary if not a sufficient condition. The next stage is co-ordination in which both specified workflow and information are exchanged to make seamless linkages between and amongst trading parties. Finally, collaboration requires high levels of trust, commitment, and information sharing amongst supply chain partners. In this stage, partners should hold a common vision of the future as well.

Figure 2.5. The Key Transition from Open-market Negotiation to Collaboration



Source: Spekman *et al.*, 1998.

Many empirical studies have categorized the types of supply chain integration and tested the usefulness of these integration efforts. Most simply, some researchers (Gustin *et al.*, 1995; Daugherty *et al.*, 1996; Stock *et al.*, 2000; Stank *et al.*, 2001) categorized supply chain integration into two dimensions – internal integration and external integration. Gustin *et al.* (1995) have mentioned the importance of linking traditional logistics functions such as transportation and warehousing internally. Additionally, it must be possible for logistics to communicate with other functional areas inside the firm such as production and marketing. The argument goes on that externally the firm must be connected with other channel members including suppliers, customers, and third-party providers. Similarly, Daugherty *et al.* (1996) have stated that "internally, supply chain management involves working to achieve a seamless integration of logistics with other functional areas." The business philosophy also requires trading partners and service companies jointly to plan, execute, and co-ordinate logistical performance. Stock *et al.* (2000) have explained that internal integration is the logistics integration across functional boundaries within a firm and external integration means the integration of logistics activities across firm boundaries. Stank *et al.* (2001) have emphasized the collaborative dimension of internal and external integration. Kahn and Mentzer (1996, 1998) and Stank *et al.* (1999) have concentrated on intra-company relationships, particularly interdepartmental integration. They proposed two types of activities for the integration: interaction/communication related activities and collaboration-related activities. According to Stank *et al.* (1999), the former involves the formal coordination of a range of interdepartmental activities to minimize misconceptions and misunderstandings between departments through routine meetings, planned teleconferencing calls, memoranda, and the flow of standard documentation. The latter involves unstructured, largely informal interdepartmental teamwork. In contrast, in this view, it is a voluntary process where two or more departments work together sharing resources and seek to achieve collective goals. Meanwhile, Larson (1994) examined the relationship between inter-organisational functional integration and total costs. In his work, inter-organisational functional integration was defined as buyer/supplier cooperation in performing activities necessary to create utility. Morash (2001) emphasized demand-management capabilities, namely collaborative integration with key customers. Such customer closeness strategies can aid business strategies of differentiation through high levels of value-added customer service, proactive quality and collaborative communications and interactions with customers. Concerning the integration stage, Bowersox and Closs (1996) and Morash (2001) remarked that intra-organisational process integration might be a preliminary requirement for subsequent successful inter-organisational integration with suppliers and customers.

Morash and Clinton (1998) categorized supply chain integration into intra-organisational integration and inter-organisational integration, and then re-categorized inter-organisational integration into collaborative form and operational form. In this categorization, an intra-organisational form is a company's cross functional process integration within the firm such as between production, logistics, and marketing. Secondly, inter-organisational collaborative integration refers to a company's collaborative closeness of relationships with customers and suppliers including collaborative forecasting, collaborative scheduling, or sharing capacity. Thirdly, inter-organisational operational integration can also entail operational integration such as optimizing inter-company material flows. Bowersox *et al.* (1999) introduced six critical areas of competence that top firms deploy to achieve supply chain logistics integration as follows: (1) customer integration (segmental focus, relevance, responsiveness, flexibility); (2) internal integration (cross-functional, unification, standardisation, simplification, compliance, structural adaptation); (3) material and service supplier integration (strategic alignment, operational fusion, financial linkage, supplier management); (4) technology and planning integration (information management, internal communication, connectivity, collaborative forecasting and planning); (5) measurement integration (functional assessment, activity-based and total cost methodology, comprehensive metrics, financial impact); and (6) relationship integration (role specificity, guidelines, information sharing, gain and risk sharing).

2) Influence of Integrated Logistics and Supply Chain Management on Firm Performance: Empirical Studies

Many empirical studies found positive relationships between integrated supply chain management and various sorts of performance. An empirical study by Larson (1994) reported a significant relationship between inter-organisational functional integration and total costs. In particular, physical distribution/logistics was found a leader in promoting functional integration. Gustin *et al.* (1995) showed that significant improvements in profitability could be realized through logistical integration.

According to this work, integration helps to minimize the build-up of inventory at critical business interfaces and at the same time improves transport and warehouse asset utilization and eliminates duplication of efforts. Savings which result from increased efficiency and productivity can then be used to enhance logistics service quality. Daugherty *et al.* (1996) found that integrated firms showed more success in improved customer service, quality improvements, productivity improvements, reduced costs, improved strategic focus and cycle time reductions than non-integrated firms. Morash and Clinton (1997) found that structural integration of the supply chain, such as operational coordination and information sharing had the effect of reducing transportation time and consequently total supply chain costs. Similarly, Morash and Clinton (1998) also found that a competitive market strategy of total cost reduction was best supported by an operationally excellent supply chain while differentiation was best supported by a collaborative relationship with customers and partners. Stank and Traichal (1998) showed that functional integration had a strong relationship with manufacturers' overall logistical flexibility. Stank *et al.* (1999) empirically showed that there were positive associations between the frequency of collaborative integration of marketing and logistics departments and between logistics managers' perceptions of the effectiveness of the relationship between departments, as well as, departmental performance relative to competitors. Ellinger *et al.* (2000) have stated that "integrated logistics management mainly focuses on co-ordinating all logistics activities in a system that will simultaneously attempt to minimize total distribution costs and maintain desired customer service levels". They showed that the ability to accommodate the specific service requests were significantly higher for integrated firms than for non-integrated firms on seven of the eight service requests. Similarly, Stank *et al.* (2002) found that synchronised logistical activities amongst supply chain members could create value for end customers by reducing costs related to redundancy and duplication.

However, some empirical studies have shown that few companies are actually engaged in extensive supply chain integration. According to Levy (1995), under the complex, dynamic system, if one element of a supply chain is disrupted it generates a sequence of changes and adjustments in other parts of the system. Through an empirical study of the personal computer industry, Levy (1995) showed that demand-related disruptions were the most important source of instability in the supply chain. Hertz (2001) found that a higher degree of integration in the relationship led to higher inertia, greater risk and higher costs associated with dissolution. According to Fawcett and Magnan (2002), although SCM has achieved much credibility as a viable competitive practice, in practice, many companies place most of their SCM emphasis on improving integration just within their own organisation. Many managers express scepticism about true integration since it is tantamount to giving up 'sovereignty' and has the potential to constrain the company's ability to respond quickly to significant changes in the competitive environment. They also show concern that a current supplier may become a potential future competitor or that a current customer will integrate backward into their domain.

Table 2.2. Summaries of Logistics and Supply Chain Integration Empirical Studies

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Fawcett and Magnan (2002)	Supply chain integration	Functional area, Channel position	5,145 managers (three different groups; purchasers, logisticians, manufacturing managers)/ 588 respondents (11%), 52 interviewees	Mail survey/ Case study Interviews	Nobody is managing the entire supply chain from suppliers' supplier to customers' customer. The 'end-to-end' transparency needed to understand and manage the entire supply chain simply has not materialised for the vast majority of supply chains.
Stank, Keller and Closs (2002)	Performance benefits (13 items)	6 competences for logistics integration: customer; internal; material & service supplier; technology & planning; measurement; relationship integration	2,680 logistics managers/ 306 respondents (12%)	Mail survey/ Correlation and Regression Analyses	Approximately 30 percent of the variation in overall performance is explained by customer and internal integration. Supplier, technology and planning, measurement, and relationship integration failed to demonstrate statistical association with logistics performance.
Hertz (2001)	Dynamics of alliances in integrated supply chains network (SCN)	Forming and Dissolving, individual supply chain integration, industry network integration	Three cases	Case study	The higher the integration in the relationship the higher the inertia and the larger the risk and costs of the dissolution. As network integration increases over time in supply chain networks this will lead to an increasing integration of the industry network.
Narasimhan and Kim (2001)	Supply chain management performance	The role of information system	590 large Korean manufacturing corporations 244 respondents (41.4%)	Mail (fax) survey/ SEM	Information system for value creation management is positively associated with SCM performance.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Stank, Keller and Daugherty (2001)	Logistics service performance	Supply chain Collaboration: Internal and External	2,680 managers (CLM members) 306 respondents (11.5%)	Mail survey/ SEM	Internal collaboration significantly influences logistical service performance, but external collaboration does not significantly influence logistics performance.
Ellinger, Daugherty and Keller (2000)	Perceived effectiveness of interdepartmental relationship and performance	Interdepartmental integration (Collaboration, Consultation, and Information exchange)	360 managers (CLM members) 309 respondents (60.4%)	Mail survey/ SEM	Perceived effectiveness of relationship was positively associated with collaboration, but negatively associated with consultation. Information exchange was not associated with perceived effectiveness of relationship.
Stock, Greis and Kasarda (2000)	Supply chain structure: geographic dispersion and channel governance Operational and financial performance	Logistics integration	1,000 managers 75 respondents (7.5%)	Mail survey/ T-test	A fit between logistics integration and geographic dispersion was associated with higher operational performance (cost and service). The hypothesis that performance will be higher in firms achieving a fit between logistics integration and channel governance was not supported.
Rabinovich, Windle, Dresner and Corsi (1999)	Outsourcing of integrated logistics function	Clusters of functions, transactional function, physical function, logistics information system	11,571 logistics managers / 463 respondents (4.32%)	Mail survey/ Pearson's Correlation Analysis	Firms outsource bundled transactional and physical functions within inventory and customer-service areas to obtain economies of scale and a higher efficiency. Firms bundle the outsourcing of logistics information systems with the information flows across transactional functions.
Stank, Daugherty and Ellinger (1999)	Performance benefits from interdepartmental integration	Collaborative integration elements, Relative performance variables, Marketing/ logistics relationship effectiveness characteristics	360 managers/ 309 respondents (86%)	Mail survey/ Multiple Regression and T-test	There are positive associations between the frequency of collaborative integration of marketing and logistics departments and logistics managers' perceptions of the effectiveness of the relationship between departments, as well as, departmental performance relative to competitors.
Morash and Clinton (1998)	Customer value	Collaborative closeness, Operational excellence	9,634 firms in U.S., Japan, Korea and Australia/ 1,951 respondents (20.1%)	Mail survey/ ANOVA Analysis	A competitive market strategy of total cost reduction is thought to be best supported by an operationally excellent supply chain while differentiation is best supported by collaborative closeness with customers and partners. Countries differ in their relative application of supply chain integrative approaches.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Spekman, Kamauff and Myhr (1998)	Cost reduction and Customer satisfaction Performance	Open market negotiations, Co-operation, Co-ordination, Collaboration	161 respondents (71%)	Survey/ T-test Regression	Cost reduction was positively associated with collaboration, but negatively associated with co-ordination. Customer satisfaction was positively associated with collaboration and co-ordination, but negatively associated with co-operation.
Stank and Traichal (1998)	Logistics strategy, Logistics organisational dimensions, Performance	Degree of functional integration	263 materials managers in Maquiladora facilities 51 respondents (21%)	Hand delivery survey/ Multiple Regression (OLS)	The organisational design impacted on firm performance and this relationship was moderated by the degree of integration. Positive linkage between procedure formalisation and integration plus the positive link between integration and overall flexibility.
Ellinger, Daugherty and Gustin (1997)	Customer service (8 items)	Integrated logistics, Customer demands, order fulfilment	295 logistics executives/ 127 respondents (45.8%)	Mail survey/ T-test	The mean scores for ability to accommodate the specific service requests were significantly higher for integrated firms than for non-integrated firms on seven of the eight service requests.
Stank and Lackey (1997)	Performance of Mexican maquiladora firms	Logistics capabilities: Positioning, Integration Agility, Measurement	263 materials managers in Maquiladora facilities 51 respondents (21%)	Hand delivery survey/ T-test	Information sharing and supplier relations had a strongly significant positive relationship with performance. Connectivity and functional integration had a moderately significant positive relationship with performance. Information technology had a weak significant positive relationship with performance.
Morash and Clinton (1997)	Transportation Capabilities, Supply chain organizational structures and integrative capabilities.	Internal supply chain integration, External supply chain integration: Operational planning/ Interactive relationships	9,634 firms from Australia, Japan, Korea, U.S./ 1,951 respondents (20.1%)	Mail survey/ ANOVA Analysis	Different countries employ different prevailing transportation and logistics structural approaches to achieve supply chain integration. Transportation capabilities must be integrated with their enabling supply chain structures.
Stank, Daugherty and Ellinger (1996)	Responsiveness Performance	Information exchange	300 US based manufacturers engaged in international business	Mail survey/ SEM	Information exchange has a direct impact on performance as well as being an indirect path to performance through responsiveness.
Daugherty, Ellinger and Gustin (1996)	Logistics Performance	Integrated logistics implementation	295 logistics executives in manufacturing, retailing and wholesaling 127 respondents (45.8%)	Mail survey/ T-test	Integrated firms indicated more success in improved customer service, quality improvements, productivity improvements, reduced costs, improved strategic focus and cycle time reductions than did non-integrated firms.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Gustin, Daugherty and Stank (1995)	Availability of logistics information, Supporting logistical decision making, Availability of information from other areas, Meeting performance requirements, Logistics costs	Integrated distribution concept	1,477 manufacturers and merchandising firms (CLM members) 345 respondents (24%)	Mail survey/ T-test	Integrated firms indicated significantly greater information availability, higher levels of information to support logistics decisions, greater availability of information from other functional areas, and better information systems performance. No statistically significant differences between integrated and non-integrated firms in respect of logistics costs and information systems support costs.
Stank, Daugherty and Gustin (1994)	Logistics system integration	Centralisation	1,477 manufacturers and merchandising firms (CLM members) 345 respondents (24%)	Mail survey/ T-test	Centralisation was found to be associated with implementation of integrated logistics and lower logistics costs. No significant differences were found between centralised and decentralised firms regarding information systems, support costs or information systems performance.
Larson (1994)	Total costs of performing logistics function	Inter-organisational (between buyer and supplier) functional integration	1,000 buyers 712 respondents (71%)	Mail survey/ SEM	Only 18% of professional buyers used total cost analysis. There is a significant relationship between inter-organisational functional integration and total costs.
Gustin, Stank and Daugherty (1994)	Logistics Data Computerisation by area: customer, inventory, product, transport, warehousing	Integrated vs. Non-integrated Firms	1,673 manufacturing, retailing and wholesaling firms (CLM and NITL members) 380 respondents (23%)	Mail survey/ χ^2 test	There were statistically significant differences for 19 of the 23 data elements between integrated and non-integrated firms.

Source: Tabulated by the Author

3) Logistics Outsourcing in the Integrated Logistics and Supply chain

The development of logistics outsourcing has grown out of the needs that companies have to seek cost savings and to focus on their core competencies (Rabinovich *et al.*, 1999). According to Stank *et al.* (2002), in extreme cases, vertical integration requires massive capital investments. However, the economies of scale necessary to support such decisions are rarely available. If they are, the complex organisational structures required to manage such an enterprise are cumbersome, inefficient, and often ineffective. As an alternative, firms may work with external supply chain partners to exploit their expertise and the synergies gained from joint operations. The objective is to outsource the specialised activities already developed and performed internally to other supply chain entities. In this model, management of external suppliers is not restricted to short-term, buy-sell transactions but also involves joint operational planning, shared assets and technology as well as willingness to share information and risk.

In practice, the outsourcing of logistics functions to partners, known as third-party logistics service providers, has increasingly become a powerful alternative to the traditional, vertically-integrated firm. According to one source, overall, 60% of the 500 largest manufacturers in the U.S. indicated that they have a minimum of one contract with a third-party logistics provider (Lieb and Randall, 1996). Some authors have found that across many industries logistics outsourcing has grown into a rapidly expanding source of competitive advantage and logistics cost savings. For example, Lieb *et al.* (1993) reported that some firms had achieved up to 30% to 40% reductions in logistics costs and had been able to greatly extend global logistics processes as a consequence of outsourcing. Moreover, logistics companies become adopt Quality Assurance Accreditation (QAA), Total Quality Management (TQM) and internal Composite Logistics Modelling (CLM), which can increase logistics efficiency in a global distribution environment (Beresford *et al.*, 2005). Some researchers have reached the same conclusion that the outsourcing of clusters of activities allows firms both to avoid extensive capital asset commitments and to achieve lower ordering costs for raw materials and parts, and lower inventory carrying and stock-out expenses (Rabinovich *et al.*, 1999). A study by Rabinovich *et al.* (1999) showed that some firms were outsourcing bundled transactional and physical functions within inventory and customer service areas. In particular, they also discovered that firms bundle the outsourcing of logistics information systems with the information flows across transactional functions such as inventory management and shipment planning. Morash and Clinton (1998) also demonstrated that several transportation and third-party companies could manage the entire supply chain inventory by using collaborative interaction and computer transferred information (EDI).

2.2.3. Antecedents of Integrated Logistics and Supply Chain Management

Two primary antecedents of an integrated supply chain management could be the availability of useful information and the level of comprehensive strategic planning. Information capability and strategic planning capability have been employed in some empirical research as the antecedents of a flexibility competence (Fawcett *et al.*, 1996) and quality and cost competencies (Fawcett *et al.*, 2000).

1) Information Capability

It has been pointed out that information capability is critical to achieving business success and long-term survival. This is a result of the emergence of an information-based society, influencing nearly every aspect of commercial activity, including the logistics function (Bowersox, 1991 cited in Roger *et al.*, 1996). Information technology expedites internal integration within an organization as well as external value chain linkage management with trading partners (Porter and Millar, 1985). "Information availability has helped make possible the concept of supply chain management." (Roger *et al.*, 1996) If compatible information technology exists amongst supply chain members it enhances communication, reduces risk and supports the efficient transfer of information. In this view, an efficient flow of information can support the development of a sustainable competitive advantage (Hoyt and Huq, 2000).

Information capability consists of two main components: information technology and information sharing. Information technology (IT) is a capability that can improve distribution performance, facilitate logistics integration and contribute to supply chain success (Shang, 2002). The advances in information technology can lead to both suppliers and buyers being more cost, product and process efficient, which means a given channel can lead to them having an advantage over competitors. Sharp (1989) suggested that adopting technology to answer the need for better and faster information control might lead to a strategic and competitive advantage for all parties involved with the ultimate result that this makes a firm provide better service to end-customers. According to Chow *et al.* (1995), management information systems are allowing the effective integration of decision making across firms as well as the introduction of new approaches, such as just-in-time supply management. Secondly, information sharing can be defined as "the willingness to make strategic and tactical data available to other members of the supply chain" (Bowersox *et al.*, 1995). Mentzer *et al.* (2001) has stated that open sharing of information such as inventory levels, forecasts, sales promotion strategies, and marketing strategies lowers the uncertainty between supply chain partners and leads to enhanced performance. Emphasizing customer-firm relations, Daugherty *et al.* (1992, 1994) has asserted that sharing information makes a firm more responsive to customer requests and builds greater customer loyalty and better customer-firm relations. According to this work, an examination of firms that have gained competitive advantage through 'individualised, but cost effective response programmes' emphasized the critical role of information sharing. Cooper *et al.* (1997a) has pointed out that one of the ingredients to the implementation of SCM is information sharing through two-way communication between partners within a supply chain. Bowersox *et al.* (1999) has posited that information sharing is of greater importance than IT as without the existence of a cooperative spirit amongst firms regarding information sharing, the arrangement will fail whether or not the technology is available.

2) Strategic Planning Capability

Strategic planning is defined as "the systematic and more or less formalised effort of a company to establish basic company purposes, objectives, polices, and strategies and to develop detailed plans to implement policies and strategies to achieve objectives and basic company purposes" (Steiner, 1979). According to Steiner (1979), "planning is inextricably interwoven into the entire fabric of management". Quinn (1980) has stated that strategic planning is commonly defined as a process that coordinates the development of a firm's goals and activation patterns in a way that results in a synergistic outcome (cited in Hahn and Powers, 1999). As cited in O'Regan and Ghobadian (2002), Johnson and Scholes (1997) defined strategic planning as "the direction and scope of a company over the long term, which achieves advantage for the company through its configuration of resources within a changing environment, to meet the needs of markets and to fulfil stakeholder expectations". According to some authors, strategic planning suggests an attempt to alter a company's strength relative to that of its competitors, in the most efficient and effective way. In other words, strategic planning focuses on the direction of the organisation and actions necessary to improve its performance (O'Regan and Ghobadian, 2002). Gluck *et al.* (1982) described four sequential phases of strategic planning: (1) basic financial planning (seeking better operational control through meeting budgets); (2) forecast-based planning (seeking more effective planning for growth by trying to predict the future beyond the next year); (3) externally oriented planning (seeking increased responsiveness to markets and competition by trying to think strategically); and (4) strategic management (seeking to manage all resources to develop competitive advantage and to help create the future).

Strategic planning is composed of strategy formality and strategy process or implementation. Formality can be defined as "incorporating an extensive analysis of risks and benefits, documentation of alternatives, and communication of the firm's objectives and strategy implementation process to all relevant management levels" (Fawcett *et al.*, 1996). In the literature, formal strategic planning is described as requiring an explicit process for determining the firm's long-range objectives, procedures for generating and evaluating alternative strategies, and a system for monitoring the results of the plan when implemented (Armstrong, 1982). According to Hahn and Powers (1999) and Schraeder (2002), five steps for a formal strategic planning process can be identified as follows: (1) defining and evaluating a firm's mission statement; (2) performing an environmental scan and competency analysis (e.g. SWOT; assessing organisational strengths, weaknesses, opportunities, and threats); (3) analysing issues identified through SWOT and establishing objectives, strategies and tactics; (4) implementing (structure/leadership/motivation); and (5) providing a performance review and adjustment mechanism. However, a sophisticated approach to planning is only one step on the way to improved performance (Hahn and Powers, 1999). Once all planning is completed, the senior management of the company must take the lead in translating strategies and goals into a business plan (Hewlett, 1999) because without successfully implementation, a strategy is but a fantasy (Hambrick and Cannella, 1989). Based on interviews and surveys, Noble (1999) designed a general model of the important stages in strategy implementation. The focus of the model is on cross-functional issues and dynamics. The model is organized around four major stages of the implementation effort: (1) preimplementation; (2) organizing the effort; (3) the ongoing management of the process; and (4) maximizing cross-functional performance.

Fawcett *et al.* (2000) have asserted that "comprehensive strategic planning helps managers select key strategic drivers and then allocate the resources needed to develop them." Stalk *et al.* (1992) have stated that the essence of strategy is selecting the correct capability. According to Hayes *et al.* (1988), strategic planning should lead the firm to arrange its resources in a manner which reinforces the priorities that a company has placed on certain competitive dimensions (cited in Fawcett *et al.*, 1996). Likewise, Hewlett (1999) has noted that "a strategic plan and the strategic planning process itself offers a competitive edge and enables a company to measure achievements against expectations". Schraeder (2002) summarised the commonly accepted reasons for strategic planning as follows: (1) to enhance organisational performance; (2) to provide staff members within the organisation with information about the direction of the organisation; (3) to appease different constituencies of the organisation; and (4) to appease funding sources or lending institutions. According to O'Regan and Ghobadian (2002), a formalised strategic planning process has the following benefits: (1) strategic planning is involved in the corporate agenda; (2) strategic planning is approached in a systematic manner; and (3) the strategic planning process increases staff awareness and enhance participation in the strategic plan.

The most important and extensive issue for empirical studies investigating strategic planning is to focus on the relationship between strategic planning and organisational performance. However, the results have been far from conclusive. For example, Ramanujam and Venkatraman (1987) found significant differences between relatively high-performing organisations and low-performing organisations by comparing and contrasting their planning practices. Robertson *et al.* (1993) concluded a positive relationship existed between planned change and certain organisational outcomes. Miller and Cardinal (1994) conducted a meta-analysis using the data from 26 previously published studies and suggested that strategic planning positively influenced firm performance. O'Regan and Ghobadian (2002) categorised eight main internal/external barriers to the implementation of strategic planning and established that non-formal strategic planning firms showed a greater emphasis on each barrier than strategic planning firms. According to their study, it implies that formal planning helps in meeting the problems to a limited extent. On the contrary, Robinson and Pearce (1983) found that there was no relationship between formality of planning procedure and financial performance of small US banks. Frederickson and Mitchell (1984) also found no relationship between planning comprehensiveness and financial performance. Mintzberg (1993, 1994) has asserted that strategic planning does not work because of separation between the strategy formulation and implementation processes. Hahn and Powers (1999) examined the relationship between strategic planning sophistication, implementation quality, and firm performance in the banking industry. They concluded that "there is no performance advantage to be gained by increasing the level of sophistication of the planning effort and implementing that plan competently".

Concerning logistics issues, Bowersox *et al.* (1989) have placed great importance on the linkage between the strategic planning process and the development of logistics capabilities. For such authors, strategic planning of the supply chain is a hugely important decision problem which has a bearing on the long-term survival and prosperity of companies in the manufacturing, retail, and other industrial sectors (Koutsoukis *et al.* 2000).

2.3. Global Sourcing

Nowadays more and more firms are purchasing their various materials, supplies, parts, and services from a global arena (Fagan, 1991). Companies have realised that global sourcing is advantageous and profitable (Monczka and Trent, 1991). Recent studies show that global sourcing becomes recognised as a critical strategic tool for firms to obtain and sustain competitive advantage. The first part introduces the definitions of global sourcing and summarises its driving forces/barriers. The second part presents the typology of global sourcing and evolutionary process of global sourcing strategy. The third part deals with global sourcing relevant issues such as effectiveness factors for global sourcing strategy, the impacts on firm performance and logistical problems. Especially, in the final part, the efforts to discover the relations with integrated logistics and supply chain management and global sourcing are made.

2.3.1. Definition, Motives and Barriers

1) Background and Definition of Global Sourcing

As cited in Nellore *et al.* (2001), Webster and Wind (1972) defined an organization's purchasing activity as "the decision-making process by which formal organizations establish the need for products, identify, evaluate and choose between alternative brands and suppliers." Zeng (2000) has said that an organization's profit is largely determined and defined by its purchases and that moreover, purchasing has become increasingly seen as one of the key drivers for a company's survival and growth. In practice, some authors have pointed to the way purchased inputs often account for 60% to 80% of the cost of goods sold (compared to about 10% for direct labour) (Scully and Fawcett, 1994). Similarly, as cited in Zeng (2000), Mihaly (1999) estimated that somewhere between 50% and 70% of a manufacturing company's potential value lies in purchased items; even in the case of service industries, half of their services are in fact purchased from other companies.

Zenz (1994) has defined sourcing as "the strategic philosophy of selecting vendors in a manner that makes them an integral part of the buying firm for a particular component or part they supply." Sourcing is directly or indirectly highlighted as a critical factor that could enhance the firm's competitive ability and market position (Samli *et al.*, 1998). As worldwide economic competitiveness grows, so an ever greater number of firms are combining domestic and international sourcing for both components and finished goods as a way to achieve a sustainable competitive advantage (Kotabe and Murray, 1990; Levy, 1995). According to Swamidass and Kotabe (1993), sourcing is an integral part of global rationalization, or the strategy of optimizing production and distribution decisions across an international network of facilities, mutually dependent upon each other for raw materials and components. Furthermore, sourcing decisions are taken in integrating multinational operations for strategic advantage through the effective movement of components, subassemblies and finished products amongst the firms' various international units. Petersen *et al.* (2000) summarised some empirical studies to describe the importance of global sourcing activities as follows. "Given that the average manufacturing firm spends 55% of sales dollars on purchased goods and services (Tully, 1995), that firms spend an average of 13% of total purchase dollars internationally (Birou and Fawcett, 1993), and that purchased materials have a significant impact on end-item quality (Crosby, 1984), global sourcing strategies are critical to the firm's success." Therefore, it is seen as important that today's managers must rethink the products their firms offer and determine how to organize a business system that designs, builds and markets these products globally (Alguire *et al.*, 1994).

Murphy and Daley (1994) have stated that "international sourcing refers to purchasing raw materials, finished goods, component parts, and/or services outside of a company's home country." Johnson and Wood (1996) have defined international sourcing as "buying components and inputs anywhere in the world in such a way that the manufacturer casts out a much wider net in search of sources rather than relying solely on its local Yellow Pages." According to Monczka and Trent (1991) global sourcing can be seen as the integration and coordination of procurement requirements across worldwide business units as well as the linking of common items, processes, technologies and suppliers. In contrast, international sourcing, multinational sourcing, and foreign sourcing have been defined as buying outside the firm's country in a way that does not coordinate requirements among worldwide business units of a single firm (Birou and Fawcett, 1993). Likewise, Bozarth *et al.* (1998) have emphasised the difference between 'international' and 'global' sourcing. In their view, international sourcing lacks the coordination of requirements between worldwide business units. In this model, global sourcing, on the other hand, necessitates the integration of requirements, in order to identify common purchases, processes, technologies and suppliers that can be coordinated.

2) Motives for and Barriers to Global Sourcing

Many studies have investigated the benefits and costs from global sourcing activities. From the existing studies the major motives might be summarised into the following five categories: (1) comparative advantage; (2) competitive advantage; (3) quality; (4) access to technology and/or new markets; and (5) shorter product development and life cycles.

Comparative advantage. Comparative advantage, sometimes referred to as location-specific advantage, has been described as affecting the strategic decision of where to source and market. Global sourcing enables a company to capture local advantages (Porter, 1990). These local advantages are based on the fact that factor costs vary from one country to another. One source suggests that organisations could take advantage of these differences by locating the activities comprising their value chains in countries possessing a comparative advantage (Kogut, 1985). Such an action enables the organisations to lower their costs and gain competitive advantage through exploiting the comparative advantages amongst nations according to one source (Alguire *et al.*, 1994). Two factors may affect the comparative advantages of global sourcing: (1) transportation cost, availability and delivery time and; (2) difference of factor costs among countries (Birou and Fawcett, 1993; Carter and Narasimhan, 1990; Frear *et al.*, 1995; Murray *et al.*, 1995b; Nellore *et al.*, 2001).

Competitive advantage. Competitive advantage, or the firm's specific advantage, refers to some uniquely held characteristics of the firm either in product or process which cannot be easily imitated by competitors without incurring non-competitive investment costs. Performing certain activities abroad or purchasing from offshore suppliers may allow access to superior quality or higher technology inputs or processes which in turn is necessary to gain and sustain competitive advantage (Porter, 1990). Firms can enhance their competitive advantage as well as their comparative advantage through coordination of their sourcing activities globally. Frear *et al.* (1995) empirically found that the successful design of international strategies was based on the interaction between the comparative advantages of locations with the competitive advantage of firms. Birou and Fawcett (1993) found lower priced goods and an enhanced competitive position were the major benefits of international sourcing.

Quality. Various authors suggest that today, multinational organisations are able to produce components and finished goods with quality equal to or better than similar goods available from suppliers in the traditional developed nations such as the U.S. and European countries (Carter and Narasimhan, 1990; Handfield, 1994; Min and Galle, 1991). The quality of the service is as important as the quality of the products. Handfield (1994) have asserted quality is the number one criterion used to evaluate both domestic and foreign suppliers.

Access to technology and/or new markets. The reason for businesses often to procure offshore materials and components is to obtain access to advanced production technologies (Frear *et al.*, 1992; Kotabe and Murray, 1990). A result of this, according to Porter (1990) is that sourcing requirements from suppliers located in other nations could facilitate local market penetration.

Shorter product development and life cycles. The shortened product life-cycles of many goods mean it can be difficult for domestic suppliers to make and supply every possible part or subassembly. It follows from this that to obtain market share and profits and preclude entry by rivals manufacturers must sometimes produce and sell in all markets simultaneously (Bozarth *et al.*, 1998). For instance, as cited in Bozarth *et al.* (1998), the automobile and computer industries have been especially affected by this phenomenon (Goldberg, 1994; Womack *et al.*, 1990).

The major barriers or challenges to global sourcing can be summarised into the following four categories: (1) logistics challenge; (2) difficulty in qualifying global sources; (3) cultural difference quality; and (4) regulation.

Logistics challenge. International logistics covers relatively longer distances than domestic logistics. That creates a longer lead time, which requires higher inventories and creates more opportunities for trouble to occur. In one view, transportation systems and intermediaries may not be as reliable as they are in the home country, which can lead to unexpected delays in delivery and result in much less flexible inventory management (Cho and Kang, 2001). In addition, costs associated with long lead-times contributed primarily to higher total costs. Regarding the total cost concept, Stank and Goldsby (2000) have suggested that transportation managers must encourage their firms to view the total cost and total value provided by carriers, and refrain from buying transportation solely based upon the lowest transactional cost. Likewise, Handfield (1994) has pointed out that managers using an international source need to consider the full costs of doing business, including customs, tariffs, currency fluctuations, transport, inventory and the cost of unreliable delivery.

According to Bowersox and Closs (1996), the total cost concept requires the holistic management of components of logistics such as order processing, transportation and warehousing as parts of an interconnected system

Difficulty in qualifying global sources. Some authors point to the problem of distance and the difficulties in qualifying international sources reduce the level of benefits derived from global sourcing (Birou and Fawcett, 1993). Furthermore, it is also difficult to assess suppliers' capabilities and develop trust in them which can increase the dependency upon agents and brokers (Nellore *et al.*, 2001).

Cultural difference. Values, attitudes, manners, customs, religion and language have been defined as some of the components of culture. Differences in these cultural factors can cause miscommunication and create further problems in supplier evaluation, contracting, product inspection and maintaining relationships in global sourcing (Cho and Kang, 2001). In addition to this, it has been pointed out that cultural differences make negotiations difficult as well (Nellore *et al.*, 2001).

Regulation. The most directly influential trade regulations are tariffs and quotas. Non-tariff restrictions, such as complicated documentation requirements for border-crossing processes, and various kinds of international trade bills also face global sourcing companies as difficult challenges (Cho and Kang, 2001).

2.3.2. Typology and Evolutionary Process of Global Sourcing

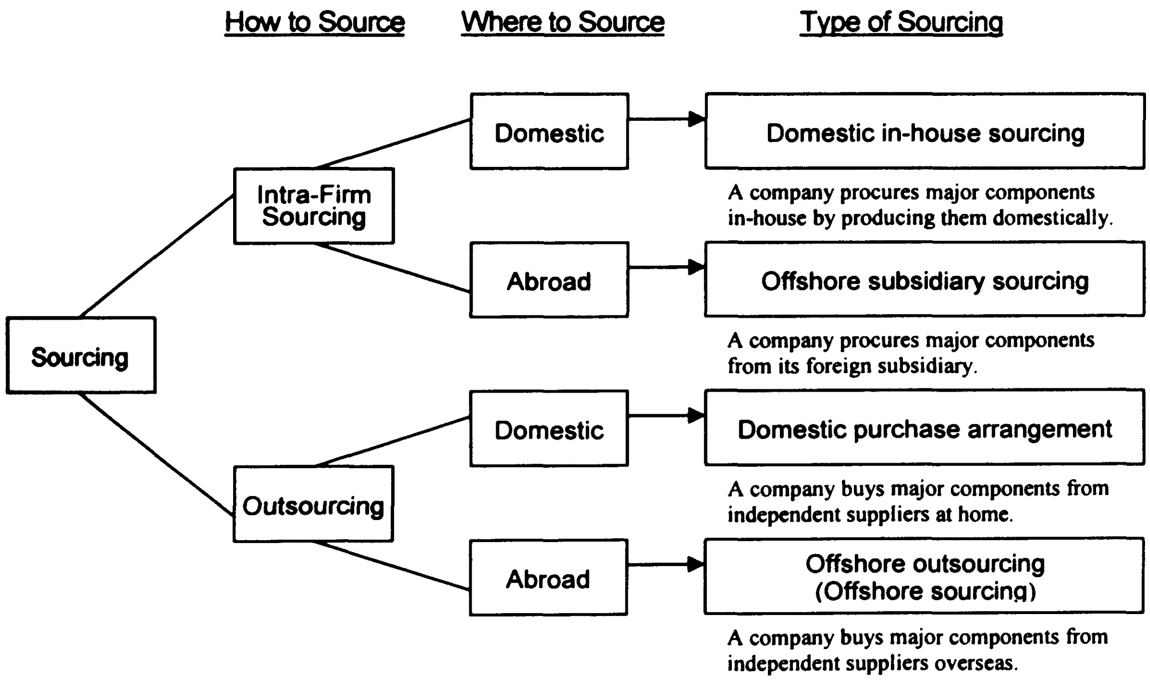
1) Typology of Global Sourcing

Global sourcing occurs in the form of intra-firm or inter-firm flow of goods. Multinational firms create intra-firm trade amongst their various international units.[2] Swamidass and Kotabe (1993) adopted four sourcing alternatives to investigate sourcing patterns of European and Japanese companies based in the U.S: (1) from home – Europe or Japan; (2) from the U.S., the host country; (3) from other developed countries; and (4) from developing or less developed countries. Murray *et al.* (1995b) categorised sourcing type according to the locational aspect (domestic or foreign

[2] In addition, in their empirical study, Kotabe and Swan (1994) included the 'platform exports' from foreign affiliates to third countries.

sourcing) and the ownership aspect (internal or external sourcing). According to Murray *et al.* (1995b), domestic sourcing refers to a situation in which a firm and its suppliers are located in the same country, while foreign sourcing refers to sourcing from abroad. Within this framework, a firm uses internal sourcing when it procures or assembles parts and components from within the corporate system while external sourcing occurs when sourcing originates from independent suppliers on a contractual basis. In their view, firms make sourcing decisions in each of the two phases of production: component sourcing and assembly. Kotabe (1998) suggested distinguishing between sourcing on a contractual basis and sourcing on an intra-firm basis as shown in Figure 2.6.

Figure 2.6. Types of Sourcing



Source: Kotabe, 1998

Murray *et al.* (1995b) summarised several determinants of internal sourcing from previous studies as follows: research intensity, technology intensity, firm size, average wage, extent of foreign investment, divisibility of production processes, and need for after-sale service. Another feature of internal sourcing is that it is most likely found in industries where firms possess certain advantages that are a potential source of quasi-rent; for example, economies of scale, technology, skills, product differentiation, advertising, etc. Inter-company sourcing at the multinational level from vendors external to the firm also constitutes a major part of international trade. Currently, the role of global sourcing from external suppliers is growing because in a fiercely competitive global marketplace, it is now far easier for multinational firms to source an increasing portion of their components for manufacture from outside suppliers (Kotabe and Murray, 1990).

2) Evolutionary Process of Global Sourcing Strategy

Kotabe and Swan (1994) have explained that Stopford and Wells (1966) firstly recognised the importance of global sourcing as part of global strategy development and then Moxon (1975) empirically found that offshore sourcing was motivated primarily by the use of inexpensive labour, particularly in newly industrialized countries for the export of finished products. Monczka and Trent (1991) have described a four-phase global procurement process. In the first phase, firms do not engage in direct international purchasing. Firms in this phase either do not perceive the need or lack the expertise to pursue foreign sourcing. A firm enters phase-two because it is confronted with a requirement for which there is no suitable domestic supplier, or because competitors are gaining an advantage from foreign sourcing. The firm is reactively driven by shortcomings within the domestic supply base to satisfy customer requirements. In phase-three, multinational companies begin to comprehend that a focused international procurement strategy creates significant performance gain. Global sourcing strategies developed in the fourth and final phase are aggressive sourcing responses which result from viewing the market from a worldwide perspective. Swamidass (1993) also suggested a four stage evolutionary process in import sourcing: (1) no import sourcing; (2) import sourcing for cost minimization; (3) import sourcing for competitive advantage; and (4) import sourcing as a strategic asset. Meanwhile Samli *et al.* (1998) explored the evolution of the interest in sourcing research. They identified five stages in sourcing strategy research through a critical literature review. In the first stage, researchers emphasized procurement as a corporate function and its importance in helping a company to maintain its competitiveness. The second stage in sourcing research emphasized the advantages of a strategic rather than a simply reactive way of sourcing. The third stage expanded sourcing into global scales. The fourth stage highlighted the development of a global sourcing strategy. In the final stage, the researchers distinguish global sourcing strategy from strategic sourcing globally. Here, the emphasis is placed on the value of global sourcing as an integrated key strategic tool rather than just having a sourcing strategy, which may not be a part of the top strategic plan.

2.3.3. Main Issues for Global Sourcing in Empirical Studies

1) Effectiveness Factors for Global Sourcing Strategy

The implementation of global sourcing strategies occurs only after a firm has decided to improve performance through worldwide sourcing (Monczka and Trent, 1992). The advantage of strategic global sourcing derives from the synergy that is achieved by managing the entire sourcing network as a single cohesive value-added conversion system (Birou and Fawcett, 1993). Kotabe (1998) has explained that "the ultimate objective of global sourcing strategy is for the company to exploit both its own competitive advantages and the comparative locational advantages of various countries in global competition." However, in developing viable sourcing strategies, companies must take into account not only manufacturing costs, the costs of various resources, and exchange rate fluctuations, but also availability of infrastructure (including transportation, communications, and energy), industrial and cultural environments, and the ease of working with foreign host governments. Furthermore, major operational problems such as logistics, inventory management, distance, nationalism, and lack of working knowledge about foreign business practices should be considered (Kotabe, 1998). Birou and Fawcett (1993) identified the following four factors as critical to successful global sourcing: (1) top management support; (2) developing communication skills; (3) establishing long-term relationships; and (4) developing the skills unique to international sourcing. Petersen *et al.* (2000) established the relationships between several factors that drive the effectiveness of global sourcing strategies. Their research indicated that the following are crucial for the effective implementation of a global sourcing strategy: (1) global sourcing structures and processes (logistics processes, supply chain processes, purchasing/supply chain information systems and purchasing personnel skills); (2) global sourcing business capabilities (awareness of cross-cultural business practices, managing international lead-time risk or uncertainty, knowledge of the location of core information, experience, and competencies worldwide for critical purchased items and international negotiation skills and abilities); (3) international language capabilities; and (4) top management commitment to global sourcing (executive management's recognition of the benefit of coordinating purchasing and supply chain strategies, the degree to which executive management was committed to coordinating and integrating purchasing/supply chain strategy across the national boundaries).

2) Influence of Global Sourcing Strategy on Firm Performance

Some researchers (such as Kotabe; Murray; Omura and Wildt) have continuously focused on the relationship between global sourcing strategy and various dimensions of market performance. Kotabe and Omura (1989) examined two dimensions of market performance (relative market share and pre-tax profitability) and sourcing strategy (internal vs. external sourcing from home, market, and third countries for components and final assembly) of US subsidiaries of European and Japanese multinational manufacturing firms. Their work has found that the product's market performance is not at all related to its life-cycle stage in world trade or to production location, but rather is positively related to the internal sourcing of component and negatively related to the product adaptation. Kotabe and Murray (1990) developed eight sourcing strategies based on three factors as follows: (1) mode of international component sourcing (internal and external); (2) degree of production innovation (low and high); and (3) degree of process innovation (low and high). European and Japanese multinational firms marketing products in the US are chosen as the subject for their study. They concluded that a product's market performance (relative market share, sales growth rate, and pre-tax profitability) was positively related to internal sourcing of major components. In addition, their regression analysis showed that product innovations or process innovations had a positive influence on a product's market performance. Murray *et al.* (1995) investigated the relationship between non-standardized component[3] sourcing strategy (internal vs. external) and

[3] They defined non-standardized components as those components that could not be sourced from local firms in newly industrialized countries (e.g. Taiwan, South Korea and Brazil) without technical assistance from the sourcing firm, and internally was from a firm within (more than 50% owned by) the parent company system.

strategic (market share and sales growth rate)/financial performance (return of sales: ROS and return on investment: ROI) and how this relationship was influenced by four selected sourcing-related factors (i.e. bargaining power of suppliers, product and process innovation, asset specificity and transaction frequency). The result showed that product innovation, process innovation and asset specificity were significant moderator variables for financial, but not strategic, performance. In addition, it showed that global sourcing strategy and several sourcing related factors (bargaining power or suppliers, process innovation and transaction frequency) had a significant direct impact on the firm's strategic performance. Murray (2001) summarised the results of the empirical studies including his own works into three categories as follows: "First, market performance is unrelated to the ownership aspect of final assembly of products (Kotabe and Omura 1989; Murray *et al.* 1995). Second, major components are sourced through global internal sourcing. Third, global internal sourcing of major components is positively related to a product's market performance (Kotabe and Murray 1990, 1996; Kotabe and Omura 1989; Murray *et al.* 1995)". Murray (2001) suggested that strategic alliance-based global sourcing when highly specific assets are deployed might enhance a firm's competitive advantage through the combination of resources in novel ways.

Meanwhile, Kotabe *et al.* (1998) investigated service firms' global sourcing activities. Their study applied a global components/finished goods sourcing strategy framework to the service sector and tested service firms' global sourcing strategy to their market performance. The result showed sourcing strategy (internal and foreign sourcing of supplementary services) was positively related to the strategic and financial performance. Hult (2002) empirically investigated the relationships between multinational companies' culture and their performance in global sourcing. In Hult's view, a culture that encourages entrepreneurial values and beliefs as well as innovation and organizational learning leads to increased performance in global sourcing.

3) Supply Chain Management and Global Sourcing: Logistical Issues

Usefulness of Integrated Logistics and Supply Chain Management. Min and Galle (1991) have argued that "logistics problems are the biggest hurdle in international sourcing." For example, through their empirical work, they found transportation delays to be the major obstacle to efficient international sourcing. Similarly, Frear (1992) discovered that the major problems in off-shore sourcing involved delivery, in contrast to quality, distance, business practice, or technical issues. Fawcett and Birou (1992) have noted that escalating logistics costs are leading firms to examine the total cost of global sourcing, which in addition to price, includes transportation, customs, duties, handling, warehousing, damage in transit, etc. The inclusion of these costs in some cases makes the total cost of global sourcing higher than the cost of purchasing domestically. Petersen *et al.* (2000) have argued that as organizations develop global sourcing strategies, new and longer inventory pipelines should be managed through the use of enhanced logistics and supply chain processes. It is therefore important to understand that logistics and supply chain processes play a key role in the development of global sourcing business capabilities.

Murphy and Daley (1994) have pointed out that an integrated approach to logistics management – that is, an approach that coordinates the various logistics functions in a cohesive system that recognizes the tradeoffs between these functions – will not guarantee success in global sourcing. However, through an empirical survey, they found that "firms with an integrated logistics system should be more successful in global sourcing than those that manage logistics in a fragmented, uncoordinated manner." For instance, increased logistics costs resulting in global sourcing activities can be offset by purchasing larger volumes under the condition of a well organised and coordinated control system. In empirical research, Bozarth *et al.* (1998) showed that several firms recorded significant cost savings and quality improvements through the centralized purchasing contract negotiation for high volume, high value parts. This can be accomplished through the implementation of global 'commodity strategy teams' responsible for coordination of needs and requirements for a class of commodities, evaluation of all global suppliers, and negotiating and awarding contracts.

Just In Time Global Sourcing. The procurement of parts and materials plays a key role in the successful implementation of a JIT strategy because it has a direct impact on increased productivity, reduced costs and improved quality. However, many researchers have pointed out there is a 'theoretical' incompatibility between JIT strategy and global sourcing strategy (Das and Handfield, 1997; Handfield, 1994; Humphreys *et* *al.*, 1998; Min and Galle, 1991; Vickery, 1989). Das and Handfield (1997) identified several inconsistencies in the joint pursuit of JIT and global sourcing strategies as shown in Table 2.3. They summarised their findings by stating that "the hurdles to global JIT sourcing appear formidable." For example, firms which are attempting to develop JIT purchasing systems which require smaller and more frequent deliveries and the reduction of inventories face the problems of longer lead times and logistics difficulties when confronted by the decision to use a foreign source (Handfield, 1994). In addition, although JIT advocates sole sourcing, the increased risk of supply disruption in global sourcing may lead to the adoption of a multiple sourcing strategy (Humphreys *et al.*, 1998). In practice, according to the empirical studies on US based firms by Handfield (1994) and Das and Handfield (1997), only 32% of respondents use JIT in conjunction with international suppliers compared to 62% of domestic JIT sourcing. Single sourcing, often an initial JIT sourcing characteristic, is therefore more prevalent in some cases with domestically sourced items than with international ones.

Table 2.3. JIT and Global Sourcing – Points of Conflict

Required elements	JIT	Global Sourcing
Frequent deliveries	Essential	Difficult
Small lots	Essential	Difficult
Supplier location	Close	Far
Single sourcing	Common	High risk
Long-term relationship	Essential	Difficult
ESI in design, manufacturing, etc.	Possible and probable	Unlikely
Co-ordination and monitoring of schedules and markets	High	Difficult
Price	Less important	Central consideration
Transit loss/damage	Low	High
Information sharing	High	Low
Potential pipeline instability	Low	High
Quality	High	Variable
Supplier flexibility and reaction time	High	Low

Source: Das and Handfield, 1997

However, several case studies have pointed to the possibility that just-in-time sourcing could be an effective policy even in a global supply environment. Vickery (1989) analysed the impact of global sourcing on JIT through a case study of three US based companies and concluded that locational proximity, while desirable, was not a major criterion in supplier selection decision. They suggested that the key success factors for achieving global JIT sourcing include: (1) improved logistics and production planning and scheduling by the buyer to increase the feasibility of more frequent deliveries from foreign suppliers; (2) improved planning and scheduling of production; (3) improved communication between buyers and suppliers; (4) developing a sole source, partnership with foreign suppliers with production and transportation 'economies of scale'; and (5) the use of foreign zone status to expedite customs clearance to reduce transportation lead time. Fawcett and Birou (1992) conducted a survey of purchasing and material managers to understand the coordinating role of logistics in linking global and JIT purchasing. They have suggested that "an incremental approach is most appropriate for integrating global and JIT sourcing in order to allow for the firms to manage the longer inventory supply line effectively while reducing lead times and enhancing flexibility." Das and Handfield (1997) found through empirical study that firms following JIT practices with their global supply base derived the benefits of more frequent deliveries, smaller lot sizes and lower on-hand inventory levels, as compared to non-JIT global sourcing firms. It seems that these benefits are driven, in part, by the increased quality and degree of information sharing and trust and greater frequency of supplier plant visits by buying manufacturing personnel amongst JIT firms.

Besides the empirical research discussed above, various studies have been conducted. Swamidass and Kotabe (1993) investigated the determinants of global sourcing decisions. Levy (1995) explored the supply chain stability in global sourcing. Samli *et al.* (1998) investigated international groups' global sourcing scale and their strategic versus opportunistic sourcing activities. Paché (1998) explored the transactional risk linked to global sourcing. The key findings of all this research are summarised in table 2.4 below.

Table 2.4. Summaries of Global Sourcing Empirical Studies

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Hult (2002)	Competitive Advantage in Global Sourcing	Entrepreneurship, Innovativeness Learning, Cycle Time, Business Performance	Sourcing Director in 1,873 Multinational Corporations	Mail survey/ SEM	A culture that stresses values and beliefs associated with entrepreneurship, innovativeness, and organizational learning leads to increased performance in global sourcing.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Nellore, Chanaron and Söderquist (2001)	Price-based Global Sourcing	Lean Supply Management	One Auto OEM and Six Suppliers	In-depth case study	Lean supply is affected negatively by global purchasing based on price.
Cho and Kang (2001)	Benefits and Challenges in Global Sourcing	Product types, Experience, Import Volume, Firm Size, Regions	1,000 apparel retail firms	Mail survey/ Factor analysis *Chi*-square analysis MANOVA	Three benefits factors and four challenge factors were identified. The types and levels of benefit and challenge factors were different in terms of a firm's managerial and demographic characteristics.
Petersen, Frayer and Scannell (2000)	Global Sourcing Strategy Effectiveness	Structures and Processes, Top Management Commitment, International Language Capabilities, Business Capabilities	Approximately 200 companies	Mail survey/ SEM	Global sourcing structures and processes, global sourcing business capabilities, international language capabilities, and top management commitment to global sourcing are critical to the effectiveness of a global sourcing strategy.
Paché (1998)	Transactional risk linked to global sourcing	Structures, Strategic Behaviours Organisational learning	11 Retail Firms	Semi-structured interviews/ Thematic analysis	Relatively similar structures on the domestic market have led to different strategic behaviours concerning importation, whereas different structures for the domestic market resulted in relatively similar behaviours concerning importation.
Kotabe, Murray and Javalgi (1998)	Global procurement of services	Internal and foreign sourcing, Service innovativeness, Strategic and financial performance, Service quality	202 executives among the Fortune service 500 firms/100 usable replies (49.5%)	Mail survey/ Principle component analysis, Regression analysis	Sourcing strategy (internal and foreign sourcing of supplementary services) was positively related to the strategic and financial performance.
Bozarth, Handfield and Das (1998)	Inter-relationship between international sourcing decisions, strategies and supplier performance	Information Sharing, Single vs. multiple sourcing, Contract, Partnering	500 US manufacturing firms/ 97 respondents (19.4%)/55 firms were included in the analysis	Mail survey/ Principal component analysis	The differences in motivating factors between the phase 2 and phase 3-4 groups did not translate into meaningful differences in on-going commodity strategy development.
Samli Browning and Busbia (1998)	Strategic vs. opportunistic sourcing dichotomy	Global sourcing decision level, Role of global sourcing in the overall strategic plan, Extension of global sourcing planning, Long term arrangement.	790 international groups/ 247 respondents (32.5%)	Mail survey, Telephone interview/ Wave analysis, GLM-ANOVA	U.S. companies engaged in large-scale global sourcing show a tendency to place this activity at top management decision levels. They also attach an important role to global sourcing in the strategic plan. However, many respondents who have engaged in global sourcing on a smaller scale seem to treat global sourcing from an opportunistic perspective.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Das and Handfield (1997)	Logistics in global sourcing	Just-in-time	500 American-based purchasing managers/ 97 respondents (19.6%)	Mail survey/ ANOVA	Firms following JIT practices with their global supply base derive the benefits of more frequent deliveries, smaller lot sizes and lower on-hand inventory levels. These benefits are driven, in part, by the increased quality and degree of information sharing and trust.
Frear, Alguire and Metcalf (1995)	International purchasing pattern, Country segmentation	Four factors; competitive/ comparative barriers/ advantage Four country cluster; NICs, LDCs, DCs, others	485 firms/ 135 respondents (27.8%)	Interview with 15 corporate executives, Mail survey/ Factor analysis, cluster analysis	The successful design of international strategies is based on the interaction between the comparative advantages of countries with the competitive advantage of firms.
Levy (1995)	International sourcing, Supply chain stability	Demand-related disruptions, production-related disruptions	6 companies, 46 employees.	An intensive case study with a single company in computer industry/ Less detailed interviews with 5 firms (electronics industry). Simulation modelling	Demand-related disruptions created substantial and unexpected costs in terms of expedited shipping, high inventories, and lower demand fulfillment. Production-related disruptions declined over time, but demand-related disruptions did not.
Murray, Wildt and Kotabe (1995b)	Global sourcing strategy of US subsidiaries of foreign multinationals	Locational and ownership aspects, two phases of production: component procurement and assembly	467 US based subsidiaries/ 104 respondents (22%)	Mail survey/ Multiple regression analysis	Internal component sourcing from abroad (foreign sourcing) is related to the highest sales growth rate, and internal sourcing of non-standardized components is also related to higher sales growth rate.
Alguire Frear and Metcalf (1994)	Determinants of global sourcing strategy	Motives and barriers	485 firms/115 respondents	Interview, Mail survey/ Factor analysis Cluster analysis	Four factors; internal barriers, competitive advantage, external barriers, comparative advantage
Forker, Scully and Fawcett (1994)	Importance of global sourcing facilitators	Global sourcing imperatives, globalisation urgency, Global sourcing challenges, performance improvements	1,000 purchasing managers/ 148 respondents (15%)	Mail survey/ Structured equation modelling	Globalisation did not directly affect the perceived importance of the global sourcing facilitator construct. Global sourcing imperatives significantly impact on the perceived importance of global sourcing facilitators.
Scully and Fawcett (1994)	International procurement strategies	Small firms and large firms	500 senior purchasing and materials management executives/ 72 respondents (15%)	Mail survey/ Simple *t*-tests	Small firms do engage in international sourcing activities. However, substantial differences exist between how small firms and large firms approach international sourcing. Small firms appear to be at stage 2 of Monczka and Trent's (1991) continuum of international sourcing development -reactive, transaction-oriented international sourcing.

Authors	Key Concept	Exploratory Concepts	Sample Description	Methodology & Method	Key Findings
Handfield (1994)	US global sourcing pattern	Performance attributes, JIT purchasing, international sourcing costs, managerial problems	500 US based purchasing managers/ 108 respondents (19.6%)	Mail survey/ Unpaired t-tests	Domestic sources of supply have an advantage in assessing delivery performance. Trust plays an important role in international supplier selection. Managers using an international source need to consider the total costs.
Murphy and Daley (1994)	Logistics issues in international sourcing	Integrated approach, modes of transportation, modal selection factors, countries' logistical (un)friendliness, use of freight forwarders	350 US firms/ 51 respondents (15%)	Mail survey/ Spearman coefficient of rank correlation	70% of respondents utilize an integrated approach to logistics management. Multiple transport modes tend to be used in global sourcing. The two most important modal selection factors in international sourcing are required delivery date and cost of transport.
Rajagopal and Bernard (1994)	Motivations and strategy of global procurement	Corporate nationality, perceived benefits and problems	350 British based manufacturers/ 76 respondents (21.7%)	Mail survey/ Mean score ranking	Successful global sourcing requires top management commitment and allocation of resources.
Kotabe and Swan (1994)	Offshore sourcing of US multinationals	R&D intensity, internal transfer of equipment & components, parent firms offshore sourcing extension, global market share, return on sale	Total population of more than 2000 US parent firms and 18,000 affiliated abroad	Secondary data from Bureau of Economic Analysis/ Path analysis	US multinationals have maintained, and even may have improved, their global consolidated profitability levels by skilfully exploiting their technological process through technology transfer and offshore sourcing.
Swamidass and Kotabe (1993)	Determinants of various forms of international sourcing	Component sourcing strategies of European and Japanese multinationals exporting to (or manufacturing in) U.S.	250 US subsidiaries of European and Japanese firms.	Mail survey/ Multiple regression (stepwise regression)	International sourcing could be explained using international plant location theory by 8 independent variables; (1) tariff and non-tariff trade barriers, (2) nationality, (3) stage in the product life cycle, (4) exchange rate, (5) transportation cost, (6) production cost, (7) growth in sales in the U.S. (8) current profitability in the U.S.
Birou and Fawcett (1993)	International purchasing	International purchasing decision, benefits and challenge, requirements	1,000 purchasing and materials management executives/ 149 respondents (15%)	Mail survey	The advantage of strategic global sourcing derives from the synergy that is achieved by managing the entire sourcing network as a single cohesive value-added conversion system. JIT sourcing requirements and logistics support were identified as two of the top three challenges and reflect the need for a coordinated inbound logistics network

Source: Tabulated by the Author

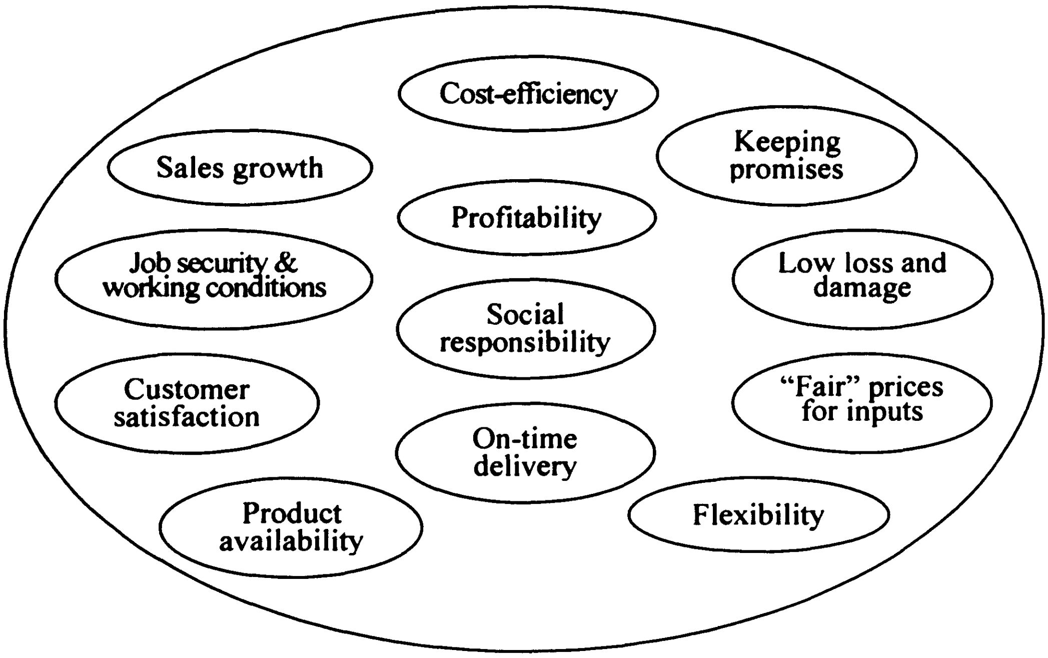
2.4. Logistics and Supply Chain Performance

This section introduces various definitions of performance from the perspective of both general management and logistics management. In addition, performance measurement issues are dealt with to suggest a suitable performance index, which will be able to capture proper information from manufacturing firms employed in the current study.

2.4.1. Definition

It has been suggested that defining performance is a challenge for researchers in management fields since organisations have multiple and frequently conflicting goals (Chow *et al.*, 1994; Rogers *et al.*, 1996). However, logistics performance or distribution service performance can be viewed as a subset of the firm or organisational performance although there is no 'one best way' of defining organisational performance itself (Chow *et al.*, 1994; Ellinger *et al.*, 2000). For example, Gleason and Barnum (1986) distinguished 'effectiveness' from 'efficiency': "Effectiveness is generally defined as the extent to which an objective has been achieved and efficiency refers to the degree to which resources are used economically." Concerning this typology, Anthony *et al.* (1992) stated that "effectiveness is doing the right things and efficiency is doing things right". "Effectiveness involves identifying appropriate service elements and efficiency means achieving adequate performance of those elements without wasting resources" (Ellinger *et al.*, 1997). Other authors suggest that a critical point is that the effectiveness component includes the dual goal criteria of cost and customer-service levels and should be part of the standard output value (Menzer and Konard, 1991). Rhea and Shrock (1987a, b) defined physical distribution effectiveness as the extent to which distribution programmes satisfy customers. They identified six key elements of logistics distribution effectiveness, namely adequacy, consistency, accuracy, timeliness, initiative and responsiveness. Similarly, Rueker *et al.* (1985) have stated that "from the system-structural view, performance is a multidimensional construct involving system effectiveness, efficiency, and adaptiveness." According to this view, "effectiveness involves the degree to which organisational goals are reached, efficiency considers the relationship between organisational outputs and the inputs required to reach those outputs, and adaptiveness reflects the ability of the organisation to adapt to changes in its environment." Sink *et al.* (1984) have suggested seven dimensions in order to capture their conception of "what performance means": effectiveness, efficiency, quality, productivity, quality of work-life, innovation and profitability/budgetability (cited in Chow *et al.* 1994). Chow *et al.* (1994) have defined logistics performance as the extent to which goals such as those suggested in Figure 2.7 are achieved. Figure 2.7 incorporates various possible dimensions of performance in a single envelope to help highlight the goals.

Figure 2.7. What is Logistics Performance?



Source: Chow *et al.*, 1994

2.4.2. Measurement Issue

The tasks of selecting and developing adequate measures for the chosen definition are also critical matters. While the importance of performance measurement has been widely recognized, there is no consensus on a uniform definition of performance or on exactly what should be measured (Chow *et al.*, 1994, 1995; Rogers *et al.*, 1996).

Haytko (1994) classified the distribution channel performance construct into 'outcome-based performance' (the final outcomes of a set of behaviours) and 'behaviour-based performance' (the set of behaviours leading the final outcome). Concerning the distribution channel performance, Maltz and Maltz (1998) have explained that outcome-based research focuses on the outcome of a channel member such as financial variables. A feature of behaviour-based studies is that they request respondents to judge specific channel activities (Maltz and Maltz, 1998). In many cases, outcome-based measures are unable to account for behaviour-based factors such as customer service or product sales support. To resolve this problem, behaviour-based measures can provide useful information (Stank and Lackey, 1997). For example, behaviour-based performance measures can be used to seek out the reasons for poor performance indicated by outcome-based performance measures (Rogers *et al.*, 1996).

Stank and Lackey (1997) stated that "outcome-based logistics performance measures such as order fill rate or percent on-time deliveries capture certain performance dimensions, yet may be considered proprietary and, therefore, hard to collect." They went on to say that behaviour-based measures such as self-reports of order cycle time reductions or lead time variability could be helpful in evaluating the quality of service rendered, but pointed out that they may be limited by self-report biases and comparability problems. For this reason, Haytko (1994) and Stank and Lackey (1997) have recommended a multiple approach that combines outcome-based and behaviour-based performance measures. Concerning the present study, in order to capture many performance dimensions, a combined approach is adopted for the measurement of a firm's capability and performance.

Performance can be measured in two ways – 'hard' or 'objective' measures such as net income or accounting figures and 'soft' or 'perceptual' measures like customer satisfaction ratings (Dalton *et al.*, 1980; Chow *et al.*, 1994; Maltz and Maltz, 1998). Logistics researchers have shown a preference for soft measures due to the difficulty of obtaining hard measures. For example, the difficulty in capturing customer satisfaction is the major reason why hard measures should be supplemented with perceptual ones. Soft measures are also useful where available hard measures are not comparable between groups because of differences in accounting standards or similar problems (Chow *et al.*, 1994, 1995). Perceptual measures have been used mainly for the measurement of traditional performance issues such as return on assets, growth in sales and market share. Govindarajan and Fisher (1990) stated that less traditional measures such as comparative cost reduction, customer service, product quality, and overall competitive position could be measured successfully by perceptual measures. However, Chow *et al.* (1995) pointed out that "the preponderance of soft measures might limit our ability to infer relationships with any degree of confidence". For this issue Fawcett *et al.* (1996) remarked that "while objective performance measures are preferable, perceptual measures have been found to correlate closely with objective measures and are therefore acceptable and useful substitutes when objective data are unavailable." Concerning the present research, soft measures are employed mainly considering the need for comparative analysis between industries and the difficulties of defining and obtaining hard measures for global sourcing related performance and competitive advantage related performance.

In addition, differing views have been presented regarding the dimensions of performance. According to some authors, the concept of performance has been operationalized in both unidimensional and multidimensional forms (Rogers *et al.*, 1996). However, no one measure is sufficient since performance itself is multi-dimensional, reflecting multiple stakeholders and interests. Therefore, the objective for researchers is to find a set of measures which collectively capture most, if not all critical performance dimensions over both short and long-term horizons. Considering the complex nature of the construct and the lack of consensus regarding its scope it would seem that the use of multiple indicators is required (Chow *et al.*, 1994, 1995; Rogers *et al.*, 1996). Therefore, a multi-faceted approach to performance is adopted in the current study.

2.5. Summary

This chapter has reviewed the literature relevant to the research on strategic management theories, integrated logistics and supply chain management, global sourcing strategy and logistics performance. This study has firstly reviewed the most acknowledged theories for strategic management – transaction cost theory, industrial organisation paradigm and resource based theory. Throughout the first section, these are discussed and compared to establish the possibility of the theoretical framework for the current study. Through the comparison, resource based theory has been perceived an effective tool for the current study since high performance can be explained primarily by the strength of a firm's resources, not by the strength of its market position and resource based theory could be a unifying paradigm for strategic management research. In accordance with this recognition, integrated logistics and supply chain management is considered to be firms' core competency.

In the second section, the definitions, evolutionary processes and typology of logistics and supply chain management were introduced. Throughout the study, the concept of 'integrated logistics and supply chain management' was selected in order to design and conduct an empirical study. Numerous empirical studies related to the impact of an integrated logistics and supply chain management on firm performance have been investigated. Many empirical studies have found positive relationships between integrated logistics and supply chain management and various sorts of performance including sustainable competitive advantage. However some researchers show that few companies are actually engaged in extensive supply chain integration and point to several reasons for this phenomenon. This section also examines two main capabilities for integrated logistics and supply chain management – information and strategic planning, which are considered to having positive relations with firm's performance.

The third section concentrates on global sourcing strategy introducing the definitions of global sourcing and categorised five deriving forces and four barriers for implementing global sourcing strategy. This section mainly deals with the influences of global sourcing upon various dimensions of market performance and companies' competitive advantage. Researchers have empirically found some positive associations between global sourcing strategy and superior performance. In particular, this section makes efforts to find the relationships between global sourcing and integrated logistics and supply chain management. Integrated logistics and supply chain management should be useful for effective implementation of global sourcing strategy. In addition, there is a possibility for multinational companies to utilise the just-in-time concept in their global sourcing context.

The final section introduces a definition of performance, especially logistics performance and deals with performance measurement issues. Concerning the present study, the empirical work will adopt a combined approach including outcome-based and behaviour-based performance measures, and mainly use soft measures with multiple indicators.

CHAPTER THREE

CHAPTER 3
RESEARCH MODEL AND HYPOTHESES

The previous chapter discussed the existing theories and empirical studies in order to establish a suitable theoretical framework and to build a foundation of hypotheses development. Based on the resource based theory, it presented existing or possible relationships between integrated logistics and supply chain management as a core competency, global sourcing strategy and firm performance including logistics and sustainable competitive advantage. In this chapter, the current study is advanced by providing a research framework and a conceptual model describing these relationships. Together with the conceptual model, research hypotheses regarding relationships between the latent variables are developed. Finally the observed variables for each latent variable are examined and chosen.

3.1. Research Framework

As argued previously, this study is mainly based on the resource based theory and assumes that integrated logistics and supply chain management is a core competency that is valuable, rare, inimitable and difficult to substitute. Before the establishment of a research framework and model, in order to avoid possible confusion, an identification of terminologies frequently used in resource based research is made first.

1) Terminology in RBT

Resource. Resources have been defined as "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney, 1991). Barney (1991) classified numerous firm resources into three categories: (1) physical capital resources (the physical technology used in a firm, a firm's plant and equipment, its geographic location, and its access to raw materials); (2) human capital resources (the training, experience, judgment, intelligence, relationships, and insight of individual managers and workers in a firm); and (3) organisational resources (a firm's formal reporting structure, its formal and informal planning, controlling, and coordinating systems, as well as informal relations among groups within a firm and between a firm and those in its environment). Olavarrieta and Ellinger (1997) summarized firm resources into three categories: (1) input factors (the generic resources that can be acquired in the market); (2) asset factors (the stocks of available factors that are owned or controlled by the firm); and (3) capabilities (complex bundles of individual skills, assets and accumulated knowledge). Miller and Shamsie (1996) classified resources into two categories according to protection modes: (1) property-based resources (which cannot be imitated because they are protected by property rights); and (2) knowledge-based resources (which are protected by knowledge barriers so that competitors do not know how to imitate a firm's processes or skills).

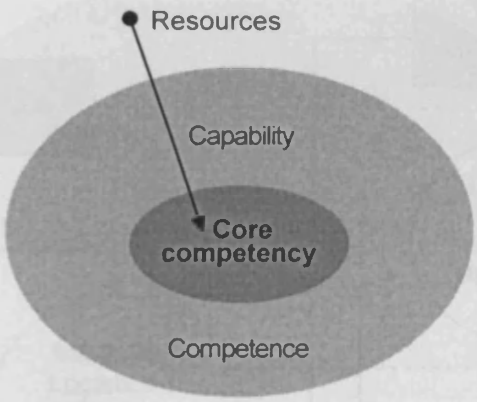
Capability. Capabilities are complex bundles of individual skills, assets and accumulated knowledge exercised through organisational processes, which enable firms to co-ordinate activities, to make use of their resources and further to achieve superior performance and sustained competitive advantage over competitors" (Olavarrieta and Ellinger 1997; Morash *et al.*, 1996). Regarding the difference between resource and capability, Foss and Eriksen (1995) have indicated that the former can be tangible and intangible, but the latter are always intangible. Brush and Artz (1999) have commented that a competitive advantage determined by capabilities is therefore different from a competitive advantage determined by resources in terms of its embeddedness within systems and management within a firm. Grant (1991) has taken the view that resources are the source of a firm's capabilities which are themselves the key source of its competitive advantage. In addition, capabilities are knowledge-based resources that combine action and cognition (Day, 1994). Olavarrieta and Ellinger (1997) explained the dynamic characteristics of capabilities by stating that in their view, the more a capability is utilised, the more it can be refined and the more sophisticated and difficult to imitate it becomes. Likewise, logistics researchers have emphasized the difficulties of copying leading edge firms' distribution systems such as Wal-Mart's, especially its cross-docking logistics system and Hewlett-Packard's postponement dexterity.

Competence. Competence has been defined as the specific tangible and intangible resources of the firm assembled in integrated clusters, which span individuals and groups to allow distinctive activities to be performed (Scarbrough, 1998). The two terms of 'capability' and 'competence' are often used interchangeably in the literature. Elaborating on this matter, Morash *et al.* (1996) has pointed out that the older concept of competence has referred primarily to production technology and physical abilities of the firm. On the contrary, the more contemporary idea of capability is a broader concept that also embraces business behaviour and processes, customer service, responsiveness to customers and order cycle time. The present research mainly employs the concept of capability, rather than competence to describe some specific resources that make firms enhance their competitiveness.

Core competency. As cited in Shang (2002), Coyne *et al.*, (1997) has explained that core competency is a combination of complementary skills and knowledge-bases embedded in a group or team that results in the ability to execute one or more critical processes to a world-class level. Olavarrieta and Ellinger (1997) have stated that core competency exists at the corporate level, but capability or competency exists at the business level. Prahalad and Hamel (1990) have suggested that core competency must satisfy three conditions: (1) providing potential access to a wide variety of markets; (2) making a significant contribution to customer satisfaction; and (3) being difficult for competitors to replicate.

Figure 3.1 and Table 3.1 represent an illustration and definition of the hierarchical system of RBT terminology defined by the author for the present study. As mentioned above, the terminologies of capability and competency have been interchangeably used in many cases; however, the current research uses 'capability' as the basic unit following the recommendations of Morash *et al.* (1996). Those definitions may explain the development process of a firm's core competencies from its resources and capabilities. In the first stage, a firm possesses and controls its individual assets, organisational process, information or knowledge to implement its strategies in an uncoordinated or loosely coordinated manner. In order to create capabilities, the individual skills, assets and knowledge should be more accumulated and embedded within the firm's process and system. Those capabilities can be selected and developed according to the firm's strategic objectives, needs and priorities. In the second stage, the more a capability is utilised, the more elaborate and sophisticated it can be. Some capabilities may evolve into the core competency level through the firm's comprehensive efforts to combine uniquely a firm's strategic capabilities and create synergic effects. Core competency is more difficult to imitate and can provide superior market access and achieve a higher level of customer satisfaction; subsequently, it becomes a critical source of the firm's sustainable competitive advantage.

Figure 3.1. A Hierarchy of Terminology in RBT - Illustration



Source: Author

Table 3.1. A Hierarchy of Terminology in RBT – Definition

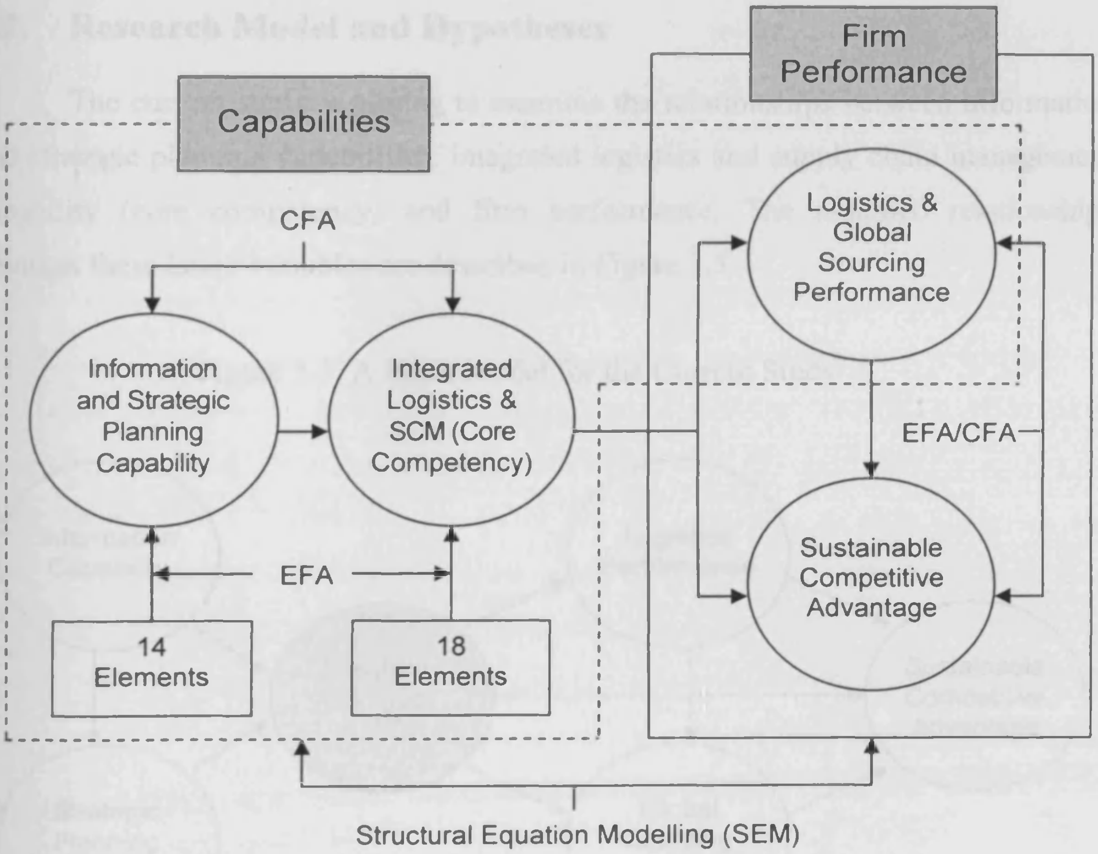
Terminology	Definition
Resource	An entire set of the organisation's physical or intangible assets, attributes, information, knowledge, process and system. The basic source creating the organisation's capability
Capability/Competency	A collection of complex bundles of knowledge-based resources embedded within the organisation's systems. The main source creating the organisation's core competency.
Core Competency	A unique synthesis of the organisation's strategic capabilities, which is difficult to replicate and can allow superior market access and customer satisfaction. The main source of the organisation's sustainable competitive advantage.

Source: Author

2) Research Framework for the Current Study

Bearing in mind this hierarchical relationship between the terminologies related to firm resources, 14 indexes of information and strategic planning capabilities were identified and 18 critical elements of integrated logistics and supply chain management capabilities (core competency) were selected over four categories. These elements will be explained in detail in the next section.

Figure 3.2. Research Framework for the Current Study



Source: Author

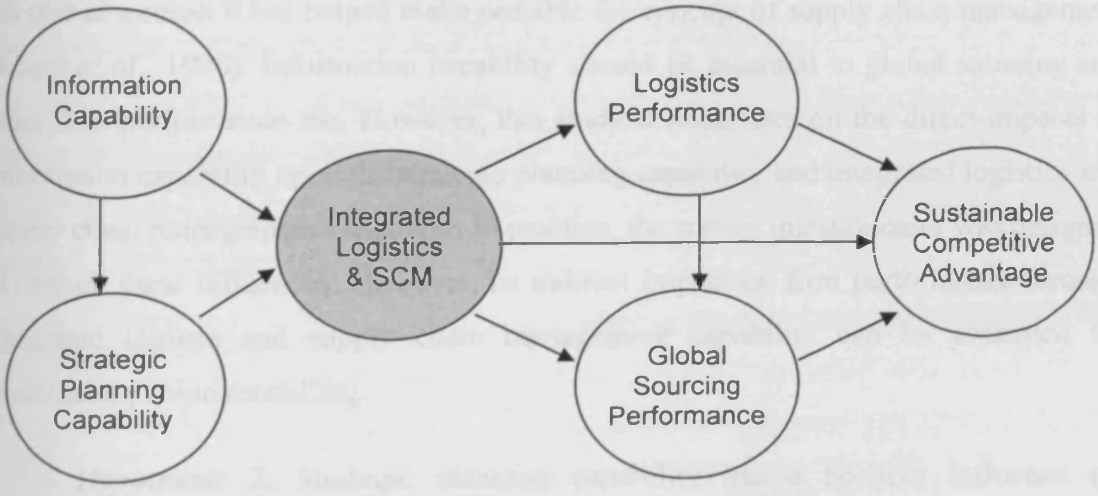
In the empirical study, exploratory factor analysis (EFA) will be undertaken to identify the critical capabilities for integrated logistics and supply chain management of the automobile and electronics industries in Korea. After the exploratory factor analysis, the relationships between these capabilities and firm performance will be examined by structural equation modelling (SEM) including measurement models (i.e.

confirmatory factor analysis: CFA) and structural models. The analysis will endeavour to examine whether information and strategic planning capabilities are the major facilitators for the integration of the logistics and supply chain; whether an integrated logistics and supply chain management moderates logistics performance, global sourcing performance and sustainable competitive advantage; and whether the superior performance of logistics and global sourcing is critical for obtaining sustainable competitiveness. In this case, superiority in logistics and global sourcing performance can be assumed to be firms' capabilities as well.

3.2. Research Model and Hypotheses

The current study is aiming to examine the relationships between information and strategic planning capabilities, integrated logistics and supply chain management capability (core competency) and firm performance. The assumed relationships amongst these latent variables are described in Figure 3.3.

Figure 3.3. A Basic Model for the Current Study



Source: Author

These relationships can be formulated more clearly by the following five hypotheses.

Hypothesis 1: Information capability has a positive influence on strategic planning capability and integrated logistics and supply chain management capability.

The firm's ability to capture information for use in the planning process is critical to selecting and developing appropriate capabilities (Fawcett *et al.*, 2000). Similarly, Akers and Porter (1995) have asserted that information is central to successful strategic planning. According to Roger *et al.* (1996), the information capability is only significant if it is utilized effectively for improved decision making. Obviously, one of the challenges associated with strategic planning is the evaluation of information, both internal and external to the company to identify opportunities, challenges, and priorities. Notably, some empirical studies show that information capability exerts a significant positive effect on strategic planning capability (Fawcett *et al.*, 1996; Fawcett *et al.*, 2000). Innovative and progressive use of the latest logistics information technologies is considered essential to meet the strategic goals of integration. Gustin *et al.* (1995) has asserted that information capability is not only critical to support effective customer service strategies but is also essential in the support of internal firm operations. Some sources see information capability as facilitating internal and external integration (Porter and Millar, 1985) and others point out that as a result it has helped make possible the concept of supply chain management (Roger *et al.*, 1996). Information capability should be essential to global sourcing and other firm performance too. However, this study concentrates on the direct impacts of information capability upon the strategic planning capability and integrated logistics and supply chain management capability. In practice, the survey questionnaire was designed to capture these influences. However, its indirect impact on firm performance through integrated logistic and supply chain management capability can be estimated by structural equation modelling.

Hypothesis 2: Strategic planning capability has a positive influence on integrated logistics and supply chain management capability.

Strategic planning helps managers select the correct capabilities and then allocate their resources to develop them (Fawcett *et al.*, 2000; Stalk *et al.*, 1992). Therefore, it could be assumed that development and maintenance of an integrated logistics and supply chain is greatly supported when logistics and supply chain management capability is combined and coordinated by strategic planning capability. As examined in chapter two, empirical studies have shown mixed results for the relationship between strategic planning and organisational performance. For this reason, the direct influence of strategic planning upon firm performance is not assumed in this study. However, the indirect impact through core competency, i.e. integrated logistics and supply chain management capability will be estimated by structural equation modelling.

Hypothesis 3: Integrated logistics and supply chain management capability has a positive influence on logistics performance, global sourcing performance and sustainable competitive advantage.

Gustin *et al.* (1995) has shown that logistical integration helps to minimize the build-up of inventory at critical business interfaces while improving transport and warehouse asset utilization and eliminating duplication of efforts. According to Gustin *et al.* (1995), the savings resulting from increased efficiency and productivity can be used to enhance logistics service quality. Morash and Clinton (1997) found that structural integration of the supply chain, such as operational coordination and information sharing could reduce transportation time and thus total supply chain costs. Stank and Traichal (1998) have shown that functional integration have a strong relationship with manufacturers' overall logistical flexibility. Meanwhile, other authors point out that global sourcing requires the integration of requirements, in order to identify common purchases, processes, technologies and suppliers that can be coordinated (Bozarth *et al.*, 1998), where logistics and supply chain processes play a key role in the development of global sourcing business capabilities (Petersen *et al.* 2000). Furthermore, firms with an integrated logistics system should be more successful in global sourcing than those that manage logistics in a fragmented, uncoordinated manner (Murphy and Daley, 1994). Stank *et al.* (2002) has asserted that synchronised logistical activities amongst supply chain members create value for end customers by reducing costs associated with redundancy and duplication. Porter (1997) has said that the core of strategy is cross-functional or cross-activity integration. In Porter's view, to sustain advantage, a company has to integrate across many activities to create a unique positioning involving trade-offs with rivals. Lambert and Stock (1993) have asserted that logistics distinctive capability can be a scarce resource and that logistics systems are much harder to copy or adjust to than changes in price, promotion or product tactics. For example, Wal-Mart's point-of-purchase inventory control systems and cross-docking distribution plants have resulted in competitive advantage over its major competitor, K-Mart (Barney, 1995). Chapter two introduced and discussed numerous empirical studies relating to the relationships between integrated logistics and supply chain management and various sorts of performance. Many of these studies have shown that positive relationships exist between them.

Hypothesis 4a: Superior logistics performance and global sourcing performance exert positive influences on firms' sustainable competitive advantage.

Hypothesis 4b: Logistics performance has a positive effect on global sourcing performance.

As cited in Kotabe (1998), Peter Drucker has pointed out that sourcing and logistics are the least exploited areas of business for competitive advantage. Naturally, regardless of their nationality, many companies that have a limited scope of global sourcing are at a disadvantage over those that exploit it to their fullest extent in a globally competitive market place. As firms become less and less hierarchical, as they grow more and more geographically dispersed, and as customers become more and more demanding, logistics can provide a coordinating role that will provide a firm with a competitive advantage (Stock *et al.*, 1999). In the present study, superior logistics performance is assumed to have a positive influence on global sourcing performance. Here, logistics performance which is not caused by integrated logistics and supply chain management could be assumed to be explained by other logistics capabilities such as total quality management, agile logistics, customer focused logistics, postponement logistics and value added logistics service, which are also able to contribute to better global sourcing performance.

3.3. Latent Variables and Observed Variables

This section presents the observed variables for each latent variable discussed to adopt the structural equation modelling. Latent variables represent theoretical constructs such as customer satisfaction or competitive advantage which are abstract and cannot be observed directly. Therefore their measurements are derived indirectly by linking the latent variable to more than one observed variable. These observed variables will be measured using multiple indicators.

3.3.1. Information Capability

As explained in chapter two, information capability consists of two main components of information technology and information sharing. Information technology means the investment, design and maintenance of hardware, software and networks to enhance accurate, timely and usable information. Information sharing involves inter-organisational information sharing and connectivity with external suppliers or customers. Thus, information capability could be observed by information technology and information sharing. However the current study includes additional components for information capability, i.e. information contents regarding strategy, manufacturing and logistics. This is because the availability of robust manufacturing and logistics information is especially critical in global operations where the complexities of configuration decisions are magnified by diverse legal, political, cultural, and economic climates, which increase levels of risk and uncertainty (Fawcett *et al.*, 2000).

Table 3.2. Latent and Observed Variables for Information Capability

Authors	Latent variables	Observed variables
Bowersox *et al.*, 1989; Fawcett *et al.*, 1996	Information capability	Information availability; Technology
Fawcett *et al.*, 1996	Information capability	Strategic information; Manufacturing information; Logistics information
Jayaram *et al.*, 2000	Information system infrastructure	Information technology; Manufacturing technology; Design-manufacturing integration

Source: Tabulated by the Author

The information technology could be measured by (1) continual investment of information technology; and (2) tailored information system for SCM. The measurement indexes of the information content are (3) usefulness of strategy related information; (4) usefulness of manufacturing related information; and (5) usefulness of logistics related information. The information sharing could be measured by (6) design of information system for the information sharing between departments and (7) with suppliers/customers. These measures can be supported by previous research as shown in Table 3.2 above.

3.3.2. Strategic Planning Capability

Strategic planning is composed of planning formality and planning process or implementation. In the previous studies (Fawcett *et al.*, 1996; Fawcett *et al.*, 2000; McGinnis and Kohn, 1990) planning formality includes overall level of strategic planning, planning for logistics and physical distribution system, production and manufacturing control system, purchasing and materials management system, marketing system, financial performance system, while the planning process contains written short and long-range plans, feedback process, evaluation process for environments and resources, and SWOT (strengths/weaknesses/opportunities/threats) analysis. However the present study takes into account the coordinated strategy development amongst functional areas, i.e. strategic planning sharing, to emphasize the importance of planning capability to make possible an integrated logistics and supply chain management.

Table 3.3. Latent and Observed Variables for Strategic Planning Capability

Authors	Latent variables	Observed variables
Schraeder, 2002	Strategic Planning	Strategic Planning Process (Participation in the Planning Process)
Fawcett *et al.*, 2000; Fawcett *et al.*, 1996	Strategic Planning Capability	Planning Formality or Planning Comprehensiveness, Planning Process
Hahn and Powers, 1999	Strategic Planning	Planning Sophistication, Planning Implementation
Ramanujam *et al.*, 1986	Strategic Planning Systems	Design Elements, Organisational Context of Planning
Shrader *et al.*, 1984	Strategic Planning	Formal Strategic Planning, Strategic Planning content
Armstrong, 1982; Kargar and Blumenthal, 1994; Lyles *et al.* 1993; O'Regan and Ghobadian, 2002; Robinson and Pearce, 1983;	Strategic Planning	Planning Formality or Formal Planning or Formalised Strategic Planning

Source: Tabulated by the Author

Thus planning formality could be measured by (1) a formal planning system for the design of operating system; and (2) a formal evaluation system for financial and logistics performance. The measurement indexes for the planning process are (3) a decision making process based on total cost measurement; (4) a continual planning process incorporating feedback; and (5) planning process evaluating environmental constraints, firm resources and organisational goals. The strategic planning sharing could be measured by (6) participation of all functional staff in strategy development; and (7) integration of logistics strategy with other strategic plans.

3.3.3. Integrated Logistics and Supply Chain Management Capability

Various typologies of logistics and supply chain integration were introduced and discussed in chapter two. Logistics and supply chain integration has been categorised simply into two or three dimensions and more complexly into six dimensions as shown in table 3.4.

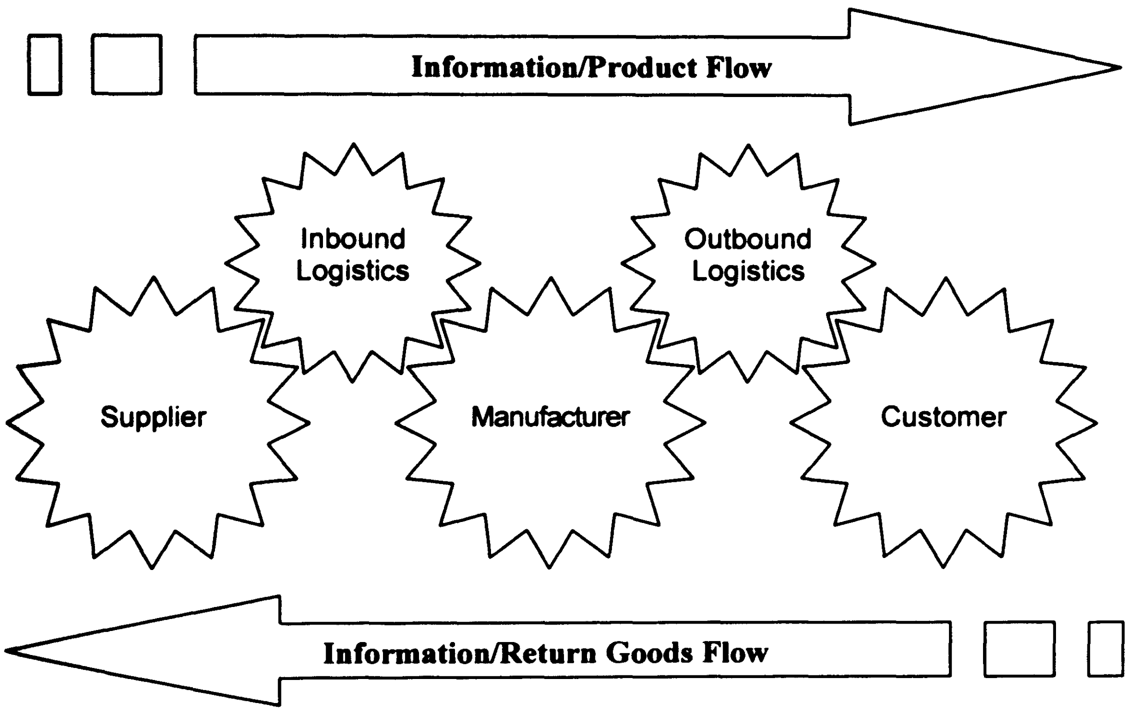
Table 3.4. Latent and Observed Variables for Integrated Logistics and SCM Capability

Authors	Latent variables	Observed variables
Bowersox, Closs and Stank, 1999	Supply Chain Integration	Customer integration; Internal integration; Material and service supplier integration; Technology and planning integration; Measurement integration; Relationship integration
Fawcett and Magnan, 2002	Supply chain integration	Functional area; Channel position
Morash and Clinton, 1997	Supply chain organisational structures and integrative capabilities	Internal supply chain integration; External supply chain integration; Operational planning/ interactive relationships
Morash and Clinton, 1998	Customer integration	Collaborative closeness; Operational excellence
Narashimhan and Kim, 2002	Supply chain integration	Integration with suppliers; Internal integration; Integration with customers
Stank *et al*,.1999	Interdepartmental integration	Collaborative integration of Marketing/logistics relationship
Stank *et al*., 2001	Logistical collaboration	Internal collaboration (IC); External collaboration (EC)
Stank *et al*., 2002	Supply chain integration	Customer integration; Internal integration; Material & service supplier integration; Technology & planning integration; Measurement integration; Relationship integration

Source: Tabulated by the Author

The current study employs four categories for integrated logistics and supply chain management, namely (1) supplier integration; (2) internal integration; (3) customer integration; and (4) inbound and outbound logistics integration. This typology is based on a simple idea focusing on the flows of materials, products and information from suppliers through manufacturer to customers as illustrated in Figure 3.4.

Figure 3.4. Typology of Integrated Logistics and SCM



Source: Adapted from Stank and Goldsby, 2000

However, it should be meaningful to involve inbound/outbound logistics integration in the current study since there has been no trial to investigate the influence of inbound/outbound logistics on the firm's performance. Firstly, supplier integration is based on the idea that the close collaboration and extensive information sharing with external material and service providers creates flexible operating systems characterised by coordinated operations that could drastically cut channel cycle times and inventory levels as goods flow seamlessly from raw material supplier to end customer (Bowersox *et al.*, 1999). Secondly, internal integration is the starting point of supply chain integration and much research has focused on this issue first. In addition, according to Bowersox and Closs (1996), some stage theories also predict that this intra-organisational process integration is a preliminary requirement for subsequent successful inter-organisational integration with suppliers and customers. Thirdly, customer integration focuses on the attempt to meet and maintain desired customer service levels (Ellinger *et al.*, 1997; 2000). Finally, inbound/outbound logistics integration means that logistics and transportation service is able to play a central role in seamless supply chain operations, moving inbound materials from supply sites to manufacturing facilities, repositioning inventory amongst different plants and distribution centres, and delivering finished products to customers (Stank and Goldsby, 2000). As firms strategically compete on the basis of cost, service, or time, logistics and transportation can play a key integrative role in supply chain structures (Morash and Clinton, 1997).

A total of eighteen measurement indicators for the four types of integrated logistics and SCM capabilities were selected and developed through the literature review and discussions with supervisors. For the supplier integration, five indexes are employed as follows: (1) increase of long-term agreements with key suppliers; (2) sharing of technical resources, R&D costs with key suppliers; (3) key suppliers' participation in the development and design of new products; (4) formal evaluation of suppliers' performance; and (5) flexible modification of the order size, volume, composition to key suppliers. Secondly, internal integration is measured by (6) establishment of cross functional policies and procedures; (7) adherence to established operational and administrative policies and procedures; (8) reduction of formal organisational structure; and (9) operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation. Next, the following four indicators are used to measure customer integration: (10) discrimination of logistics service strategies for different customers; (11) utilisation of flexible programmes providing special services for the changing customer requirements; (12) formal measurement of customer satisfaction; and (13) maintenance of a high level of communication with customers. For the inbound and outbound logistics integration another five indexes are chosen: (14) integrated logistical operations under single control; (15) utilisation of total transportation chain performance measurement; (16) flexible multimodal transportation management; (17) coordination of inbound/outbound transportation; and (18) increase of long-term agreements with logistics service providers.

Table 3.5. Summary of Latent/Observed Variables and Source for Integrated Logistics and SCM Capability

Latent variables	Observed variables	Source
Supplier Integration	Increase of long-term agreements with key suppliers	Stank and Crum, 1997; Stank, Keller and Closs, 2002
	Sharing of technical resources, R&D costs with key suppliers	Stank and Lackey, 1997; Stank, Keller and Closs, 2002
	key suppliers' participation in the development and design of new products	Narasimhan and Kim, 2002; Stank and Crum, 1997; Stank, Keller and Closs, 2002
	Formal evaluation of suppliers' performance	Morash and Clinton, 1998
	Flexible modification of the order size, volume, composition to key suppliers.	Stank, Keller and Daugherty, 2001; Stank, Keller and Closs, 2002
Internal Integration	Establishment of cross functional policies and procedures;	Bowersox, Closs and Stank, 1999; Morash and Clinton, 1998
	Adherence to established operational and administrative policies and procedures;	Bowersox, Closs and Stank, 1999
	Reduction of formal organisational structure	Bowersox, Closs and Stank, 1999; Stank, Keller and Closs, 2002
	Operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation.	Bowersox, Closs and Stank, 1999
Customer Integration	Discrimination of logistics service strategies for different customers	Bowersox, Closs and Stank, 1999; Fawcett and Clinton, 1996; Stank, Keller and Closs, 2002
	Utilisation of flexible programmes providing special services for the changing customer requirements	Bowersox, Closs and Stank, 1999; Fawcett and Clinton, 1996; Stank, Daugherty and Ellinger, 1999
	Formal measurement of customer satisfaction	Bowersox, Closs and Stank, 1999; Fawcett and Clinton, 1996; Stank, Keller and Closs, 2002
	Maintenance of a high level of communication with customers	Morash and Clinton, 1998; Narasimhan and Kim, 2002

Latent variables	Observed variables	Source
Inbound/outbound Logistics Integration	Integrated logistical operations under single control	Stank, Keller and Closs, 2002
	Utilisation of total transportation chain performance measurement	Morash, Dröge, and Vickery, 1996; Stank, Keller and Daugherty, 2001
	Flexible multimodal transportation management;	Author
	Coordination of inbound/outbound transportation	Murphy and Daley, 1994
	Increase of long-term agreements with logistics service providers.	Stank and Crum, 1997; Stank, Keller and Closs, 2002

Source: Tabulated by the Author

3.3.4. Logistics Performance

A wealth of research has suggested various dimensions to capture the concept of logistics performance as shown in Table 3.6. These include effectiveness, efficiency, quality, productivity, innovation, profitability, on-time delivery, quick response, customer satisfaction, flexibility, zero damage, etc.

In the present study logistics performance was measured by five indexes related to three observed variables. This categorisation is based on a suggestion from Andraski and Novack (1996). According to the authors, a traditional logistics service such as order fill, on-time delivery, zero damage and accurate invoicing can be called a 'reliability' service and an 'evolving' logistics service such as customer pick-up options and special material handling options can be called a 'responsiveness' service. In addition, they label the ultimate logistics service including quick response, continuous replenishment and category management as an 'innovation' service. In the current thesis, the observed variables for logistics performance are selected focusing on the real logistical activities, and several broader performance indexes, for instance quality, innovation and flexibility are utilised in other performance areas such as sustainable competitive advantage. The following are the observed variables and indexes of the logistics performance adopted in the present research: (1) meeting accurately quoted or anticipated delivery dates and quantities on a consistent basis

(reliability); (2) responding promptly to the needs and wants of key customers; (3) being flexible in terms of accommodating customers' special requests **(responsiveness)**; (4) notifying customers in advance of delivery delays or product shortages; and (5) utilising just-in-time management **(innovativeness)**.

Table 3.6. Latent and Observed Variables for Logistical Performance

Authors	Latent variables	Observed variables
Andraski and Novack, 1996	Logistics performance	Responsiveness (store-built pallets; customer pick-up options; special material handling options)
Andraski and Novack, 1996; Morash and Clinton, 1997	Logistics performance	Reliability (order fill; delivery times; absence of shipment loss and damage; on-time delivery; accurate invoicing)
Andraski and Novack, 1996; Fawcett and Fawcett, 1995	Logistics performance	Innovativeness (quick response; efficient consumer response; continuous replenishment; vendor managed replenishment; category management; shorter lead times; customer service enhancements; improved forecasting and scheduling; innovative technology including bar codes, satellite tracking, electronic data interchange, automated picking/packing to offer customized services)
Ansari and Modarress, 1990; Handfield, 1994	JIT Sourcing performance	Smaller and more frequent deliveries; Longer lead times
Beamon, 1999	Logistics performance	Resources; Output; Flexibility
Fawcett and Clinton, 1996	Logistics performance	Inventory turns; Average inventory; Accommodation of customers' special requests; Specific logistics strategies to deal with distinct customers
Fawcett and Cooper, 1998	Supply chain performance	Cash-to-cash cycle time; Inventory days of supply; Inventory dwell time; Perfect order; Total order fulfilment cycle time; Supply-chain response time
Jayaram *et al.*, 2000	Supply-chain time-based performance	New product development; Manufacturing lead time performance; Delivery speed performance; Customer responsiveness performance
Lai *et al.*, 2002	Supply chain performance in transport logistics	Service effectiveness for shippers(SES); Operations efficiency for transport logistics service providers(OE); Service effectiveness for consignees(SEC)
Michigan State Univ.1995; Ellinger *et al.*, 2000	Distribution service performance areas	Meeting delivery dates and quantities; Responding to the needs and wants of customers; Pre-notification of delivery delays or product shortage

Authors	Latent variables	Observed variables
Morash, 2001	Demand & supply-side performance measures in supply chain	Demand-side: customer service measures (11 items), quality measures (9 items); Supply-side: cost measures (17 items), productivity measures (9 items)
Morash *et al.*, 1996	Logistics capabilities needed for competitive advantage	Delivery reliability; Post-sale customer service; Responsiveness to target market; Delivery speed; Pre-sale customer service; Widespread distribution coverage; Selective distribution coverage; Low total cost distribution
Morash and Clinton, 1997	Flexibility	Flexibility in terms of time, items, quantity, location, or delivery sequencing
Murphy and Daley, 1994	Logistics issues in international sourcing	Integrated approach; Modes of transportation; Modal selection factors; Countries' logistical (un)friendliness; Use of freight forwarders
Otto and Kotzab, 2003	Logistics performance	Integration; Lead times; Order cycle time; Inventory level; Flexibility
Pearson and Semeijn, 1999	Logistics service priorities	Reliability; Transit time; Cost (freight rate), Over/short/damage; Carrier considerations; Forwarding services; Shipper considerations; Electronic data interchange; Warehousing facilities; Distribution services
Stank and Lackey , 1997	Logistical performance measures	Lead time from receipt of order to delivery; The percentage of on-time shipment deliveries; Estimated percent of on-time deliveries of shipments to customers; Expedited shipments of in/outbound freight; Routing and scheduling to consolidate in/outbound freight shipments; Effective strategy for dealing with border crossing delays of freight shipments
Stank *et al.*, 2002	Overall logistics performance	Advanced shipping notification; Customer satisfaction; Delivery dependability; Delivery speed; Delivery time flexibility; Inventory turns; Information systems support; Low logistics costs; Order fill capacity; Order flexibility; Product flexibility; Responsiveness to key customers; Return on assets (ROA)

Source: Tabulated by the Author

3.3.5. Global Sourcing Performance

A great deal of empirical research has attempted to find the relations between global sourcing strategy and various performance elements as shown in table 3.7.

These performance indexes can be organised into four observed variables and five measurement indexes: (1) achieving lower factor cost (**comparative advantage**); (2) access to advanced production technologies; (3) penetrating local markets (**access to technology and market**); (4) reducing time delays involved in waiting for local suppliers to provide the requisite components (**shorter product development time**); and (5) reducing local disadvantage/difficulties (**reduction of local differences**). These performance indexes are mainly explained in 'motives/barriers of global sourcing' in chapter two. Meanwhile, competitive advantage, another important motivation for global sourcing will be treated as an independent performance category in the next section.

Table 3.7. Latent and Observed Variables for Global Sourcing Performance

Authors	Latent variables	Observed variables
Alguire *et al.*, 1994; Scully and Fawcett, 1994	Advantage of global sourcing	Better quality; Better availability, Better technology, Better delivery; Better customer service, Enhanced competitive position
Birou and Fawcett, 1993; Carter and Narasimhan, 1990; Frear *et al.*, 1995; Murray *et al.*, 1995b; Nellore *et al.*, 2001	Local specific advantage; Comparative advantages	Transportation cost: trade barriers, availability, delivery time, lead-time, inventories; Factor costs: materials, labour, engineering costs
Bozarth *et al.*, 1998	Procurement performance	Quality; Delivery; Lead time; Lower cost; Scheduling flexibility
Carter and Narasimhan, 1990; Fawcett and Birou, 1992; Monczka and Trent, 1992	Shorter product development time	International PLC(product life cycle)
Carter and Narasimhan, 1990; Handfield, 1994; Min and Galle, 1991	Quality	Components, finished goods, service
Frear *et al.*, 1992; Kotabe and Murray, 1990; Porter, 1990	Access to technology/market	Advanced production technologies; Local market penetration
Kotabe and Murray, 1990	Performance of global sourcing strategy	International product life cycle; Specialized competence; Intra-firm transactions; Product and process innovations
Kotabe and Swan, 1994	Offshore sourcing of US multinationals	R&D intensity; Internal transfer of equipment & components; Parent firms offshore sourcing extension; Global market share; Return on sale

Authors	Latent variables	Observed variables
Monczka and Trent, 1992	Competitive factors in worldwide sourcing	Quality; Cost; Technology; Concept-to-customer and process cycle time reduction (cycle time reduction for new products and processes); Availability to schedule (product and service availability)
Nellore *et al.*, 2001	Management of local differences	Cultural difference; Regulation
Rajagopal and Bernard, 1994	Factors considered important in deciding to purchase from international source	On-time delivery; Better quality; Lower prices; Item unavailable domestically; Willingness to solve problems.
Scully and Fawcett, 1994	Performance impact of global sourcing	Above average rate of growth in return on total assets, sales, market share; Above average cost reductions, product quality; Overall competitive position

Source: Tabulated by the Author

3.3.6. Sustainable Competitive Advantage

Hayes *et al.* (1988) have identified five performance dimensions capable of providing a firm with competitive advantage. These are cost, quality, dependability, flexibility and innovation. Scannell *et al.* (2000) has noted that effective supply chain management may positively affect cost, quality, flexibility, and innovation performance. In this conception, cost and quality are traditional major strategic factors for cost leadership and differentiation. However, today, cost and quality are recognised as minimum standards by which competitiveness is measured. In contrast, flexibility has received increasing attention as a viable differentiator especially under the context of time-based competition. Regarding innovation, Porter (1997) has suggested that the only way to have an advantage is through innovation and improvement, involving a consistent strategic visional direction. The current study adopts four competitive dimensions and one competitive position presented in the market place which is developed through discussions with author's supervisors. These are measured by ten indexes as follows: (1) lower manufacturing cost (**cost**); (2) meeting customer's expectation for manufacturing quality and (3) design quality

(quality); (4) flexibility in production volume, changeover, and modification; (5) ability to deal with unexpected events **(flexibility)**; (6) product innovation level and (7) process innovation level in the product **(innovation)**; (8) market share; (9) sales growth rate compared to competitors; and (10) sales growth rate compared to market growth rate **(competitive position in the market)**.

Table 3.8. Latent and Observed Variables for Sustainable Competitive advantage

Authors	Latent variables	Observed variables
Barney, 1991	Firm resources to generate sustained competitive advantage	Value (valuable resources); Rareness (rare resources);Imitability (imperfectly imitable resource); Substitutability
Stock *et al.*, 1999	Competitive advantage	Speed; Time; Innovation
Vickery, 1991; Stock *et al.*, 1999	Competitive priorities	Cost; Quality (performance quality or conformance quality); Flexibility (design flexibility or volume flexibility); Delivery (speed or reliability)
Fawcett and Fawcett, 1995; Fawcett *et al.*, 1996	Competitive advantage	Cost leadership (economies of scale, productivity, access to low cost factor inputs, extensive cost control); Differentiation (delivery, flexibility, innovation, quality)
Hayes *et al.*, 1988; Fawcett and Closs, 1993	Competitive advantage	Cost; Quality; Dependability; Flexibility; Innovation
Hult, 2002	Core cultural facilitators of competitive advantage	Entrepreneurship, Innovativeness, Learning
Scannell *et al.*, 2000	Competitive Performance	Flexibility (volume, mix, changeover, modification) Innovation (production innovation, design quality, process innovation) Quality (production durability, production reliability, conformation to specifications) Cost (cost reduction, low production cost)
Stalk *et al.*, 1992	Five dimensions for competitive advantage	Speed (the ability to respond quickly to customer or market demands and to incorporate new ideas and technologies quickly into products) Consistency (the ability to produce a product that unfailingly satisfies customers' expectations) Acuity (the ability to see the competitive environment clearly and thus to anticipate and respond to customers' evolving needs and wants) Agility (the ability to adapt simultaneously to many different business environments) Innovativeness (the ability to generate new ideas and to combine existing elements to create new sources of value)

Source: Tabulated by the Author

3.4. Summary

The current study introduces a research framework and a hierarchy of the terminologies related to resource based theory. According to this hierarchal system, integrated logistics and supply chain management is assumed to be a core competency to achieve and sustain competitive position. In addition, information and strategic planning abilities are considered to be the main capabilities of the integration strategy. The second section presents a conceptual model describing the relationships between integrated logistics and SCM related capabilities, logistics performance, global sourcing performance and in addition, sustainable competitive advantage. To formulate these relationships, five research hypotheses have been developed, which are composed of latent variables. In order to adopt structural equation modelling, the observed variables for each latent variable are examined and selected. In order to measure these observed variables, measurement indicators have been developed through the previous studies. As a result, seven indexes for three observed variables for information capability and strategic planning capability have been chosen respectively. Eighteen measurements for four categories of integration in logistics and supply chain were sought: five indicators for supplier integration; four indexes for internal integration; four indicators for customer integration; and five indexes for inbound and outbound logistics integration. Regarding performance, five indicators for logistics performance were summarised into three categories and five indexes for global sourcing performance were represented by four categories. Finally, ten measurements were selected to capture firms' sustainable competitive advantage and their real competitive position in the market place. The questionnaire to collect the related information will be developed in the next chapter, in which the observed variables and measurement indexes will be described in more detail.

CHAPTER FOUR

CHAPTER 4
RESEARCH METHODOLOGY

The previous two chapters were devoted to the development of a conceptual model and the hypothetical relationships among constructs examined in the current study. This chapter makes the connection between the proposed research model and hypotheses and the empirical results which will be presented in the next two chapters.

The present chapter focuses solely upon research methodology. The chapter begins with an exploration of the research process seeking a philosophical foundation, research approach, research strategy and time horizons for the current study. In the second section, the data collection method is discussed to present an appropriate method for the present study. The third section employs Churchill and Iacobucci's (2002) nine-step questionnaire development process to provide a clear and concise sequential procedure for the formation of the questionnaire instrument. The next section introduces two target industries – automobile and electronics. In this section, the general production or supply chains of these industries are illustrated and the trade records of Korean automobile and electronics commodities are presented. In addition, the sampling design process is explained. The fifth section elaborates the concepts and sub-dimensions of validity and reliability in detail. The sixth section introduces structural equation modelling as the main data analysis technique and discusses related critical issues. Finally, this section adopts Hair *et al.*'s (1998) seven-step SEM analysis process to obtain the correctly specified measurement and structural models and consequently valid results.

4.1. Research Process

As addressed in the previous chapters, the main questions of the current study are: (1) to specify the major capabilities of integrated logistics and supply chain management; (2) to examine the impact of integrated logistics and supply chain management on the firm's logistics performance, global sourcing performance, and sustainable competitive advantage and; (3) to define the interrelationships between those three performance areas. The nature of the research question is fundamental to determine the research methodology and methods adopted in answering these questions. In other words, the research design should be determined by the research problem itself: "the problem under investigation properly dictates the methods of investigation" (Trow, 1957).

However, selection of methodology needs to be guided by more fundamental principles. Avision and Fitzgerald (1995) have outlined the importance of a philosophical approach in designing a research project as follows: "A methodology is a collection of procedures, techniques, tools and documentation aids... but a methodology is more than merely a collection of these things. It is usually based on some philosophical view, otherwise it is merely a method, like a recipe". According to Bryman and Bell (2003), "the philosophical approach reflects particular ontologies and epistemologies". Ontology is the branch of metaphysics which concerns the nature of existence. It examines whether social entities can and should be considered objective entities that have a reality external to social actors, or whether they can and should be considered social constructions derived from the perceptions and actions of social actors. "These positions are frequently referred to respectively as objectivism and constructivism" (Bryman and Bell, 2003). Epistemology is derived from ontology and concerns the theory of knowledge, its nature and limits (Blackburn 1996) and how people discover reality, and acquire and accept knowledge about the world. One of the most crucial aspects of epistemology is its examination of whether or not a natural science model of the research process is suitable for the study of the social world. Generally, there are two opposing philosophical perspectives on epistemology: positivism and interpretivism. Positivism advocates the application of the methods of the natural sciences to the study of social reality and beyond (Bryman and Bell, 2003), in which the objective of research is to identify 'laws' which characterise individual behaviour. "Knowledge is extended through logical deduction and objective observation and measurement" (Bryman and Bell, 2003). The researchers inclined toward positivism must study social phenomena "in the same state of mind as the physicist, chemist or physiologist when they probe into a still unexplored region of the scientific domain" (Durkheim, 1964). Therefore, positivist research is scientific, structured, has a prior theoretical foundation, seeks to build the nature of relationships and causes and effects, and employs empirical validation and statistical analyses to test and confirm theories. On the contrary, interpretivists argue that positivism is a kind of stimulus response model of human behaviour. They assert that people do not simply respond to external stimuli but actively interpret the world. Human beings act on the basis of their subjective understanding of the implications of phenomena of which they are consciously aware. Data has to be interpreted; it does not 'speak for itself'. Research is conducted inductively whereby abstract theoretical constructs are created at the end of, and on the basis of, the fieldwork (Glaser and Strauss, 1967).

The next consideration should be the choosing of the research approach, which is related to the nature of the relationship between theory and research. The question is whether a researcher should employ the deductive approach, where the researcher develops a theory and hypothesis (or hypotheses) and designs a research strategy to test the established hypothesis, or the inductive approach, where the researcher should collect data and develop theory through the data analysis process (Saunders *et al.*, 2000). As explained above, the deductive approach is dominant in positivism, whilst the inductive approach is prevalent in interpretivism. The questions addressed by the current study mainly assume an objective and positivist position since the integrated logistics and supply chain is considered an objective entity and its influence on firm performance is examined by testing a series of hypotheses established through a logical deduction from the existing theories and empirical studies. Recognising these points, the major research method of the current study should be a quantitative one. Here, research methods refer to the systematic, focused and orderly collection of data for the purpose of obtaining information from it, to solve and answer the research problems or questions (Ghauri and Grønhaug, 2002). Bryman and Bell (2003) have identified the fundamental differences between quantitative and qualitative research strategies. In their view, the quantitative method is suitable for research based on objectivism (ontological orientation), positivism (epistemological orientation), and a deductive approach (principle orientation to the role of theory in relation to research).

Table 4.1. Fundamental differences between quantitative and qualitative research strategies

	Quantitative	**Qualitative**
Ontological orientation	Objectivism	Constructivism
Epistemological orientation	Natural science model, in particular positivism	Interpretivism
Principle orientation to the role of theory in relation to research	Deductive; testing of theory	Inductive; generation of theory

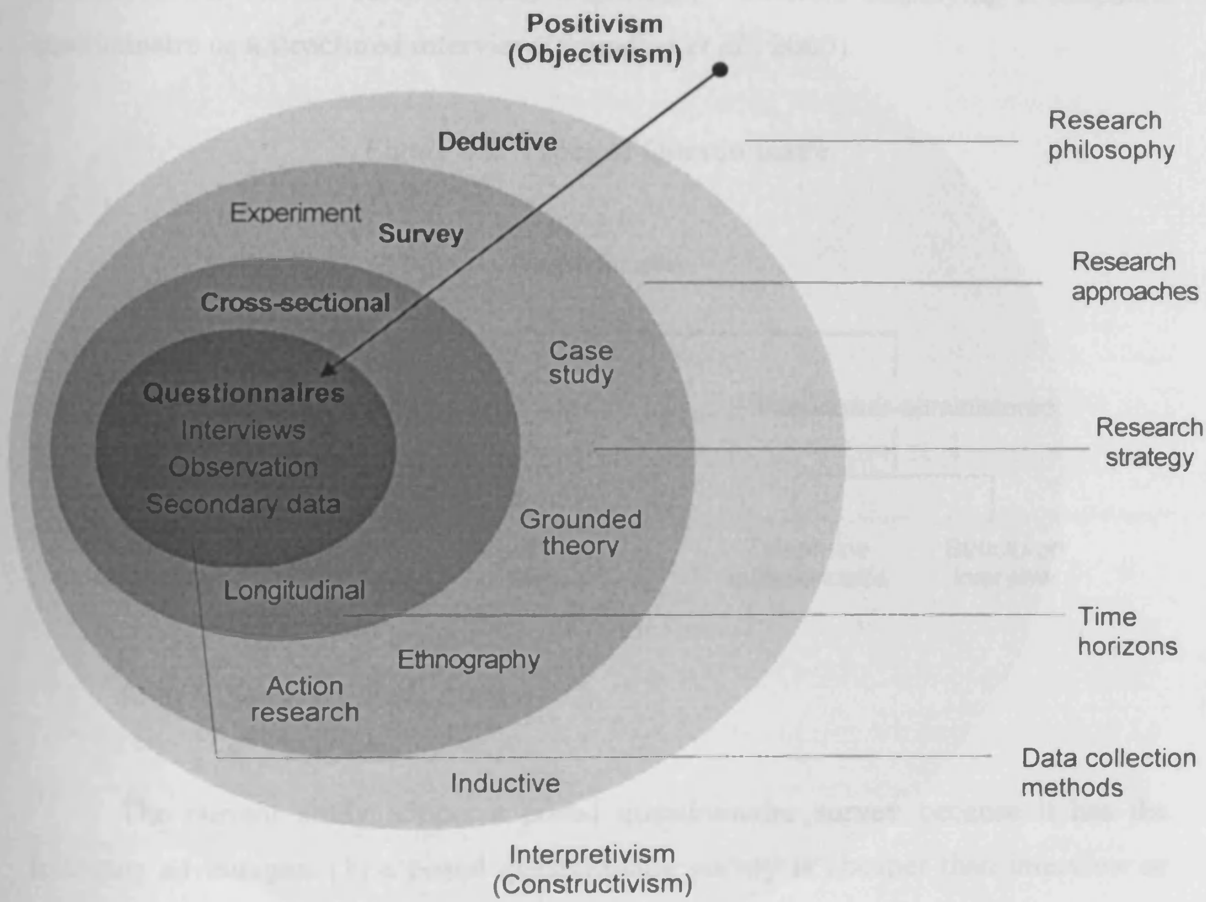
Source: Bryman and Bell, 2003

However, there exist diverse research strategies, some of which belong to the quantitative strategy and others to the qualitative one. For instance, experiment and survey method (particularly the former) are usually associated with the quantitative strategy (i.e. a deductive approach). In contrast, grounded theory, ethnography and action research are all frequently and strongly related with qualitative strategy (i.e. an inductive approach). In this spectrum, the case study could be located in a neutral position (Ghauri and Grønhaug, 2002; Saunders *et al.*, 2000). In the current study, the survey method was selected as the main research strategy since (1) the survey method is associated with the deductive approach; (2) it is perceived as authoritative by researchers; (3) it should give the researcher more control over the research process; (4) it allows the collection of a large amount of data from a sizeable population in a highly economical way; and (5) it is based most often on a questionnaire, whose data is standardised allowing easy comparison (Saunders *et al.*, 2000).

Another important question before choosing a data collection method is "should the research be a 'snapshot' of a particular time or a 'diary' of events over a given period?" (Saunders *et al.*, 2000). The former is called cross-sectional approach while the latter is called longitudinal approach (Saunders *et al.*, 2000). The current research should adopt a cross-sectional study because the main interest of this research is focused on a particular phenomenon – the impact of manufacturing companies' integrated logistics and supply chain management on their performance – at a particular time and especially cross industries.

The final process can be the selection of a data collection method. In the current study, a questionnaire survey was adopted as the main data collection method. Therefore the entire research process can be presented as an 'onion' in the figure 4.1. Regarding the data collection method and questionnaire survey, the following section provides more detailed information and discussion.

Figure 4.1. The Research Process in the Current Study

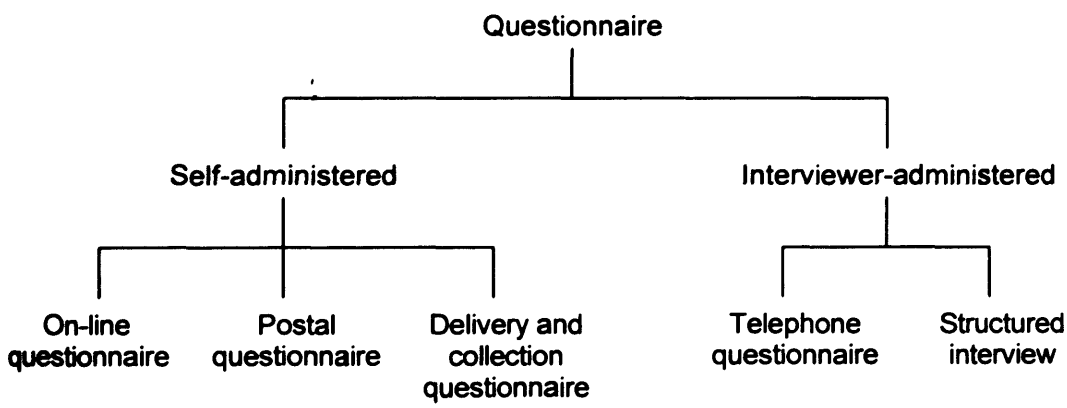


Source: Adapted from Saunders *et al.*, 2000

4.2. Data Collection Method

There are different data collection methods in surveys, for example a structured questionnaire and structured interview and observation. In this study, a structured questionnaire survey was employed as the main method for data collection since a questionnaire can be used to examine and explain relationships between variables, in particular cause-and-effect relationships (Saunders *et al.*, 2000). The 'questionnaire design' differs according to how it is administered, in particular the amount of contact with the potential respondents. 'Self-administered' questionnaires are generally completed by the respondents and include an on-line questionnaire using email or the Internet, postal questionnaire and delivery and collection questionnaire. In contrast, the responses to 'interviewer administered' questionnaires are recorded by the interviewer on the bases of each respondent's answers employing a telephone questionnaire or a structured interview (Saunders *et al.*, 2000).

Figure 4.2. Types of Questionnaire



Source: Saunders *et al.*, 2000

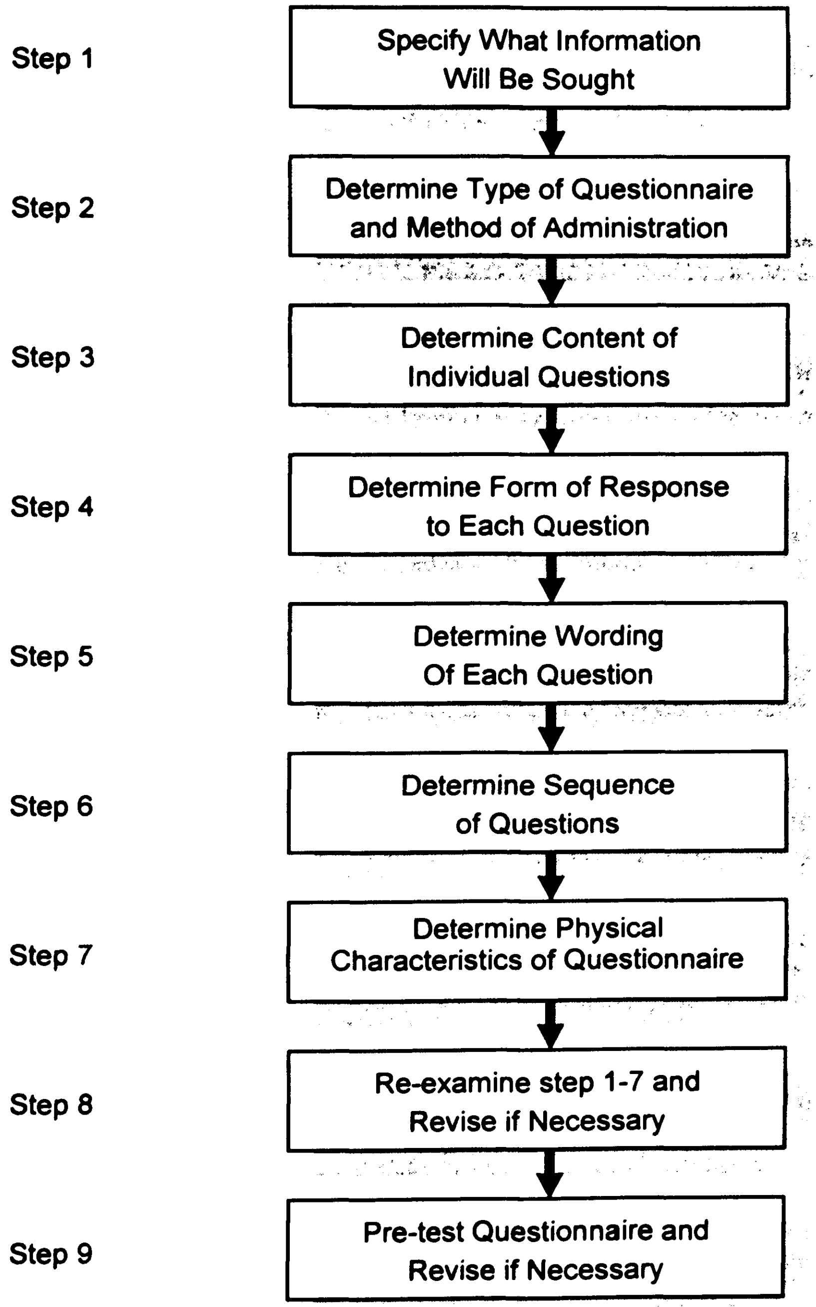
The current study adopts a postal questionnaire survey because it has the following advantages: (1) a postal questionnaire survey is cheaper than interview or delivery and collection questionnaire, which is especially advantageous when a sample is large and geographically widely dispersed; (2) questionnaires can be sent out by post in very large quantities at the same time; (3) postal questionnaires are more convenient for respondents since they can complete a questionnaire when they want and at the speed that they want to go; (4) a postal questionnaire survey allows respondents time to think about questions; and (5) allows contact with otherwise inaccessible respondents especially compared to an on-line questionnaire (Cooper and Emory, 1995; Bryman and Bell, 2003). However, one of the most critical limitations is that postal questionnaire survey frequently result in lower response rates than comparable interview-based studies (Bryman and Bell, 2003). Nevertheless much research has been done to improve survey response. For instance, Bryman and Bell (2003) have suggested the following steps to improve response rates to postal questionnaires: (1) writing a good covering letter explaining the reasons for the research (why it is important and why the recipient has been selected) and providing guarantees of confidentiality; (2) including a stamped addressed envelope or return postage; (3) following up individuals who do not reply at first; (4) making the questionnaire as short as possible; (5) providing clear instructions and an attractive layout; and (6) beginning with questions that are more likely to be of interest to the respondent.

4.3. Questionnaire Design

Questionnaire design is a difficult task and cannot be taught from books (Oppenheim, 1992). Likewise, Churchill and Iacobucci (2002) have stated that "questionnaire design is still an art not a science". However, many authors have suggested some questionnaire design guidelines to help researchers develop a coherent questionnaire. For instance, McDaniel and Gates (1999) have suggested a ten-step questionnaire design process and Baines and Chansarkar (2002) have proposed an eight-stage process for questionnaire development. Churchill and Iacobucci (2002) have suggested nine-step guidelines. Those questionnaire development processes are similar to each other and involve many common factors. Amongst them, the current study employed Churchill and Iacobucci's (2002) process because their guidelines provide a rigorous and concise sequential procedure for the formation of the questionnaire instrument (see Figure 4.3).

Step 1: Specifying Information. The specification of what information will be collected mainly relies on the constructs investigated and selected by the researchers in their conceptual framework and research hypotheses. Therefore the questionnaire was designed to invite responses for six constructs proposed in the research framework of the present study: (1) information capability; (2) strategic planning capability; (3) integrated logistics and supply chain management capability (core competency); (4) logistics performance; (5) global sourcing performance; and (6) sustainable competitive advantage (see Figure 3.3). In addition, the questionnaire involves some questions related to the demographic characteristics of respondents and manufacturing companies.

Figure 4.3. Questionnaire Development Process



Source: Adapted from Churchill and Iacobucci, 2002

Step 2: Determining Types of Questionnaire and Method of Administration. After specifying the information to be sought, it is necessary for the researcher to specify how these questions will be framed and how to administer the questionnaire. In the previous section, it was decided that a structured questionnaire and consequently a postal survey would be the most appropriate data generating method for the current study.

Step 3: Determining Content of Individual Questions. The observation variables and indicators for the six constructs or latent variables were sought and selected earlier in Chapter 3. The following table presents all the multi-dimensional measurements for each construct.

Table 4.2. Measurements for Six Constructs

Category	Construct	Observation variable (Indicator)	
Antecedents for Integrated Logistics and SCM	Information Capability	Information Technology	• Continual investments in IT • Tailored information system for SCM
		Information Contents	• Usefulness of strategy-related information • Usefulness of manufacturing related information • Usefulness of logistics related information
		Information Sharing	• Design of information system for the information sharing between departments • Design of information system for the information sharing with suppliers/customers
	Strategic Planning Capability	Strategic Planning Formality	• A formal planning system for the design of operating system • A formal evaluation system for financial and logistical Performance
		Strategic Planning Process	• A decision making process based on total cost measurement • A continual planning process incorporating feedback • Planning process evaluating environmental constraints, firm resources and organisational goals
		Strategic Planning Sharing	• Participation of all functional staff in strategy development • Integration of logistics strategy with other strategic plans
Integrated Logistics and SCM	Supplier Integration	• Increase of long-term agreements with key suppliers • Sharing of technical resources, R&D costs with key suppliers • Key suppliers' participation in the development and design of new products • Formal evaluation of suppliers' performance • Flexible modification of the order size, volume, composition to key suppliers	
	Internal Integration	• Establishment of cross functional policies and procedures • Adherence to established operational and administrative policies and procedures • Reduction of formal organisational structure • Operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation	

Category	Construct	Observation variable (Indicator)	
Integrated Logistics and SCM (Continued)	Customer Integration		• Discrimination of logistics service strategies for different customers • Utilisation of flexible programmes providing special services for changing customer requirements • Formal measurement of customer satisfaction • Maintenance of a high level of communication with customers
	Inbound/ Outbound Logistics Integration		• Integrated logistical operations under single control • Utilisation of total transportation chain performance measurement • Flexible multimodal transportation management • Coordination of inbound/outbound transportation • Increase of long-term agreements with logistics service providers
Performance	Logistics Performance	Reliability	• Meeting accurately quoted or anticipated delivery dates and quantities on a consistent basis
		Respon-siveness	• Responding promptly to the needs and wants of key customers • Being flexible in terms of accommodating customers' special requests
		Innovativeness	• Notifying customers in advance of delivery delays or product shortages • Utilising just-in-time management
	Global Sourcing Performance	Comparative Advantage	• Achieving lower factor cost
		Access to Technology	• Access to advanced production technologies
		Access to Market	• Penetrating local markets
		Shorter Product Development Time	• Reducing time delays involved in waiting for local suppliers to provide the requisite components
		Reduction of Local Differences	• Reducing local disadvantage/difficulties
	Sustainable Competitive Advantage	Cost	• Lower manufacturing cost
		Quality	• Meeting customer's expectation for manufacturing quality • Meeting customer's expectation for design quality
		Flexibility	• Flexibility in production volume, changeover, modification • Ability to deal with unexpected events
		Innovation	• Product innovation level in the product • Process innovation level in the product
		Competitive Position in Market	• Market share • Sales growth rate compared to competitors • Sales growth rate compared to market growth rate

Source: Author

Step 4: Determining Form of Response. After the content of the individual questions was determined, the researcher should specify the form that responses to these questions would take. In this step, a significant consideration should be whether to ask a question in an open or closed format. With an open question respondents are asked a question and can respond in any way they want. With a closed question respondents are presented with a set of fixed alternatives from which they have to choose a suitable answer. The merit of open questions is that they allow freedom and spontaneity in the answer and the exploration of new areas or ones in which the researcher has limited knowledge. However, the disadvantage of open questions is that they are time-consuming for interviewers to administer and require more effort from respondents. In addition, the collected data have to be coded, which is very costly and slow and may be unreliable (Bryman and Bell, 2003; Oppenheim, 1992). On the contrary, closed questions offer the following advantages to researchers; (1) they require little time and have low costs; (2) closed questions may clarify the meaning of a question for respondents; (3) they are useful for testing specific hypotheses; and (4) closed questions enhance the comparability of answers, making group comparisons easy. However, closed questions have certain disadvantages: (1) there may be the loss of spontaneous responses; (2) it can be difficult to make force-choice answers mutually exclusive; and (3) there may be variation among respondents in the interpretation of forced-choice answer (Bryman and Bell, 2003; Oppenheim, 1992). The main forms of response adopted in this study are closed format using the Likert scales technique. The Likert-type scale is a common response type utilised to draw out opinions and attitudes in social science research (Ryan and Garland, 1999) and has been used in much logistics research. In order to maintain uniformity a seven-point scale was applied to all the items in the questionnaire. For example, to measure integrated logistics and supply chain management capability, respondents were asked to tick one scale from 1 (strongly disagree) to 7 (strongly agree). Table 4.3 illustrates the type of scales adopted in order to measure the variables. In addition, the measurement scales include the 'not available/applicable' option because potential respondents could not have all the knowledge of the entire questions in the questionnaire. In some cases, respondents who are lacking certain knowledge might mark the midpoint of the scale if the scale does not provide a 'not applicable' response option. As a consequence, this will distort measures of central tendency and variance

(Dillon *et al.*, 1990). According to Ryan and Garland (1999), the non-response rate can decrease when 'don't know' or similar response options are provided.

Table 4.3. Measurement Scale

Construct/Variable	Scale Construction
Information Capability Strategic Planning Capability Integrated Logistics and SCM	***Seven point scale***: (1) strongly disagree; (2) disagree; (3) slightly disagree; (4) neutral; (5) slightly agree; (6) agree; (7) strongly agree ***Not available/applicable***
Logistics Performance Global Sourcing Performance Sustainable Competitive Advantage	***Seven point scale***: (1) much worse; (2) worse; (3) slightly worse; (4) no difference; (5) slightly better; (6) better; (7) much better ***Not available/applicable***

Source: Author

Step 5: Determining Wording of Each Question. The phrasing of each question was made at this stage to re-examine understandability. The following guidelines were suggested (Churchill, 1991; Churchill and Iacobucci, 2002; Dillon *et al.*, 1990): (1) using simple language; (2) avoiding ambiguous words and questions; (3) eliminating vague words; (4) using familiar vocabulary for the respondents; and (5) avoiding leading questions, implicit alternatives, implicit assumption, generalisation and estimates, and double-barrelled questions (i.e. questions that have different answers to their subparts).

Step 6: Determining Sequence of Questions. The next step is to put together these questions into a questionnaire. Churchill (1991) has suggested the following as a guideline to the ordering of the questionnaire: (1) beginning with general, simple and interesting questions (e.g. company characteristics); (2) funnelling the scope of subsequent questions (i.e. the questionnaire should begin with broad questions before gradually narrowing down to a more specific scope); (3) carefully designing the branching questions (e.g. global sourcing performance indexes); and (4) placing difficult or sensitive questions at the end of the questionnaire (e.g. performance and competitive advantage indexes).

Step 7: Determining Physical Characteristics of Questionnaire. The physical characteristics of the questionnaire can affect not only the accuracy of the replies obtained, but also how respondents react to it and the ease with which the replies can be processed. In determining the physical format of the questionnaire, the researcher wants to do those things that help the respondents accept the questionnaire (e.g. good cover letter, sponsorship, letter of recommendation) and that facilitate handling and control by the researcher (e.g. questionnaire size, letter size, numbering) (Churchill and Iacobucci, 2002).

Step 8: Re-examining the previous steps. This step involves reassessment of all the decisions which were made through the previous steps. Each question should be checked to ensure that the question is not ambiguous or confusing, potentially offensive to the respondent, leading or bias inducing, and also that it is easy to answer. When a potential problem is found out, the question should be revised (Churchill and Iacobucci, 2002).

Step 9: Pre-testing Questionnaire. Pre-testing is essential to construct a good questionnaire as it provides a real test before the formal survey and helps to establish content validity (Churchill, 1991; Dillon *et al.*, 1990; Saunders *et al.*, 2000). Firstly, the initial version of the questionnaire was examined by Prof. Marlow and Dr. Beresford (the author's research supervisors) in order to make the questions more clearly understandable to respondents and determine the overall layout and sequence of the questionnaire. Through the review, several adjustments of the wording for some questions and measurement scale and the overall sequence of the questionnaire were made. In addition, a job scale was proposed by Prof. Marlow to compare respondents' ranks and allow for cross-comparison despite their different job grade systems. After that the English version of the survey instrument was pre-tested by six managers (or directors) in charge of logistics and SCM, production, marketing and sales of Korean automobile and electronics companies. These respondents are working either in U.K. branches or headquarters in Korea and among them one British logistics manager was included. They were asked to comment on the terms and wording, to check the time to complete the entire questionnaire and to report any non-available or non-applicable question and the reasons. Through the pre-test, respondents reported that there was no 'not understandable question' and 'not available/applicable question'. The average time to complete the questionnaire was 15 to 25 minutes, which was considered reasonable since it was anticipated that the Korean version of the questionnaire might be more easily and rapidly answered by Korean managers in the real survey. One respondent recommended expanding the grade of total sales value of the companies since many international firms implementing global sourcing activities had recorded a much higher turn over. Another point discovered through the pre-test is that two respondents were confused with the branching questions regarding global sourcing performance indexes. Bearing these problems in mind, the sales value grade and the sequence of performance indexes was adjusted. After those corrections, the questionnaire was translated into a Korean version and pre-tested again by two logistics managers from the automobile and electronics companies and two experts in the logistics companies, the logistics subsidiary of the automobile company. They reported that the average answering time was 10 to 15 minutes and every question was understandable. The final versions of the questionnaire in English and Korean are presented in Appendices A and B respectively.

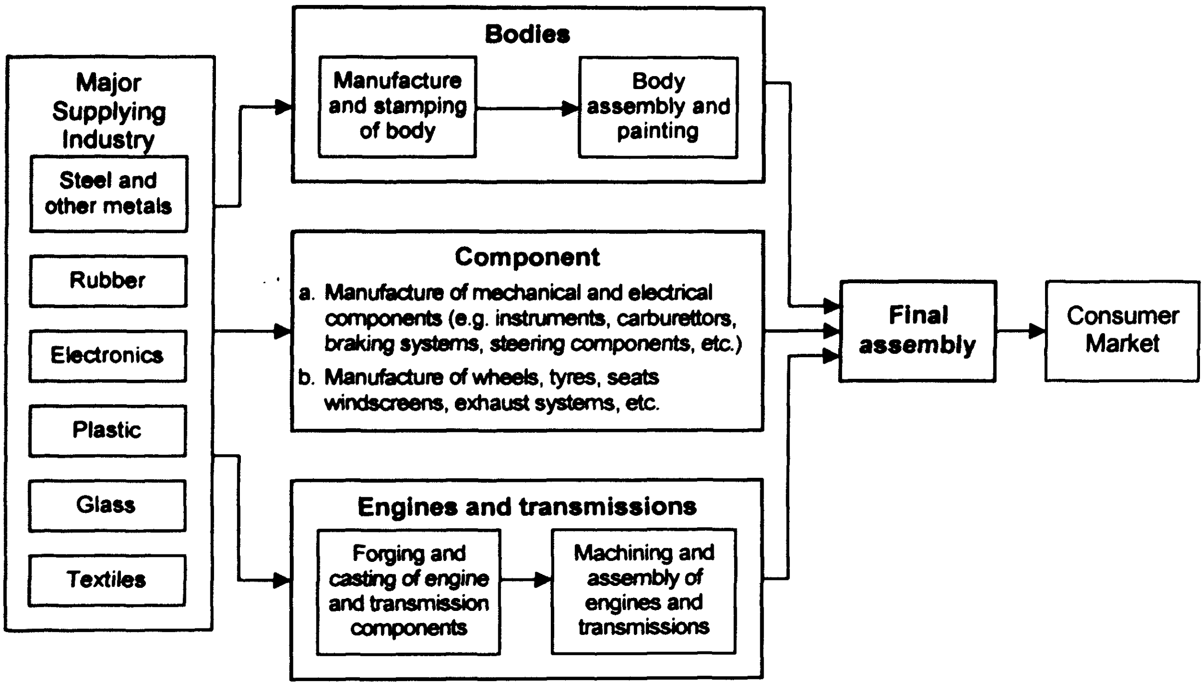
4.4. Sample Industry and Sampling Design

The first part of this section introduces the automobile and parts industry and electronics industry. Specifically, the general production or supply chains of these industries are illustrated and the trade records of Korean automobile and electronics commodities are presented. In the second part, the sampling design process is explained.

4.4.1. Sample Industry

The current study selected the Korean automobile and parts industry and electronics industry as sample industries for the empirical research considering their following characteristics. Firstly, the production or supply chains of both industries include numerous components and the manufacturing firms have been increasingly organising their activities on internationally integrated lines. Therefore, these components and products are commonly purchased from overseas suppliers (Dicken, 1998, 2003; Frear *et al.*, 1992; Min and Galle, 1991). Di cken (1998, 2003) has illustrated the automobile production chain as shown in Figure 4.4. The automobile industry is essentially an assembly industry which means it brings together an immense number and variety of components, many of which are manufactured by independent firms in other industries. There are three main processes prior to final assembly: the manufacture of bodies, of components and of engines and transmissions. "The nature of the industry offers the possibility of organisational and geographical separation of the individual processes" (Dicken, 1998).

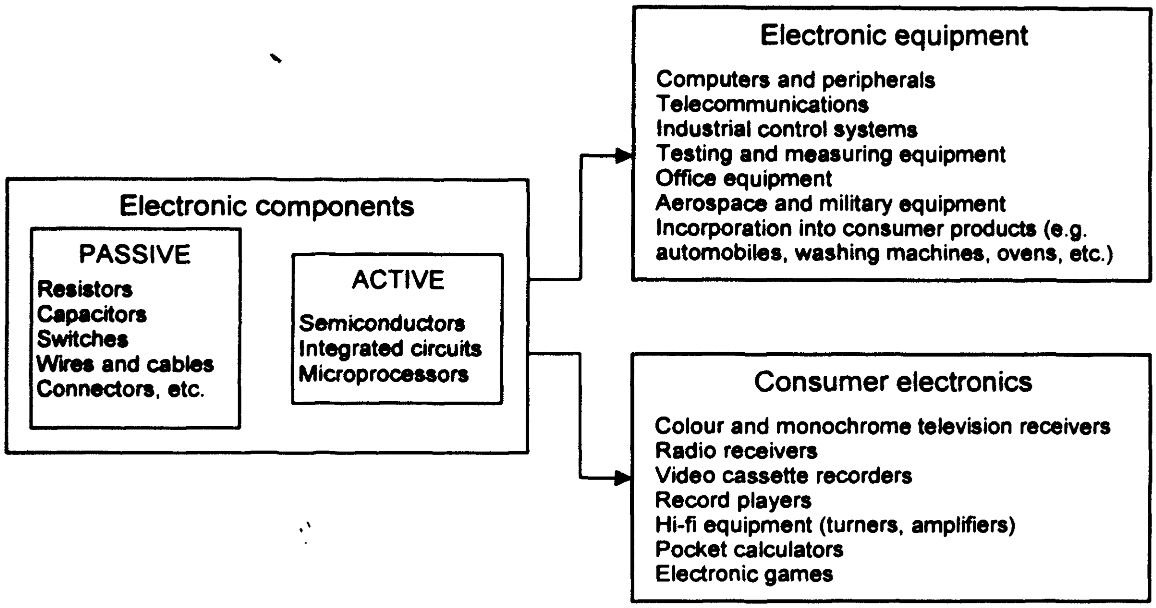
Figure 4.4. The Automobile Production Chain



Source: Dicken, 1998

Dicken (1998) has presented the electronics production chain as shown in Figure 4.5. The core of the electronics industry is the components sector and its most important elements are the active components, based on the semiconductor, which control the flow of electrical current. Semiconductors can be classified into two main categories: memory chips which contain pre-programmed information and microprocessors which are 'computers on a chip'. Semiconductors and related components are employed in various applications which can be divided into two categories: electronic equipment and consumer electronics. Within the electronic equipment sector there is much overlap, for instance, the computer is universally involved in the other equipment sectors. In contrast, consumer electronics is usually defined in terms of 'complete' electronic products such as radios, televisions, video and audio recorders, etc.

Figure 4.5. The Electronics Production Chain



Source: Dicken, 1998

Secondly, the two sample industries mainly produce standardised commodities, which are virtually similar regardless of manufacturers worldwide, which means they compete with multinational competitors (Korbin, 1991). Therefore, an effective and unique supply chain management could be a critical determinant of a firm's competitiveness. For instance, Corswant and Fredriksson (2002) empirically found that both car manufacturers and part suppliers continue to increase supplier involvement in product development and the share of inbound JIT deliveries.

Thirdly, both industries are representative Korean industries and have increased their market shares in the world market. As shown in Table 4.4, electronics commodities such as semiconductor, wireless communication apparatus, computer and video apparatus were ranked first, third, fourth, and eighth respectively of the Korean exports in 2003. In addition, automobiles and automobile parts were ranked second and tenth respectively. Similarly, semiconductors, computer and electronic application apparatus are ranked second, fourth and fifth respectively among Korean imports in 2003.

Table 4.4. Top 10 Export Commodities of Korea

	2000 (Million U.S. dollars)		2003 (Million U.S. dollars)	
1	Semiconductor	26,006(15.1)	Semiconductor	19,535(10.1)
2	Computer	14,687(8.5)	Automobile	19,119(9.9)
3	Automobile	13,221(7.7)	Wireless communication Apparatus	18,697(9.6)
4	Petroleum Products	9,055(5.3)	Computer	14,977(7.7)
5	Vessel	8,420(4.9)	Vessel	11,334(5.8)
6	Wireless communication Apparatus	7,882(4.6)	Petroleum Products	6,623(3.4)
7	Synthetic Resin	5,041(2.9)	Synthetic Resin	6,260(3.2)
8	Steel Flate-rolled Products	4,828(2.8)	Steel Flate-rolled Products	5,841(3.0)
9	Garments	4,652(2.7)	Video Apparatus	5,618(2.9)
10	Video Apparatus	3,667(2.1)	Parts of Automobile	4,227(2.2)
	Top 10 total	97,459 (56.6)	Top 10 total	112,231(57.9)
	Total	172,268(100.0)	Total	193,817(100.0)

Note: Figures in ( ) are the component ratios

Source: Korea International Trade Association, 2005

Table 4.5. Top 10 Import Commodities of Korea

	2000 (Million U.S. dollars)		2003 (Million U.S. dollars)	
1	Crude Oil	25,216(15.7)	Crude Oil	23,082(12.9)
2	Semiconductor	19,923(12.4)	Semiconductor	21,328(11.9)
3	Computer	7,890(4.9)	Petroleum Products	5,987(3.3)
4	Petroleum Products	4,911(3.1)	Computer	5,672(3.2)
5	Natural Gas	3,882(2.4)	Natural Gas	5,082(2.8)
6	Equipments for Semiconductor	3,748(2.3)	Steel Flate-rolled Products	3,320(1.9)
7	Gold, Silver or Platinum	2,698(1.7)	Gold, Silver or Platinum	3,266(1.8)
8	Cable communication Apparatus	2,544(1.6)	Equipments for Semiconductor	3,003(1.7)
9	Steel Flate-rolled Products	2,463(1.5)	Electronic Application Apparatus	2,798(1.6)
10	Fine Chemical Material	2,317(1.4)	Fine Chemical Material	2,704(1.5)
	Top 10 total	75,592 (47.1)	Top 10 total	76,242(42.6)
	Total	160,481(100.0)	Total	178,827(100.0)

Note: Figures in ( ) are the component ratios

Source: Korea International Trade Association, 2005

The following tables show the overall export and import trends of selected commodities from Korean industries

Table 4.6. Exports by Selected Commodities of Korea

Million U.S. dollars

Year	1990	1995	2000	2003
Primary Products	3,199	6,067	4,776	5,291
Chemical Products	3,136	10,091	15,734	18,684
Petrochemicals	1,291	5,987	9,666	11,917
Precision Chemistry	805	1,886	2,731	3,303
Ceramics	350	450	832	830
Articles of Plastic, Rubber or Leather	2,035	4,556	5,128	5,565
Articles of Plastic	726	1,471	2,120	2,555
Articles of Rubber	986	1,514	1,630	1,967
Tire	733	1,143	1,291	1,573
Textiles	14,766	18,656	18,783	15,253
Raw Textile Materials	325	996	859	782
Yarn	878	1,353	1,535	1,564
Fabrics	4,675	10,195	10,263	8,307
Textile Products	8,889	6,111	6,126	4,601
Garments	7,600	4,714	4,652	3,350
Living Ware	7,663	4,371	3,314	2,512
Footwear	4,307	1,506	799	509
Musical Instruments	248	364	290	226
Toys & Dolls	727	188	206	156
Iron & Metal Products	6,491	10,518	11,263	12,737
Iron & Steel Products	4,327	7,482	7,861	9,282
Iron Steel Sheet	2,446	3,791	4,828	5,841
Iron Tubes	476	508	533	551
Nonferrous Metal Products	568	1,449	2,353	2,801
Containers	1,025	822	240	28
Electrics & Electronics	18,001	44,602	68,932	77,438
Industrial Electronic Articles	3,959	12,252	24,190	35,862
Wire Telecomm Equipment	438	793	677	715
Portable Cellular Phone	-	483	5,509	13,355
Computer	2,549	4,743	14,687	14,977
Parts of Electronics	5,949	20,805	32,229	26,189
Semiconductor	4,541	17,695	26,006	19,535
Electrontube	826	1,730	3,574	2,743
Home Electronics	7,346	10,041	10,136	12,610
Colour TV sets	1,638	2,536	1,759	3,587
VCR	1,188	1,614	1,002	925
Audio Equipment	2,480	2,720	2,671	2,108
Heavy Electric Equipment	586	1,000	1,614	1,835
Electric Wire	162	504	763	942
Machinery	8,436	23,200	34,079	48,047
General Machine	585	1,707	2,509	3,314
Special Machine	1,002	3,026	3,387	5,023
Precision Machine	238	353	694	661
Mechanical Elements & Tools	492	1,145	1,650	2,194
Transporter	5,990	16,367	24,956	35,619
Automobile	1,971	8,439	13,221	19,119
Vessel, Ocean Structure	2,829	5,669	8,420	11,334
Other Products	615	591	980	1,599

Source: Korea International Trade Association, 2005

Table 4.7. Imports by Selected Commodities of Korea

Million U.S. dollars

Year	1990	1995	2000	2003
Agro, Forestry & Fishery	**7,360**	**12,319**	**10,783**	**13,146**
Mineral Products	**12,885**	**24,240**	**43,225**	**45,046**
Non metallic Minerals	436	633	538	838
Metallic Minerals	1,527	4,526	4,798	5,901
Mineral Fuels	10,908	19,053	37,888	38,306
Coal	1,288	2,081	2,186	2,552
Crude Oil	6,386	10,809	25,216	23,082
Chemical Products	**9,752**	**16,930**	**16,749**	**19,589**
Petrochemicals	3,686	5,581	5,154	5,821
Precision Chemistry	3,133	5,968	6,467	8,004
Articles of Plastic,Rubber or Leather	2,686	3,467	2,926	3,469
Textiles	**2,316**	**5,214**	**4,788**	**5,897**
Raw Textile Materials	206	218	161	164
Yarn	625	1,586	1,525	1,344
Fabrics	1,162	2,047	1,517	1,350
Textile Products	324	1,363	1,585	3,039
Garments	138	1,041	1,241	2,457
Iron & Metal Products	**6,712**	**13,652**	**12,260**	**15,275**
Iron & Steel Products	4,169	8,106	7,004	9,402
Iron Tubes	258	479	322	261
Nonferrous Metal Products	2,417	5,317	5,037	5,553
Electrics & Electronics	**12,225**	**27,278**	**46,646**	**48,713**
Industrial Electronic Articles	4,226	9,625	15,629	14,419
Wire Telecomm Equipment	229	584	2,544	1,232
Computer	1,719	3,377	7,890	5,672
Parts of Electronics	5,520	12,073	25,168	26,532
Semiconductor	4,222	9,048	19,923	21,328
Home Electronics	1,120	2,392	2,352	3,497
Video Equipment	236	436	408	1,036
Audio Equipment	554	1,150	1,249	1,306
Heavy Electric Equipment	1,275	2,922	2,737	3,102
Machinery	**14,742**	**29,445**	**20,634**	**22,767**
General Machine	2,479	6,066	3,858	4,592
Prime Mover	468	1,587	885	1,009
Special Machine	5,362	7,780	4,108	4,538
Precision Machine	375	952	4,266	3,703
Optical Instruments	329	1,207	1,029	1,094
Equipment for semiconductor Manufacturing	45	407	3,748	3,003
Mechanical Elements & Tools	1,481	2,627	2,173	2,486
Transporter	3,747	7,988	4,081	5,851
Automobile	400	652	319	1,214
Vessel, Ocean Structure	882	1,920	635	987
Aircrafts	1,624	3,226	1,188	985
Living Ware	**618**	**1,698**	**1,631**	**2,543**
Foot wears	91	352	274	516

Source: Korea International Trade Association, 2005

Concerning the market shares of Korean automobile and electronics industries, the following table shows that the world market shares of selected commodities were around 4% in the automobile industry and 3.4% to 7.4% in the electronics industry in 2002.[1]

Table 4.8. Korea's Share in Selected Commodities of the World Exports

Million U.S. dollars

	World (A)		Korea (B)		Share (B/A, %)	
Year	2000	2001	2000	2001	2000	2001
Computer Equip.	172,498	161,684	9,291	7,485	5.4	4.6
TV Sets	26,684	27,170	1,582	1,546	5.9	5.7
Radio Receivers	15,448	12,935	565	441	3.7	3.4
Sound/TV Recorders	24,533	23,354	1,716	1,684	7.0	7.2
Telecomm. Equip.	200,829	182,747	10,500	12,273	5.2	6.7
Transistor	262,534	198,768	24,688	14,742	9.4	7.4
Passenger Cars	298,941	303,356	11,896	12,029	4.0	4.0
Motor Vehicle Parts	139,217	140,668	1,792	1,906	1.3	1.4

Source: Korea International Trade Association, UN, International Trade Statistics Yearbook

4.4.2. Sampling Design

As explained above, Korean automobile and electronics industries samples were employed for the empirical research. The hypotheses were tested on 1,002 automobile and parts firms and 1,213 electronics companies and in Korea selected from company lists provided by the Korea Chamber of Commerce and Industr y, Korea Auto Industries Cooperation Association, Korea Automobile Manufacturers Association, Korea Electrical Manufacturers Association and Electronic Industries Association of Korea. These firms were selected from a total of 15,230 firms (11,550 electronics companies; 3,680 automobile and parts companies). The main selection criterion is whether a certain firm is a share-listed company on the Korean stock market or KOSDAQ market. In addition, some family firms employing more than 100 persons were also involved to increase the sample size.

In accordance with the suggestions proposed in the second section of this chapter, the six-page survey instrument (Korean version shown in Appendix B) was

[1] According to Dicken (2003), the world share of Korean automobile production was 6% in 2000.

mailed to respondents with a cover letter explaining the aim and purpose of the present study and assuring respondents of the confidentiality of their responses and anonymity. In addition, two letters of recommendation signed by Prof. Peter B. Marlow, the author's first supervisor and the head of the Logistics and Operations Management Section in Cardiff Business School (see Appendix C) and signed by Dr. Jung-Ook Lee, the President of the Korea Maritime Institute in Seoul, where the researcher has held a research fellowship (see Appendix D) were sent together to motivate potential respondents' participation in the research and confirm the confidentiality. A postage paid return envelope was also attached with each questionnaire. In Korea, Logistics/SCM activities are conducted by sales and marketing departments in many cases. Therefore, the questionnaires were mainly sent to the sales and marketing directors or managers. However, when the organisational system was available through a certain firm's Internet homepage, the questionnaire was sent to the specific person who was in charge of Logistics/SCM strategy and implementation.

4.5. Validity and Reliability

The validation of the measures could be the final step of the measure development. This term is used to mean demonstration of the measures' validity and reliability (Olsen, 2002). Validity could be understood as "whether what we tried to measure was actually measured" (McDaniel and Gates, 1999), while reliability means "the internal consistency of the items that are used to measure a latent construct" (Dunn *et al.*, 1994). This section elaborates the concepts and sub-dimensions of validity and reliability in detail.

4.5.1. Validity

Steenkamp and van Trijp (1991) have argued that the validity of constructs is a fundamental condition for theory development. Validity is defined as "the extent to which differences in scores on a measure reflect true difference among individuals on the characteristic we seek to measure, rather than constant or random errors" (Selltiz *et al.* 1976). Sekaran (2000) has described validity as the ability of a scale to measure the concept that it was set out to measure. Validity is specifically concerned with systematic errors rather than random errors, which was the main source of reliability evaluation. According to Kline (1998), measures that are relatively free from both random and systematic errors may be called valid. Validity is composed of four sub-dimensions, namely content validity, unidimensionality, convergent validity and discriminant validity (Mentzer and Flint, 1997; Steenkamp and van Trijp, 1991).

1) Content Validity

Content validity is concerned with the relevance and representative nature of the measures in capturing all aspects of the phenomenon investigated in research. Content validity exists when the domain of the characteristics is adequately reflected by the scale items (Churchill, 1992; Dunn *et al.*, 1994). Content validity is a precondition towards establishing the correspondence between theoretical constructs and measurement items (Mentzer and Flint, 1997). However, there is no rigorous way to test content validity (Dunn *et al.*, 1994) because it mainly depends on a subjective judgment of the researcher (Churchill, 1992; Garver and Mentzer, 1999). Nevertheless, Churchill (1979) has asserted that content validity should be satisfied by specifying the construct domain, generating an exhaustive list of items and purifying the resulting construct. Likewise, Ahire *et al.* (1996) have stated that if the constructs are created from a comprehensive analysis of the relevant literature, content validity can be certified.

2) Unidimensionality

Unidimensionality means the existence of one construct underlying a set of items (Steenkamp and van Trijp, 1991). Some traditional techniques such as Cronbach's Alpha, item-total correlations, and exploratory factor analysis (EFA) have been adopted to evaluate unidimensionality (Koufteros, 1999; Anderson *et al.*, 1987). However, many authors have argued that these techniques can measure reliability, but can not truly assess unidimensionality (Gerbing and Anderson, 1988; O'Leary-Kelly and Vokurka, 1998; Segars, 1997). For this matter, some researchers (Anderson *et al.*, 1987; Gerbing and Anderson, 1988; Segars, 1997) have proposed a confirmatory factor analysis (CFA) of a multiple-indicator measurement model to directly assess unidimensionality.

3) Convergent Validity

Convergent validity may be understood as the extent to which the latent variable correlates to items designed to measure that same latent variable (Garver and Mentzer, 1999). In other words, convergent validity means that a measure should have relatively high correlations with other measures of the same common factor. Convergent validity can be assessed from a measurement model (i.e. confirmatory factor analysis) by determining whether each indicator's estimated coefficient on its posited underlying construct is statistically significant (Anderson *et al.*, 1987; Anderson and Gerbing, 1988; Koufteros, 1999; O'Leary-Kelly and Vokurka, 1998; Segars, 1997).

4) Discriminant Validity

Discriminant validity refers to "the extent to which the items representing a latent variable discriminate that construct from other items representing other latent variables" (Garver and Mentzer, 1999). In other words, discriminant validity means that a measure should have rather lower correlations with measures of different factors (Rigdon, 1998). Discriminant validity can be assessed by examining the inter-correlations among the constructs that have been generated and purified by exploratory factor analysis and confirmatory factor analysis. There is no definite limit to specify what high correlations are; however, Kline (1998) has suggested a cut-off point of 0.85. Generally low to moderate correlations between factors indicate the existence of discriminant validity.

4.5.2. Reliability

Reliability is concerned with the question of whether the results of a study are repeatable (Bryman and Bell, 2003). Reliable instruments provide stable measures at different times under different conditions (McDaniel and Gates, 1999). According to McDaniel and Gates (1999), a key question regarding reliability is: "If we measure some phenomenon over and over again with the same measurement device, will we get the same or highly similar results?" If the answer is approved, the device is reliable. Reliability can be examined by many statistical methods such as test-retest approach, split-half technique and Cronbach's Alpha (Bagozzi, 1984; McDaniel and Gates, 1999). Amongst them, the test-retest approach involves a high cost and includes the serious problem that respondents could remember their first answers. Meanwhile, the split-half technique has the problem that the correlation results of the two sets greatly depend on how the researcher splits the items. On the contrary, Cronbach's coefficient alpha is the most commonly used technique for reliability evaluation (Koufteros, 1999). In general, scales achieving an alpha score over 0.7 are considered reliable (Gerbing and Anderson, 1988). However, Cronbach's alpha has several disadvantages. For example, it is inflated on a measuring scale that has a large number of items and assumes all the measured items have equal reliabilities (Gerbing and Anderson, 1988). Concerning these limitations, CFA approaches provide more rigorous tests, namely, the composite reliability of construct and variance extracted measure (Fornell and Larker, 1981; Hair *et al.*, 1998; Garver and Mentzer, 1999). The construct reliability is calculated as

$$\textit{Construct reliability} = \frac{(\sum \textit{standardised loading})^2}{(\sum \textit{standardised loading})^2 + \sum \varepsilon_j}$$

where the standardised loadings are obtained directly from the programme output and ε_j is the measurement error for each indicator which is 1.0 minus the reliability of the indicator, which is the square of the indicator's standardised loading. The acceptable construct reliability value is 0.70 (Hair *et al.*, 1998; Garver and Mentzer, 1999).

A complementary measure of the construct reliability value is the variance extracted measure, which reflects the overall amount of variance in the indicators accounted for by the latent constructs. Higher variance extracted values occur when the indicators are truly representative of the latent construct. The variance extracted measure is calculated as

$$\textit{Variance extracted} = \frac{\sum \textit{standardised loading}^2}{\sum \textit{standardised loading}^2 + \sum \varepsilon_j}$$

The acceptable value for the variance extraction is 0.5 (Garver and Mentzer, 1999; Hair *et al.*, 1998; Koufteros, 1999).

4.6. Data Analysis Method/Technique

The empirical research of the current study aims to examine the inter-relationships of multiple independent and dependent variables relating integrated logistics and supply chain management capabilities and various performance indexes.

Several possible techniques exist to assist with such an analysis. For instance both Analytical Hierarchy Process (AHP) and Multi-Attribute Utility Technique (MAUT) are considered. The former AHP (Saaty, 1977, 1980, 1994, 1996) is a multi-criteria decision-making technique which allows resolution of complex problems characterised by the existence of multiple actors, scenarios, and tangible and intangible criteria (Aguarón *et al.*, 2000). This is achieved through the construction of a ratio scale for the priorities related to the alternatives of the problem, by means of hierarchical modelling and pairwise comparisons (Aguarón *et al.*, 2000). The AHP technique includes three steps: (1) structuring a hierarchy; (2) making pairwise comparisons to determining priorities; and (3) synthesising the priorities into composite measures of the decision alternatives (Wedley *et al.*, 2001 cited in Song and Yeo, 2004). Compared with other multi-criteria decision-making (MCDM) models, the AHP is able to provide a more systematic structuring of any complex multi-player, multidimensional problem. However, the AHP has a major disadvantage: researchers have to decompose all the main criteria in a vertical direction to ensure the factors in each horizontal sub-criterion have similar qualities to make comparisons, and the number of factors to be compared in each hierarchy is constrained to 7±2 (Lim, 2005). The latter MAUT is a methodology which can be adopted as a tool for measuring objectivity in a subjective area (Fellows *et al.*, 1983); the use of MAUT can minimize the subjective elements and can increase transparency (Shen *et al.*, 1998) (cited in Cheung and Suen, 2002). In their empirical study, Cheung and Suen (2002) proposed four steps to utilise MAUT technique: (1) determining selection criteria; (2) determining dispute resolution strategies; (3) collecting utility factors; and (4) collecting of selection criteria weightings. However, the MAUT technique has a potential weakness in its application. For instance, Yang (2001) has stated that in order to evaluate different qualitative attributes, different sets of assessment grades need to be defined; moreover some attributes are quantitative and may be evaluated using certain or random numbers, which increase the complexity in attribute aggregation.

For this sort of empirical research, structural equation modelling (hereafter SEM) has been strongly recommended as the most effective analytical strategy by many authors (Byrne, 1998, 2001; Hair *et al.*, 1998; Tabachnick and Fidell, 2001), because SEM can easily evaluate validity and reliability of the measurement (Gerbing and Anderson, 1988) and provides a flexible and powerful tool to assess the hypothesised relationships simultaneously (Hair *et al.*, 1998; Rigdon, 1998). For these reasons, SEM was employed as the main data analysis technique applied in empirical analysis.

4.6.1. Basic Concepts of SEM

The term SEM does not refer to a single statistical technique; rather it is associated with a family of related procedures. SEM encompasses many different terms, such as covariance structure analysis, latent variable analysis (Dunn *et al.*, 1994), causal modelling (Hulland *et al.*, 1996), linear structural relationship and LISREL (the name of one of the most popular software packages).

SEM techniques significantly differ from other multivariate analysis such as multiple regression and exploratory factor analysis in various aspects (Bollen and Long, 1993; Hair *et al.*, 1998). Firstly, SEM can estimate a series of separate, but interdependent, multiple regression equations simultaneously (Hair *et al.*, 1998). In contrast, multiple regression or factor analysis can examine only a single relationship at a time. Even though some statistical techniques such as multivariate analysis of variance (MANOVA) and canonical correlation analysis can provide the estimation of multiple dependent variables, they calculate only a single relationship between the dependent and independent variables at any one time (Hair *et al.*, 1998). Secondly, SEM is able to take account of measurement error including both unreliability and random error in order to avoid bias (Rigdon, 1998). In addition, SEM is considered a more powerful method than other multiple methods because it can effectively deal with multicollinearity (Rigdon, 1998).

As explained in Chapter 3, there are two typical classifications of variables in the SEM system, namely latent and observed variables. Latent variables may include exogenous and endogenous variables. Exogenous latent variables (i.e. independent variables) cause fluctuations in the value of other latent variables in the model, while endogenous latent variables (i.e. dependent variables) are influenced by other variables within the model either directly or indirectly (Bollen, 1989; Byrne, 2001). For a general form of SEM, Appendix E provides a graphical example and related explanation.

SEM is composed of two components, namely, the measurement model and the structural model (Garver and Mentzer, 1999; Hair *et al.*, 1998). The measurement model specifies the relationships between the observed variables and the latent (i.e. unobserved) variables, while the structural model specifies the hypothesised 'causal' relationships among the latent variables (Byrne, 2001; Kline, 1998; Koufteros, 1999; Maruyama, 1998). Kline (1998) has stated that "the core of the SEM technique can be conceived as a fusion of path analysis, confirmatory factor analysis and the evaluation of hybrid models which have features of both of these analyses procedures".

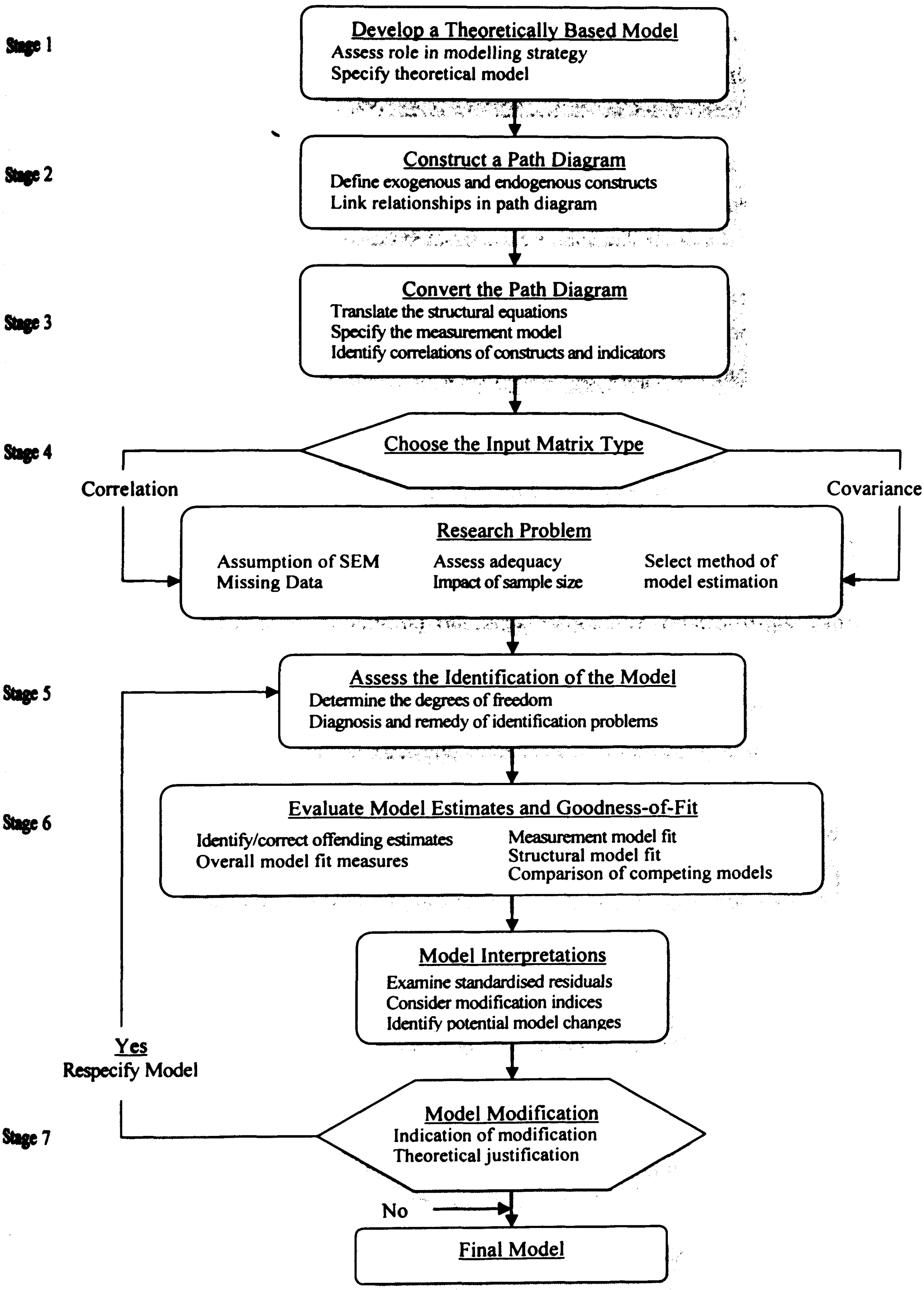
4.6.2. Important Issues Related to SEM Techniques

There are two critical issues concerning SEM analysis: sample size considerations and the choice of a one-step or two-step approach. Firstly, sample size is concerned with whether it is likely to be sufficient to execute the model with the given number of parameters to be estimated (Baumgartner and Homburg, 1996). Sample size is very critical in SEM analysis because many measure indexes are either directly or indirectly related to sample size, such as significance testing of parameter estimates, model misspecification, model complexity, estimation procedure (Hair *et al.*, 1998). However, there is no correct or absolute sample size rule; instead it can simply be categorized as small (less than 100 samples), medium (between 100 and 200 samples) and large (more than 200 samples). For this matter, some authors (Hair *et al.*, 1998; Kelloway, 1998; Ullman, 1996) have suggested that 200 samples are the critical size. Secondly, researchers have debated which of the one-step or two-step approach is more appropriate for the application of SEM. The two-step approach firstly assesses the validity of the measurement model. Once the measurement model is validated, the researcher proceeds to the second step, estimating the structural model between latent variables (Anderson and Gerbing, 1988; Garver and Mentzer, 1999). On the contrary, the one-step approach estimates both measurement and structural models simultaneously (Hair *et al.*, 1998). Although the one-step approach is considered appropriate when the model possesses a strong theoretical rationale and the measures used in the study are highly reliable (Hair *et al.*, 1998), the majority of SEM researchers prefer the two-step approach (Anderson and Gerbing, 1992; Koufteros, 1999; Schumacker and Lomax, 1996) since it is difficult to achieve a good model fit in a single step (Hulland *et al.*, 1996). Consistent with the view of the majority of authors, the current study employed the two-step approach.

4.6.3. SEM Procedural Steps

In order to ensure that the measurement and the structural model are correctly specified and the results are valid, many authors have proposed several stages or steps in the SEM process. For instance, Bollen and Long (1993) have suggested a five-stage process and Kline (1998) has proposed a six-step procedure whereas Hair *et al.* (1998) have suggested a seven-step process. In the current study, Hair *et al.*'s (1998) seven-step structure will be employed to guide the SEM analysis process because their process is elaborately structured and comprehensive. The overall procedure is presented in Figure 4.6.

Figure 4.6. A Seven-Stage Process for SEM



Source: Hair *et al.*, 1998

Step 1: Developing a Theoretically Based Model. SEM is based on causal relationships, in which a change in one variable is assumed to result in a change in another variable. These causal relationships can possibly be made if the relationships are based on a theoretical rationale. However it should be noted that SEM techniques cannot provide a means of 'proving' causation without having any underlying theoretical perspective. The most important error in developing theoretically based models is the omission of key predictive variables, a problem known as 'specification error'. However, the desire to include all variables must be balanced against practical limitations: In general, interpretation of the results becomes difficult as the number of construct becomes large. Therefore, the researcher should recognize the benefits of using a concise number of theoretical models. The empirical models of the current study are fully based on theoretical foundations and involve six constructs carefully selected through critical literature review.

Step 2: Constructing a Path Diagram. A path diagram allows the researcher to present not only the predictive relationships among constructs (i.e. the dependent – independent variable relationships) but also associative relationships (correlations) amongst constructs and even indicators. A straight arrow indicates a direct causal relationship from one construct to another. A curved arrow between constructs indicates simply a correlation between constructs. In addition, a straight arrow with two heads indicates a nonrecursive, or reciprocal, relationship between constructs. Two assumptions underlie path diagrams: (1) all causal relationships are indicated and theory is the basis for inclusion or omission of any relationship; (2) the causal relationships are assumed to be linear.

Step 3: Converting the Path Diagram into a Set of Structural and Measurement Models. After developing the theoretical model and portraying it in a path diagram, the next step is specifying the model in more formal terms. Model specification means that the causal relationships of the researcher's hypothesis must be expressed in the form of a series of equations. These equations define the model's parameters, which correspond to the relationships among observed or latent variables. It should be noted that AMOS (the computer software package used for the current study) can automatically translate the figure symbols expressed in the path diagram into a series of equations.

As briefly explained above, the general SEM model can be decomposed into two sub-models: a measurement model and a structural model. The measurement model defines relations between the observed and unobserved variables. In other words, it provides the link between scores on a measuring instrument (i.e. the observed variables) and the underlying constructs they are designed to measure (i.e. the latent variables). "The oldest and best known statistical procedure for investigating relations between sets of observed and latent variables is factor analysis" (Byrne, 2001). According to one explanation, in using this approach to data analyses, the researcher should examine the co-variation amongst a set of observed variables in order to obtain information on their underlying latent constructs. There are two types of factor analyses: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Byrne (2001) has clarified the differences between those two factor analyses as follows. Firstly, EFA is designed for the situation where connections between the observed and latent variables are unknown or uncertain. Therefore, the analysis proceeds in an exploratory mode to determine how and to what extent the observed variables are related to their underlying factors. In general, the researcher wishes to identify the minimal number of factors that underlie co-variation amongst the observed measures. In contrast to EFA, confirmatory factor analysis can be employed when the researcher has some knowledge of the latent variable structure. Based on theoretical knowledge, empirical research, or both, the researcher postulates relations between the observed variables and the underlying factors a priori and then tests this hypothesized structure statistically. In summary the factor-analytic model (EFA or CFA) focuses on how, and the extent to which, the observed variables are linked to their underlying latent constructs. More specifically, it is concerned with the extent to which the observed variables are generated by the underlying latent variables, and thus strengths of the regression paths from the factors to the observed variables (namely, factor loadings) are of major interest. Meanwhile, the structural model defines relations amongst the latent construct. The researcher can hypothesize the influence of one latent construct on another in the modelling of causal direction. Therefore, it specifies the manner by which particular latent construct directly or indirectly influence the changes in the values of certain other latent construct within the hypothesised model.

Step 4: Choosing the Input Matrix Type and Estimating the Proposed Mode. SEM differs from other multivariate techniques in that it uses only the variance-covariance or correlation matrix as its input data because its focus is not on individual observations but on the pattern of relationships across respondents. Thus, the researcher must perform all of the diagnostic tests on the data before they are used in the estimation procedure. The researcher should identify any outliers in the data before they are converted to matrix form. These diagnostic tests will be conducted in the next chapter. It has been proposed that the researcher should employ the variance-covariance matrix when a 'test of theory' is being performed, since the variances and covariances satisfy the assumptions of the methodology and are the appropriate form of the data for validating causal relationships. However, when the research is concerned only with patterns of relationships, not with total explanation as needed in theory testing, the correlation matrix is acceptable. In the current study, all the input data will be converted into covariance matrices.

Model estimation involves "using a model-fitting programme to derive estimates of the model's parameters with the data" (Kline, 1998). In other words, researchers must choose both the estimation techniques and the computer programme in this step (Hair *et al.*, 1998). The early estimation technique called ordinary least squares (OLS) has been supplanted by maximum likelihood estimation (MLE), which is efficient and unbiased when the assumption of multivariate normality is met. However, the sensitivity of MLE to nonnormality creates a need for alternative estimation techniques such as weighted least squares (WLS), generalised least squares (GLS), and asymptotically distributed free (ADF) estimator which can offset nonnormality but needs a huge sampling size (Hair *et al.*, 1998; Rigdon, 1998). There are many alternative SEM software packages exist including LISREL (Linear Structural Relations: Jöreskog & Sörbom, 1988), EQS (Equations: Bentler, 1995) and AMOS (Analysis of Moment Structure: Arbuckle, 1997). In the current study, the AMOS programme will be used since the execution of SEM is easy and efficient with AMOS: for example its graphical interface with the drag-and-drop drawing features provides rapid model specification and displays parameter estimates on a path diagram.

Step 5: Assessing the Identification of the Structural Model. Model identification focuses on whether or not there is a unique solution or set of parameters consistent with the data (Byrne, 2001). A model is said to be identified if it is theoretically possible to calculate a unique estimate of every one of its parameters (Kline, 1998). In order to be identified, there should be at least as many observations as free parameters. If a model fails to meet this requirement, attempts to estimate its parameters could not be successful. In general, there are three levels of model identification (Byrne, 2001; Schumacker and Lomax, 1996). The structural model could be just-identified, over-identified or under-identified. A just-identified model has exactly zero degrees of freedom. Although this will provide a perfect fit of the model, the solution is uninteresting because it has no generalisability. An over-identified model is the goal for all structural equation models since it has more information in the data matrix than the number of parameters to be estimated, meaning that there is a positive number of degrees of freedom. A model failing to meet the order condition is known as an under-identified model.

Step 6: Evaluating Goodness-of-Fit Criteria. Evaluation of model fit means determining how well the a priori model fits the observed data (Kline, 1998). However, SEM has no single index to satisfy statistical tests (Hair *et al.*, 1998). Many authors have suggested adopting combined goodness-of-fit indexes to evaluate model fit (Kline, 1998; Garver and Mentzer, 1999; Hoyle, 1995). Hair *et al.* (1998) have recommended three categories for assessing goodness-of-fit indexes: absolute fit measures, incremental fit measures and parsimonious fit measures. Firstly, the absolute fit measures certify only the overall model fit, such as the chi-square (χ^2), the normed fit chi-square (χ^2/df), the root mean square residual (RMSR), the root mean square error of approximation (RMSEA) and the goodness-of-fit (GFI). The chi-square (χ^2) statistic is the only statistically based index of goodness-of-fit in SEM (Hair *et al.*, 1998) and provides a null hypothesis (H_0) test in that "the sample covariance matrix is equivalent to the model-implied covariance matrix, within sampling error" (Rigdon, 1998). A nonsignificant result implies that the hypothesised model is consistent with the data. However, as the chi-square statistic is too sensitive to sample size, researchers should take an alternative approach to the evaluation process (Byrne, 2001). For instance, a RMSEA index attempts to minimize the impact of sample size, which measures the discrepancy between observed and estimated input matrices per degree of freedom.

Secondly, incremental fit measures mainly measure the extent of fit improved by comparing the proposed model to some more restricted, nested baseline model: this is most often referred to as the null or independence model (Hu and Bentler, 1995; Kelloway, 1998). These measures include the adjusted goodness-of-fit index (AGFI), the normed fit index (NFI), the Tucker-Lewis index (TLI), the comparative fit index (CFI) and the incremental fit index (IFI). Amongst them, the TLI is robust against sample size effects. Empirically, Marsh *et al.* (1988) tested more than 30 goodness-of-fit indexes and concluded that the TLI was the only widely used index that was relatively independent of sample size. Together with the TLI, the comparative fit index (CFI) was also developed to overcome the influence of sample size effect. Therefore, researchers have highly recommended employing both TLI and CFI as the fit indexes of choice (Baumgartner and Homburg, 1996; Garver and Mentzer, 1999; McDonald and Marsh, 1990).

The last type of goodness-of-fit measure is parsimonious fit measures. Their basic objective is to diagnose whether model fit has been achieved by over-fitting the data with too many coefficients (Hair *et al.*, 1998). These measures include the consistent Akaike information criterion (CAIC), the parsimonious normed fit index (PNFI) and the parsimonious comparative index (PCFI). CAIC is generally used in the comparison of two or more models, with smaller values indicating a better fit of the hypothesised model (Byrne, 2001). Concerning evaluation of goodness-of-fit, Kline (1998) has remarked on three points which must be kept in mind. Firstly, values of fit indexes indicate only the overall or average fit of a model. Hence, it is possible that some parts of the model may poorly fit the data even if the value of the index seems favourable. Secondly, fit indexes do not indicate whether the results are theoretically meaningful. Thirdly, good values of fit indexes do not indicate that the predictive power of the model is also high. Table 4.9 presents the description of those fit indexes.

Table 4.9. Summary of Alternative Goodness-of-Fit Indexes

Fit Index	Description	Criteria
1) Absolute Fit Measures		
Chi-square (χ^2) statistic	Teȿt of the null hypothesis that the sample covariance matrix is equivalent to the model implied covariance matrix.	Non significant χ^2 at least p-value > 0.05
Normed Fit Chi-square (χ^2/df) = CMIN/DF	Chi-square statistics taking into account the degrees of freedom	Value as low as 2 or as high as 5 reasonable fit
Standardised Root Mean Square Residuals (SRMR)	Representing a standardised summary of the average covariance residuals.	Value < 0.05 good fit Value 0.1 ~ 0.05 adequate fit
Root Mean Square Error of Approximation (RMSEA)	Representing how well the fitted model approximates per degree of freedom	Value 0.05 ~ 0.08 adequate fit
Goodness-of-Fit (GIF)	Representing a comparison of the square residuals adjusted for the degree of freedom	Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
2) Incremental Fit Measures		
Adjusted Goodness of fit index (AGFI)	Goodness-of-fit adjusted for the degree of freedom	Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
Bentler-Bonett normed fit index (NFI)	Representing a comparative index between the proposed and more restricted, nested baseline model (null model) not adjusted for degree of freedom, thus the effects of sample size are strong	Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
Tucker-Lewis Index (TLI) also known as Bentler-Bonett non-normed fit index (NNFI)	Comparative index between proposed and null models adjusted for degrees of freedom. Can avoid extreme underestimation and overestimation and is robust against sample size. Highly recommended fit index of choice	Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
Comparative Fit Index (CFI) identical to Relative Non centrality Index (RNI)	Comparative index between proposed and null models adjusted for degrees of freedom. Interpreted similarly as NFJ but may be less affected by sample size. Highly recommended as the index of choice	Close to 1 very good fit Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
Bollen's incremental fit index (IFI)	Comparative index between proposed and null models adjusted for degrees of freedom	Value > 0.95 good fit 0.9 ~ 0.95 adequate fit
3) Parsimonious Fit Measures		
Akaike Information Criterion (AIC)	Comparative index between alternative models	Values closer to 0 indicate better fit and greater parsimony
Parsimony Normed fit index (PNFI)	The index takes into account both the model being evaluated and the baseline model	Higher values indicates better fit, comparison between alternative models
Parsimony comparative index (PCFI)	The index takes into account both the model being evaluated and the baseline model	Same as above

Source: Adapted from Arbuckle and Wothke, 1999; Bollen and Long, 1993; Kline, 1998; Musa, 2004

Step 7: Interpreting and Modifying the Model. Once the model is deemed acceptable, the researcher should examine the results considering the following questions. "Are the principal relationships in the theory supported and found to be statistically significant? Are all of the relationships in the hypothesized direction (positive or negative)? Do the competing models add insight in alternative formulations of the theory that can be supported? " (Hair *et al.*, 1998)

After model interpretation is complete, the researcher most likely is looking for methods to improve model fit and/or its correspondence to the underlying theory. Model modification can be derived from examination of the residual of the predicted correlation or covariance matrix. Standardised residuals (normalised residuals) with value greater than ± 2.58 are considered statistically significant at a 0.05 level, which indicates substantial prediction error for a pair of indicators (i.e. one of the correlations or covariances in the original input data). Another way of ascertaining the fit of a specified model is the modification index. The modification index value corresponds approximately to the reduction in chi-square that would occur if the coefficient were estimated. A value of 3.84 or higher suggests that a statistically significant reduction in the Chi-square can be obtained when the coefficient is estimated (Hair *et al.*, 1998). However, many authors (Bollen and Long, 1993; Hair *et al.*, 1998; Byrne, 2001) have pointed out that researchers should not make model changes based only on the modification indices; instead any theoretical support should be assumed before the modification.

4.7. Summary

This chapter discussed the main issues related to research methodology employed in the current study. Firstly, the present research is based on objectivism and positivism. The main research approach is a deductive one. Consequently, a survey method and cross sectional analysis were selected as a research strategy and time horizon. In the second section, the data collection method was discussed and a postal questionnaire survey was selected due to its comparative advantages over on-line questionnaires and delivery & collection questionnaires. In addition, some useful suggestions to improve response rates to postal questionnaires were introduced. The third section employs Churchill and Iacobucci's (2002) nine-step questionnaire development process. In accordance with this process, the initial English questionnaire was developed and pre-tested. After revision, this questionnaire was translated into a Korean version and pre-tested again. In the fourth section, the automobile and parts industry and electronics industry were introduced focusing on the production chains and Korean industry system. In addition, the sampling design process was explained briefly. The fifth section elaborates the concepts and sub-dimensions of validity and reliability. In particular, validity was discussed using four categories: content validity, unidimensionality, convergent validity and discriminant validity. This validation issue will be examined using confirmatory factor analysis in Chapter six. The final section introduces the SEM technique as the main data analytical tool for the empirical research. Hair *et al.*'s (1998) seven-step SEM analysis process was illustrated to correctly specify measurement and structural models. Their procedure will be adopted in chapter six step by step.

CHAPTER FIVE

CHAPTER 5
DESCRIPTIVE ANALYSIS

This chapter mainly presents the descriptive statistics resulting from the mail questionnaire survey in order to provide a general picture of survey participants and their responses to the questions. Chatfield (1985) has asserted that the initial data analysis is critical for most statistical investigations, not only for exploring and summarising data, but also for model formulation employing more advanced statistical techniques at the later stage of the analysis process. The first section presents an overview of the research sample profile determining response rate and examining any non-response bias. Section two provides the demographic characteristics of respondents and section three presents the characteristics of respondents' companies. Descriptive analysis for the integrated logistics and supply chain management capabilities are elaborated in section four. Finally, section five presents descriptive statistics for firm performance classified into three categories – logistics performance, global sourcing performance and sustainable competitive advantage.

5.1. Overall Sample Demographic Profile

This section is designed to provide an overview of the research sample profile. The survey was conducted over about 2 months, commencing in late June until mid-August 2004. As explained in the previous chapter, the six-page Korean survey instruments were mailed to the potential respondents of 1,002 automobile and parts companies and 1,213 electronics firms. Each questionnaire was accompanied by a cover letter and two letters of recommendation. A postage paid return envelope was also included with each questionnaire. Table 5.1 presents the response rate of the mail survey. 147 questionnaires were returned due to non-delivery; specifically, many electronics companies had moved their offices or factories or shut down in some cases. Five of the 200 returned questionnaires were discarded since the respondents had put the same answers on all the seven-point Likert scale items.

The total response rate was 9.43% (195/2068), which does not seem so high when it is compared with those of the previous studies examined in Chapter 2; however it was assumed to be an acceptable level considering the following aspects. Firstly, even though the response rate is somewhat low, the number of respondents is almost 200, which is the critical number to adopt structural equation modelling (Hair et al., 1998; Kelloway, 1998; Ullman, 1996). Secondly, the distribution of the respondent firm size in terms of the number of full employees is similar to that of the sample population of each industry, which implies the respondents could represent the sample population (See Table 5.2).[1] Thirdly, the final sample numbers of the two industries are almost equal (automobile 101 vs. electronics 94), which makes a comparison study possible.

Table 5.1 Questionnaire Response Rate

	Number Distributed (1)	Non-Deliverable (2)	Effectively Delivered (3)=(1)-(2)	Total Response (4)	Dis-carded (5)	Effective Questionnaire (6)=(4)-(5)	Response Rate (7)=(6)/(3)
Automobile	1,002	21	981	105	4	101	10.30%
Electronics	1,213	126	1,087	95	1	94	8.65%
Total	2,215	147	2,068	200	5	195	9.43%

Table 5.2 Comparison of Distribution of Full Employment between Respondents and Sample Population

Full-time Employees	Automobile and Parts		Electronics	
	Respondents (%)	Population (%)	Respondents (%)	Population (%)
< 100	10.9	12.4	29.0	29.9
101-300	53.5	56.3	39.8	42.2
301-500	11.9	11.5	10.8	13.2
501-1000	16.8	13.5	12.9	8.9
1001-2000	4.0	4.2	1.1	3.3
> 2000	3.0	2.3	6.5	2.5
Sum	100.0	100.0	100.0	100.0

In order to check any potential non-response bias, the last quartile of respondents was compared to the first quartile of respondents as suggested by Armstrong and Overton (1977) and Lambert and Harrington (1990). In order to implement the non-response bias test, firstly, sequential numbers in chronological

[1] A T-test could not be adopted due to the style of questionnaire asking respondents to tick a range of options between one and seven.

order were given to each respondent questionnaire according to its arrival time. Next, the mean scores of the first quartile of responses were compared with those of the last quartile on all the questionnaire items. The reason for doing so has been described as follows: "The first quartile of responses could be assumed to respondents who are most willing to participate in the survey and the last quartile could be assumed to be most similar to the non-respondents because they delayed their replies and in some cases any additional action to remind is necessary" (Stank *et al.*, 2002). Table 5.3 summarises the results of a series of T-tests conducted for all the variables indicated on the Likert scale. The results show that most assessments yielded no statistically significant differences (P>0.05) between the two groups with regard to characteristics of respondents, characteristics of respondents' firms, integrated logistics and supply chain management capabilities and performance except for only one item from the integrated logistics and SCM capabilities – 'design of information system for the information sharing with suppliers and customers'. Therefore, it was assumed that respondents did not differ from non-respondents and thus non-response bias was not an issue in this study (see Appendix F).

Table 5.3. Comparison of Respondent and Non-Respondent Groups in Respect of Relative Dimensions

	Significant Differences	Non Significant Differences
Characteristics of Respondents		3
Characteristics of Respondents' Firms		4
Integrated Logistics and SCM Capabilities	1	31
Respondent Firms' Performance		20
Total	1	58

Note: One item from section A (Job title) and five items from section B (main products, type of distribution channel, global sourcing locations, global sourcing type and Incoterms) are excluded because those items are indicated by more than 2 answers.

5.2. Characteristics of Respondents

The characteristics of respondents were analysed by identifying their position and work experience in the automobile and parts and electronics industries as shown in Table 5.4 below.

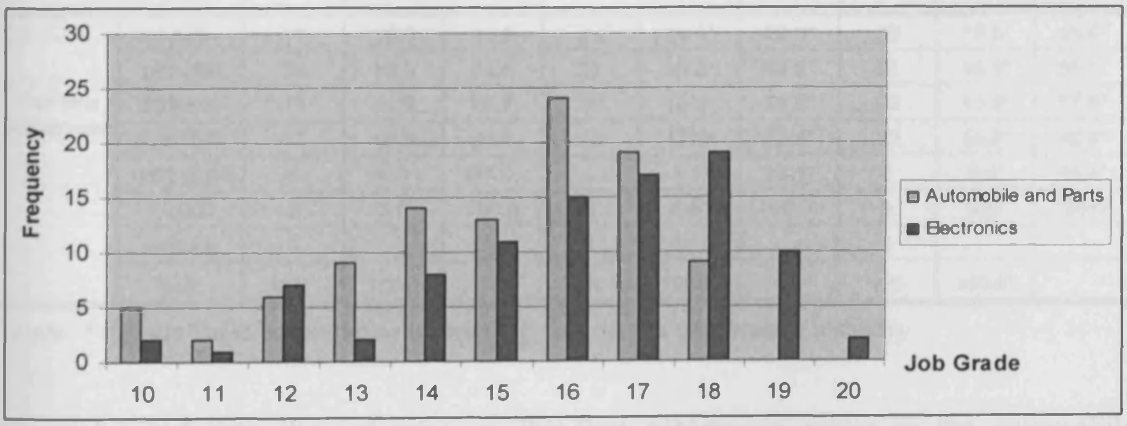
Table 5.4. Respondents Profiles

Industry		Automobile/Parts			Electronics			Total		
		Fre-quency	%	Cumulative %	Fre-quency	%	Cumulative %	Fre-quency	%	Cumulative %
Work experience in the industry (years) Mean Auto:12.01 Elec: 11.53 Sum: 11.78 S.D. Auto: 6.29 Elec: 6.60 Sum: 6.43	1-3	8	7.9	7.9	11	11.7	11.7	19	9.7	9.7
	4-6	13	12.9	20.8	16	17.0	28.7	29	14.9	24.6
	7-9	10	9.9	30.7	9	9.6	38.3	19	9.7	34.4
	10-12	25	24.8	55.4	17	18.1	56.4	42	21.5	55.9
	13-15	21	20.8	76.2	14	14.9	71.3	35	17.9	73.8
	16-18	11	10.9	87.1	14	14.9	86.2	25	12.8	86.7
	19-21	6	5.9	93.1	8	8.5	94.7	14	7.2	93.8
	22-24	1	1.0	94.1	2	2.1	96.8	3	1.5	95.4
	25-27	3	3.0	97.0	1	1.1	97.9	4	2.1	97.4
	28-30	3	3.0	100.0	2	2.1	100.0	5	2.6	100.0
	sum	101	100.0		94	100.0		195	100.0	
Work experience in the Company (years) Mean Auto:10.51 Elec: 8.41 Sum: 9.50 S.D. Auto: 6.08 Elec: 6.39 Sum: 6.31	1-3	15	14.9	14.9	28	29.8	29.8	43	22.1	22.1
	4-6	13	12.9	27.7	22	23.4	53.2	35	17.9	40.0
	7-9	14	13.9	41.6	8	8.5	61.7	22	11.3	51.3
	10-12	19	18.8	60.4	9	9.6	71.3	28	14.4	65.6
	13-15	20	19.8	80.2	11	11.7	83.0	31	15.9	81.5
	16-18	13	12.9	93.1	9	9.6	92.6	22	11.3	92.8
	19-21	3	3.0	96.0	4	4.3	96.8	7	3.6	96.4
	22-24	1	1.0	97.0	1	1.1	97.9	2	1.0	97.4
	25-27	2	2.0	99.0	2	2.1	100.0	4	2.1	99.5
	28-30	1	1.0	100.0	0	0.0	100.0	1	0.5	100.0
	sum	101	100.0		94	100.0		195	100.0	
Respondents' position Mean Auto:15.06 Elec: 16.16 Sum: 15.59 S.D. Auto: 2.10 Elec: 2.28 Sum: 2.25	10	5	5.0	5.0	2	2.1	2.1	7	3.6	3.6
	11	2	2.0	6.9	1	1.1	3.2	3	1.5	5.1
	12	6	5.9	12.9	7	7.4	10.6	13	6.7	11.8
	13	9	8.9	21.8	2	2.1	12.8	11	5.6	17.4
	14	14	13.9	35.6	8	8.5	21.3	22	11.3	28.7
	15	13	12.9	48.5	11	11.7	33.0	24	12.3	41.0
	16	24	23.8	72.3	15	16.0	48.9	39	20.0	61.0
	17	19	18.8	91.1	17	18.1	67.0	36	18.5	79.5
	18	9	8.9	100.0	19	20.2	87.2	28	14.4	93.8
	19	0	0.0	100.0	10	10.6	97.9	10	5.1	99.0
	20	0	0.0	100.0	2	2.1	100.0	2	1.0	100.0
	Sum	101	100.0		94	100.0		195	100.0	

Note: no missing data

Firstly, regarding work experience in the industry, the average lengths of work experience were 12.01 years in the automobile and parts industry and 11.53 years in the electronics industry. The sample showed that in the automobile industry 69.3% of respondents had worked for more than 9 years and 23.8% had worked for more than 15 years. Similarly, in the electronics industry, 61.7% had more than 9 year work experience and 28.7% had more than 15 year experience. In sum, 65.6% of respondents of both industries had worked for their industries for more than 9 years and 26.2% had worked for more than 15 years. Secondly, concerning work experience in the current company, the average lengths of work experience were 10.51 years in the automobile and parts industry and 8.41 years in the electronics industry. The sample showed that, in the automobile industry, 58.4% of respondents had more than 9 years work experience and 19.8% had more than 15 years. Meanwhile, in the electronics industry, over half (53.2%) had worked in their current companies for less than 6 years and only 38.3% had worked for more than 9 years, while 17.0% had worked for more than 15 years for their current companies. In sum, almost half (48.7%) of respondents in both industries had worked for more than 9 years and 18.5% had worked for more than 15 years for their present companies. Thirdly, corresponding to the questions related to the respondents' job grade, a total of 71.3% (66.4% in the automobile and parts industry; and 78.7% in the electronics industry) marked their position between 15 and 20 on an ascending scale that ranged from 10 (clerk) to 20 (CEO/president), which indicates that the respondents held managerial or higher positions. The average grades were 15.06 in automobile and parts industry and 16.16 in electronics industry; the total average grade was 15.59. The bar chart in Figure 5.1 illustrates the distribution of respondents' positions in the both industries.

Figure 5.1. Distribution of Respondents' Positions in the Target Industries



Considering the statistical characteristics of the respondents' position and work experience, it was assumed that the respondents had sufficient knowledge about their firm's activities and provided accurate and reliable information.

5.3. Characteristics of Respondents' Firms

In order to obtain company information, the respondents were commonly asked to indicate their company age, total sales value, number of full time employees, main products, type of distribution channel and global sourcing stage. In addition, three extra questions related to global sourcing were given to those firms conducting global sourcing activities (see Table 5.5).

Table 5.5. General Profiles of Respondents' Companies

Industry		Automobile/Parts			Electronics			Total		
		Frequency	%	Cumulative %	Frequency	%	Cumulative %	Frequency	%	Cumulative %
Company age (Years)	< 5	3	3.0	3.0	10	10.6	10.6	13	6.7	6.7
	5-8	12	11.9	14.9	9	9.6	20.2	21	10.8	17.4
	9-12	13	12.9	27.7	12	12.8	33.0	25	12.8	30.3
	13-16	18	17.8	45.5	14	14.9	47.9	32	16.4	46.7
	17-20	14	13.9	59.4	15	16.0	63.8	29	14.9	61.5
	> 20	41	40.6	100.0	34	36.2	100.0	75	38.5	100.0
	sum	101	100.0		94	100.0		195	100.0	
Total sales value (100 million Korean Won; 2003)	< 10	1	1.0	1.0	1	1.1	1.1	2	1.0	1.0
	10-50	4	4.0	5.0	8	8.5	9.6	12	6.2	7.2
	51-100	1	1.0	5.9	8	8.5	18.1	9	4.6	11.8
	101-250	20	19.8	25.7	16	17.0	35.1	36	18.5	30.3
	251-500	24	23.8	49.5	19	20.2	55.3	43	22.1	52.3
	501-1000	14	13.9	63.4	15	16.0	71.3	29	14.9	67.2
	1001-2500	23	22.8	86.1	14	14.9	86.2	37	19.0	86.2
	2501-5000	9	8.9	95.0	7	7.4	93.6	16	8.2	94.4
	> 5000	5	5.0	100.0	6	6.4	100.0	11	5.6	100.0
	sum	101	100.0		94	100.0		195	100.0	
Full time employees	< 100	11	10.9	10.9	27	29.0*	29.0*	38	19.6*	19.6*
	101-300	54	53.5	64.4	37	39.8*	68.8*	91	46.9*	66.5*
	301-500	12	11.9	76.2	10	10.8*	79.6*	22	11.3*	77.8*
	501-1000	17	16.8	93.1	12	12.9*	92.5*	29	14.9*	92.8*
	1001-2000	4	4.0	97.0	1	1.1*	93.5*	5	2.6*	95.4*
	> 2000	3	3.0	100.0	6	6.5*	100.0*	9	4.6*	100.0*
	missing	0			1			1		
	sum	101	100.0		94	100.0*		195	100.0*	

Note: * means valid percent due to missing data in the electronics industry

In analysing the information, the first percentage refers to the automobile industry while the second, in parenthesis, refers to the electronics industry. Firstly, 73.3% (67.0%) of sampled firms had been in operation for more than 12 years and 40.6% (36.2%) had been operating for more than 20 years. Secondly, 25.7% (35.1%)

firms had total sales value below 25 billion Korean Won, 60.4% (51.1%) companies had recorded total sales value between 25 and 250 billion Korean Won and 13.9% (13.8%) firms had total sales value of over 250 billion Korean Won in 2003.[2] Thirdly, it was also identified that 10.9% (29.0%) of the firms had 100 or fewer employees, 65.4% (50.6%) of the companies employed between 101 and 500 workers, 16.8% (12.9%) of the firms had 501 to 1,000 employees and 7.0% (7.6%) of the firms had more than 1,000 full time workers in 2004.

Concerning the main products of respondents companies, in the automobile and parts industry, 89.3% of respondents' firms manufactured automobile parts, 9.7% of companies produced cars and 1.0% of firms manufactured trailers. In the electronics industry, respondents firms produced home electronics (20.0%), portable cellular phones (18.2%), computers (10.0%), heavy electric equipment (9.1%), semiconductors (9.1%), wire telecommunication equipment (7.3%), electric wire (6.4%) and others (20.0%). Those companies manufactured more than two items in many cases; for this reason, only the percentages of the products were calculated.

Table 5.6. Respondents' Companies Products

Industry	Automobile/Parts		Electronics		Total	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Home electronics	-	-	20.0	20.0	10.3	10.3
Wire telecom equipment	-	-	7.3	27.3	3.8	14.1
Portable cellular phone	-	-	18.2	45.5	9.4	23.5
Computer	-	-	10.0	55.5	5.2	28.6
Semi-conductor	-	-	9.1	64.5	4.7	33.3
Heavy electric equipment	-	-	9.1	73.6	4.7	38.0
Electric wire	-	-	6.4	80.0	3.3	41.3
Automobile	9.7	9.7	-	-	4.7	46.0
Automobile parts	89.3	99.0	-	-	43.2	89.2
Trailer	1.0	100.0	-	-	0.5	89.7
Others	0.0	100.0	20.0	100.0	10.3	100.0
Sum	100.0		100.0		100.0	

Concerning the type of distribution channel, 'outsourcing' was the most general case in both industries but 'own account' also had a very high share. Some respondents indicated that their companies had been operating more than two types of

[2] £1 is approximately equal to 2000 Korean Won.

distribution channel; for this reason, only the percentages of the types of distribution channel were calculated.

Table 5.7. Types of Distribution Channel

Industry	Automobile/Parts		Electronics		Total	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
Own account	43.2	43.2	42.3	42.3	42.8	42.8
Sales subsidiary	1.8	45.0	0.9	43.2	1.4	44.1
Joint venture	1.8	46.8	7.2	50.5	4.5	48.6
Outsourcing	53.2	100.0	49.5	100.0	51.4	100.0
Sum	100.0		100.0		100.0	

Regarding the global sourcing stage, 84.2% of automobile (and parts) companies and 86.3% of electronics companies had been conducting global sourcing activities. In particular, 35.6% of automobile companies and 45.3% of electronics companies had employed strategic global sourcing activities rather than 'foreign buying based on need'.

Table 5.8. Global Sourcing Stage

Industry	Automobile/Parts			Electronics			Total		
	Frequency	%	Cumulative %	Frequency	%	Cumulative %	Frequency	%	Cumulative %
Domestic purchasing only	16	15.8	15.8	13	13.7	13.7	29	14.9	14.9
Foreign buying based on need	49	48.5	64.4	39	41.1	54.7	88	45.1	60.0
Foreign buying as part of procurement strategy	18	17.8	82.2	19	21.1	75.8	37	19.0	79.0
Integration of global procurement strategy	18	17.8	100.0	23	24.2	100.0	41	21.0	100.0
Sum	101	100.0		94	100.0		195	100.0	

Both industries had been conducting global sourcing activities all over the world. The main global sourcing countries for automobile and parts companies were Japan (25.7%), China (22.8%), Western Europe (13.1%) and North America (12.6%). Likewise, the main global sourcing regions for electronics firms were Japan (26.8%), China (19.7%), North America (15.5%), Western Europe (9.4%) and Taiwan (8.9%).

Table 5.9. Global Sourcing Country

Industry	Automobile/Parts		Electronics		Total	
	Percent	Cumulative Percent	Percent	Cumulative Percent	Percent	Cumulative Percent
China	22.8	22.8	19.7	19.7	21.2	21.2
Japan	25.7	48.5	26.8	46.5	26.3	47.5
Taiwan	4.4	52.9	8.9	55.4	6.7	54.2
Hong Kong	3.9	56.8	7.0	62.4	5.5	59.7
Singapore	2.9	59.7	6.1	68.5	4.5	64.2
ASEAN	1.9	61.7	2.3	70.9	2.1	66.3
North America	12.6	74.3	15.5	86.4	14.1	80.4
South America	1.9	76.2	0.9	87.3	1.4	81.9
Western Europe	13.1	89.3	9.4	96.7	11.2	93.1
Eastern Europe	5.3	94.7	2.3	99.1	3.8	96.9
Caribbean Basin	0.0	94.7	0.0	99.1	0.0	96.9
Middle east	1.0	95.6	0.0	99.1	0.5	97.4
Africa	0.0	95.6	0.0	99.1	0.0	97.4
Australia	2.4	98.1	0.9	100.0	1.7	99.0
Others	1.9	100.0	0.0	100.0	1.0	100.0
Sum	100.0		100.0		100.0	

Concerning trade terms, almost all 'Incoterms' had been used for global sourcing activities (see Table 5.10 and see Appendix A for the full list of the Incoterms).

Table 5.10. Main Terms of Trade (Incoterms)

Industry	Automobile/Parts				Electronics				Total			
Incoterms	Import		Export		Import		Export		Import		Export	
	%	Cumulative	%	Cumulative	%	Cumulative	%	Cumulative	%	Cumulative	%	Cumulative
EXW	11.3	11.3	7.7	7.7	8.9	8.9	4.4	4.4	10.1	10.1	6.0	6.0
FAS	3.3	14.6	2.6	10.3	0.7	9.6	0.0	4.4	2.0	12.1	1.2	7.1
FOB	38.4	53.0	37.6	47.9	41.8	51.4	46.7	51.1	40.1	52.2	42.5	49.6
FCA	5.3	58.3	0.9	48.7	2.7	54.1	1.5	52.6	4.0	56.2	1.2	50.8
CFR	6.0	64.2	5.1	53.8	4.8	58.9	5.2	57.8	5.4	61.6	5.2	56.0
CIF	23.2	87.4	29.1	82.9	26.7	85.6	28.9	86.7	24.9	86.5	29.0	84.9
CPT	0.0	87.4	0.9	83.8	2.7	88.4	1.5	88.1	1.3	87.9	1.2	86.1
CIP	2.6	90.1	2.6	86.3	4.1	92.5	4.4	92.6	3.4	91.2	3.6	89.7
DAF	0.0	90.1	0.0	86.3	0.7	93.2	0.0	92.6	0.3	91.6	0.0	89.7
DES	0.7	90.7	0.0	86.3	0.0	93.2	0.0	92.6	0.3	91.9	0.0	89.7
DEQ	0.0	90.7	0.0	86.3	0.0	93.2	0.0	92.6	0.0	91.9	0.0	89.7
DDU	4.0	94.7	5.1	91.5	4.8	97.9	4.4	97.0	4.4	96.3	4.8	94.4
DDP	5.3	100.0	8.5	100.0	2.1	100.0	3.0	100.0	3.7	100.0	5.6	100.0
Sum	100.0		100.0		100.0		100.0		100.0		100.0	

Among them, FOB was the most frequently used term for import (38.4%) and export (37.6%), while CIF was the second most widely used term for import (23.2%) and export (29.1%) in the automobile and parts industry. Similarly, FOB was the most frequently used term (import 41.8% and export 46.7%) and CIF was the second most common term (import 26.7% and export 28.9%) in the electronics industry.

5.4. Integrated Logistics and Supply Chain Management Capabilities

After the characteristics of the survey respondents and their firms had been identified, attention turned to how they answered the survey questions related to integrated logistics and supply chain management capabilities. In this section, percentage frequencies for all the items are presented with central tendency (mean) and dispersion (standard deviation). Firstly, in order to understand firms' information and strategic planning capabilities, respondents were asked to indicate their companies' achievement with regard to 14 specific information and strategic planning capability variables using a seven-point scale, ranging from 'strongly disagree' (1) to 'strongly agree' (7) and 'not available/applicable (N)'. The frequency (percentage), central tendency and dispersion were calculated and are presented in Table 5.11 below.

Table 5.11. Descriptive Findings for the Information and Strategic Planning Capabilities

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Continual investments in IT (Info1)	Automobile	4.0	8.9	19.8	20.8	13.9	20.8	11.9	0.0	4.42	1.67
	Electronics	6.4	13.8	11.7	24.5	19.1	13.8	8.5	2.1	4.14	1.68
	Total	5.1	11.3	15.9	22.6	16.4	17.4	10.3	1.0	4.28	1.68
Tailored information system for SCM (Info2)	Automobile	4.0	10.9	22.8	13.9	22.8	17.8	7.9	0.0	4.26	1.62
	Electronics	4.3	10.6	16.0	28.7	14.9	20.2	4.3	1.1	4.18	1.52
	Total	4.1	10.8	19.5	21.0	19.0	19.0	6.2	0.5	4.22	1.57
Usefulness of strategy related information (Info3)	Automobile	6.9	16.8	25.7	12.9	18.8	9.9	6.9	2.0	3.79	1.67
	Electronics	7.4	19.1	19.1	21.3	16.0	9.6	3.2	4.3	3.63	1.57
	Total	7.2	17.9	22.6	16.9	17.4	9.7	5.1	3.1	3.71	1.62
Usefulness of manufacturing related information (Info4)	Automobile	4.0	20.8	16.8	25.7	14.9	12.9	5.0	0.0	3.85	1.57
	Electronics	6.4	24.5	19.1	19.1	12.8	8.5	5.3	4.3	3.57	1.63
	Total	5.1	22.6	17.9	22.6	13.8	10.8	5.1	2.1	3.72	1.60
Usefulness of logistics related information (Info5)	Automobile	6.9	9.9	21.8	18.8	23.8	13.9	5.0	0.0	4.04	1.58
	Electronics	5.3	20.2	19.1	14.9	19.1	10.6	6.4	4.3	3.83	1.67
	Total	6.2	14.9	20.5	16.9	21.5	12.3	5.6	2.1	3.94	1.62
Design of information system for the information sharing between departments (Info6)	Automobile	2.0	14.9	18.8	14.9	21.8	20.8	5.9	1.0	4.27	1.59
	Electronics	4.3	10.6	13.8	24.5	22.3	14.9	8.5	1.1	4.30	1.58
	Total	3.1	12.8	16.4	19.5	22.1	17.9	7.2	1.0	4.28	1.58

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Design of information system for the information sharing with suppliers/customers (Info7)	Automobile	3.0	14.9	21.8	19.8	16.8	18.8	3.0	2.0	4.03	1.53
	Electronics	8.5	22.3	18.1	21.3	14.9	11.7	2.1	1.1	3.56	1.58
	Total	5.6	18.5	20.0	20.5	15.9	15.4	2.6	1.5	3.80	1.57
A formal planning system for the design of operating system (SP1)	Automobile	4.0	12.9	16.8	12.9	20.8	23.8	7.9	1.0	4.38	1.68
	Electronics	6.4	18.1	10.6	26.6	18.1	16.0	4.3	0.0	3.97	1.62
	Total	5.1	15.4	13.8	19.5	19.5	20.0	6.2	0.5	4.18	1.66
A formal evaluation system for financial and logistical Performance (SP2)	Automobile	2.0	14.9	13.9	21.8	18.8	20.8	5.9	2.0	4.29	1.57
	Electronics	7.4	13.8	16.0	24.5	18.1	10.6	6.4	3.2	3.92	1.63
	Total	4.6	14.4	14.9	23.1	18.5	15.9	6.2	2.6	4.12	1.61
A decision making process based on total cost measurement (SP3)	Automobile	1.0	6.9	15.8	13.9	18.8	30.7	10.9	2.0	4.82	1.53
	Electronics	0.0	7.4	8.5	26.6	26.6	23.4	5.3	2.1	4.67	1.29
	Total	0.5	7.2	12.3	20.0	22.6	27.2	8.2	2.1	4.75	1.42
A continual planning process incorporating feedback (SP4)	Automobile	0.0	4.0	18.8	19.8	20.8	26.7	7.9	2.0	4.73	1.37
	Electronics	0.0	5.3	16.0	23.4	28.7	22.3	4.3	0.0	4.60	1.26
	Total	0.0	4.6	17.4	21.5	24.6	24.6	6.2	1.0	4.66	1.32
Planning process evaluating environmental constraints, firm resources and organisational goals (SP5)	Automobile	0.0	10.9	15.8	13.9	19.8	31.7	5.9	2.0	4.65	1.50
	Electronics	0.0	6.4	12.8	25.5	20.2	23.4	8.5	3.2	4.69	1.38
	Total	0.0	8.7	14.4	19.5	20.0	27.7	7.2	2.6	4.67	1.44
Participation of all functional staff in strategy development (SP6)	Automobile	1.0	5.9	14.9	18.8	27.7	21.8	9.9	0.0	4.71	1.42
	Electronics	2.1	8.5	18.1	22.3	25.5	19.1	4.3	0.0	4.35	1.42
	Total	1.5	7.2	16.4	20.5	26.7	20.5	7.2	0.0	4.54	1.43
Integration of logistics strategy with other strategic plans (SP7)	Automobile	1.0	6.9	21.8	28.7	15.8	20.8	5.0	0.0	4.34	1.39
	Electronics	2.1	14.9	24.5	26.6	21.3	7.4	3.2	0.0	3.85	1.35
	Total	1.5	10.8	23.1	27.7	18.5	14.4	4.1	0.0	4.10	1.39

When examining the 14 information and strategic planning capabilities, the automobile (and parts) companies' responses indicated that 12 items are rated above the 4.0 point. In particular, the majority of the automobile and parts firms rated reasonably high on the 4 variables at more than 4.5 points concerning 'a decision making process based on total cost measurement' (mean = 4.82), 'a continual planning process incorporating feedback' (mean = 4.73), 'participation of all functional staff in strategy development' (mean = 4.71) and 'planning process evaluating environmental constraints, firm resources and organisational goals' (mean = 4.65). On the contrary, the following 2 items were marked below 4.0: 'usefulness of strategy related information' (mean = 3.79) and 'usefulness of manufacturing related information' (mean = 3.85). The mean values of the remainder were between 4.03 and 4.42. Meanwhile, the electronics companies indicated that 7 items are rated above 4.0 points, among which 'planning process evaluating environmental constraints, firm resources and organisational goals' (mean = 4.69), 'a decision making process based on total cost measurement' (mean = 4.67) and 'a continual planning process incorporating feedback' (mean = 4.60) are rated at more than 4.5 points. In contrast, the following 7 items are marked below 4.0 points: 'a formal planning system for the design of operating system' (mean = 3.97), 'a formal evaluation system for financial and logistical Performance' (mean = 3.92), 'integration of logistics strategy with other strategic plans' (mean = 3.85), 'usefulness of logistics related information' (mean = 3.83), 'usefulness of strategy-related information' (mean = 3.63), 'usefulness of manufacturing related information' (mean = 3.57), and 'design of information system for the information sharing with suppliers/customers' (mean = 3.56).

Figure 5.2. Comparison of Information and Strategic Planning Capabilities between the Automobile (and parts) and Electronics Industry

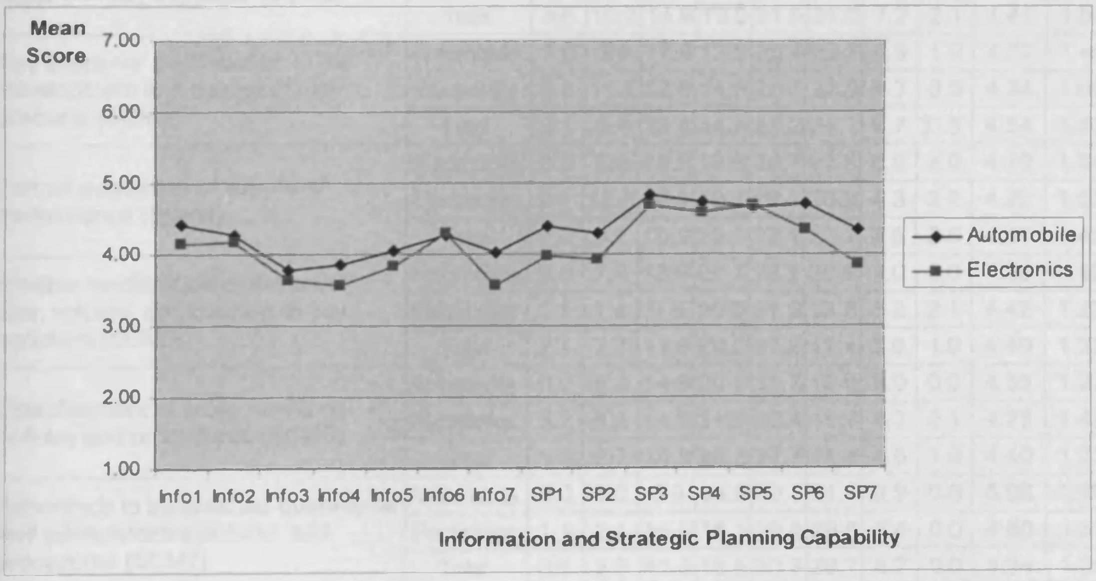


Figure 5.2 above provides a comparison of the mean values for 14 items between the automobile (and parts) companies and electronics companies. The two industries present a very similar pattern for all the items while the mean values of the automobile and parts firms are slightly higher than those of the electronics companies. The findings would imply that Korean automobile (and parts) and electronics firms were relatively well qualified for information technology in information capability and the strategic planning process and participation of all functional staff in strategy development in strategic

planning capability. However, they are unsatisfactory for information availabilities or contents concerning strategic, manufacturing and logistics related information.

Secondly, 18 items concerning the integrated logistics and supply chain management capabilities (core competency) were marked on a seven-point Likert scale ranging from 'strongly disagree' (1) to 'strongly agree' (7) and 'not available/applicable (N)'. The results are summarised in Table 5.12 below.

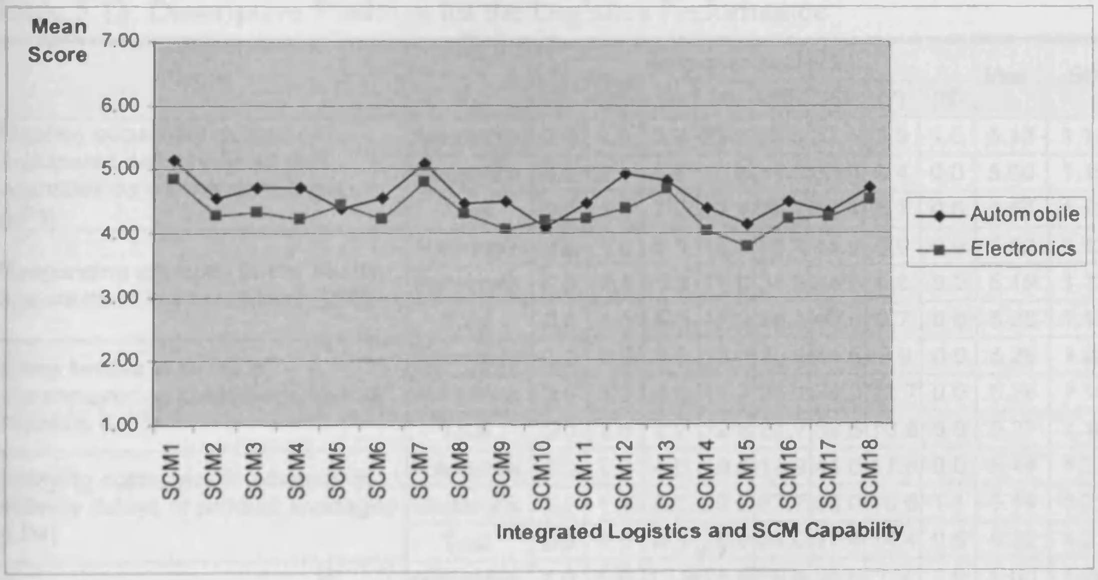
Table 5.12. Descriptive Findings for the Integrated Logistics and SCM Capabilities

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Increase of long-term agreements with key suppliers (SCM1)	Automobile	1.0	5.9	5.9	14.9	21.8	35.6	13.9	1.0	5.15	1.42
	Electronics	4.3	9.6	7.4	12.8	18.1	35.1	11.7	1.1	4.85	1.68
	Total	2.6	7.7	6.7	13.8	20.0	35.4	12.8	1.0	5.01	1.55
Sharing of technical resources, R&D costs with key suppliers (SCM2)	Automobile	2.0	8.9	15.8	19.8	18.8	23.8	8.9	2.0	4.55	1.55
	Electronics	5.3	11.7	13.8	18.1	24.5	18.1	6.4	2.1	4.27	1.62
	Total	3.6	10.3	14.9	19.0	21.5	21.0	7.7	2.1	4.41	1.59
Key suppliers' participation in the development and design of new products (SCM3)	Automobile	1.0	5.9	17.8	13.9	25.7	25.7	8.9	1.0	4.72	1.46
	Electronics	5.3	11.7	12.8	14.9	28.7	22.3	4.3	0.0	4.34	1.60
	Total	3.1	8.7	15.4	14.4	27.2	24.1	6.7	0.5	4.54	1.53
Formal evaluation of suppliers' performance (SCM4)	Automobile	0.0	5.9	14.9	19.8	26.7	23.8	6.9	2.0	4.70	1.34
	Electronics	2.1	12.8	19.1	19.1	19.1	20.2	4.3	3.2	4.22	1.53
	Total	1.0	9.2	16.9	19.5	23.1	22.1	5.6	2.6	4.47	1.45
Flexible modification of the order size, volume, composition to key suppliers (SCM5)	Automobile	3.0	7.9	13.9	27.7	22.8	20.8	4.0	0.0	4.38	1.42
	Electronics	1.1	7.4	9.6	30.9	31.9	13.8	3.2	2.1	4.42	1.23
	Total	2.1	7.7	11.8	29.2	27.2	17.4	3.6	1.0	4.40	1.33
Establishment of cross functional policies and procedures (SCM6)	Automobile	0.0	5.0	14.9	26.7	31.7	16.8	5.0	0.0	4.55	1.22
	Electronics	3.2	8.5	14.9	31.9	23.4	11.7	4.3	2.1	4.23	1.42
	Total	1.5	6.7	14.9	29.2	27.7	14.4	4.6	1.0	4.40	1.33
Adherence to established operational and administrative policies and procedures (SCM7)	Automobile	0.0	3.0	6.9	18.8	30.7	31.7	8.9	0.0	5.08	1.19
	Electronics	1.1	2.1	16.0	18.1	29.8	25.5	7.4	0.0	4.80	1.31
	Total	0.5	2.6	11.3	18.5	30.3	28.7	8.2	0.0	4.94	1.25
Reduction of formal organisational structure (SCM8)	Automobile	1.0	8.9	17.8	20.8	19.8	22.8	5.9	3.0	4.46	1.47
	Electronics	2.1	13.8	18.1	17.0	18.1	23.4	5.3	2.1	4.29	1.59
	Total	1.5	11.3	17.9	19.0	19.0	23.1	5.6	2.6	4.38	1.52
Operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation (SCM9)	Automobile	1.0	7.9	16.8	22.8	25.7	17.8	7.9	0.0	4.50	1.43
	Electronics	1.1	12.8	22.3	26.6	17.0	13.8	4.3	2.1	4.07	1.41
	Total	1.0	10.3	19.5	24.6	21.5	15.9	6.2	1.0	4.29	1.43
Discrimination of logistics service strategies for different customers (SCM10)	Automobile	3.0	7.9	22.8	25.7	22.8	13.9	2.0	2.0	4.09	1.35
	Electronics	2.1	11.7	18.1	27.7	20.2	11.7	7.4	1.1	4.18	1.48
	Total	2.6	9.7	20.5	26.7	21.5	12.8	4.6	1.5	4.14	1.41
Utilisation of flexible programmes providing special services for the changing customer requirements (SCM11)	Automobile	1.0	6.9	17.8	19.8	30.7	17.8	5.0	1.0	4.47	1.35
	Electronics	2.1	11.7	17.0	26.6	21.3	12.8	7.4	1.1	4.23	1.49
	Total	1.5	9.2	17.4	23.1	26.2	15.4	6.2	1.0	4.35	1.42

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Formal measurement of customer satisfaction (SCM12)	Automobile	0.0	8.9	10.9	14.9	17.8	37.6	8.9	1.0	4.92	1.47
	Electronics	2.1	13.8	16.0	18.1	22.3	18.1	9.6	0.0	4.37	1.61
	Total	1.0	11.3	13.3	16.4	20.0	28.2	9.2	0.5	4.65	1.56
Maintenance of a high level of communication with customers (SCM13)	Automobile	1.0	3.0	12.9	18.8	30.7	22.8	8.9	2.0	4.83	1.32
	Electronics	2.1	9.6	7.4	22.3	23.4	24.5	9.6	1.1	4.69	1.52
	Total	1.5	6.2	10.3	20.5	27.2	23.6	9.2	1.5	4.76	1.42
Integrated logistical operations under single control (SCM14)	Automobile	1.0	9.9	18.8	16.8	30.7	18.8	4.0	0.0	4.39	1.40
	Electronics	2.1	14.9	23.4	22.3	16.0	13.8	6.4	1.1	4.03	1.54
	Total	1.5	12.3	21.0	19.5	23.6	16.4	5.1	0.5	4.22	1.47
Utilisation of total transportation chain performance measurement (SCM15)	Automobile	1.0	13.9	23.8	16.8	21.8	19.8	2.0	1.0	4.13	1.45
	Electronics	3.2	17.0	23.4	25.5	17.0	9.6	3.2	1.1	3.78	1.43
	Total	2.1	15.4	23.6	21.0	19.5	14.9	2.6	1.0	3.96	1.44
Flexible multimodal transportation management (SCM16)	Automobile	1.0	8.9	11.9	28.7	19.8	24.8	4.0	1.0	4.49	1.38
	Electronics	1.1	13.8	13.8	26.6	26.6	14.9	3.2	0.0	4.21	1.38
	Total	1.0	11.3	12.8	27.7	23.1	20.0	3.6	0.5	4.36	1.39
Coordination of inbound/outbound transportation (SCM17)	Automobile	0.0	10.9	11.9	33.7	23.8	16.8	3.0	0.0	4.33	1.28
	Electronics	1.1	14.9	7.4	33.0	27.7	10.6	5.3	0.0	4.24	1.38
	Total	0.5	12.8	9.7	33.3	25.6	13.8	4.1	0.0	4.29	1.33
Increase of long-term agreements with logistics service providers (SCM18)	Automobile	3.0	5.9	5.9	26.7	23.8	27.7	5.9	1.0	4.71	1.41
	Electronics	4.3	10.6	10.6	17.0	22.3	26.6	6.4	2.1	4.51	1.61
	Total	3.6	8.2	8.2	22.1	23.1	27.2	6.2	1.5	4.61	1.51

Almost all the mean values of the 18 items for the integrated logistics and SCM capabilities were presented above 4.0 in both industries. The automobile and parts companies indicated that all the items had mean values of more than 4.0. In particular, 2 items – 'increase of long-term agreements with key suppliers' (mean = 5.15) and 'adherence to established operational and administrative policies and procedures' (mean = 5.08) – were rated over 5.0 and 7 items – 'formal measurement of customer satisfaction' (mean = 4.92), 'maintenance of a high level of communication with customers (mean = 4.83), 'key suppliers' participation in the development and design of new products' (mean = 4.72), 'increase of long-term agreements with logistics service providers' (mean = 4.71), 'formal evaluation of suppliers' performance' (mean = 4.70), 'Sharing of technical resources, R&D costs with key suppliers' (mean = 4.55) and 'establishment of cross functional policies and procedures' (mean = 4.55) – were rated at more than 4.5 while the following 3 items had the lowest points: 'coordination of inbound/outbound transportation' (mean = 4.33), 'utilisation of total transportation chain performance measurement' (mean = 4.13) and 'discrimination of logistics service strategies for different customers' (mean = 4.09). Meanwhile, the electronics industry's responses indicated that 17 items were rated at above 4.0 points, among which 'increase of long-term agreements with key suppliers' (mean = 4.85), 'adherence to established operational and administrative policies and procedures' (mean = 4.80), 'maintenance of a high level of communication with customers' (mean = 4.69) 'increase of long-term agreements with logistics service providers' (mean = 4.51) were rated at more than 4.5 points. In contrast, 'utilisation of total transportation chain performance measurement' (mean = 3.78) was the only item possessing a mean score below 4.0, and 'operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation' (mean = 4.07) and 'integrated logistical operations under single control' (mean = 4.03) had relatively low points.

Figure 5.3. Comparison of Integrated Logistics and SCM Capabilities between the Automobile (and parts) and Electronics Industry



The shapes of the two lines indicating the integrated logistics and SCM capabilities of two industries resemble each other while the mean values of the automobile firms are consistently slightly higher than those of the electronics companies (Figure 5.3). This tendency is the same as the case of information and strategic planning capabilities. The findings would imply that Korean automobile (and parts) and electronics firms are relatively well qualified for 'supplier integration' and 'customer relationship'; however, they are relatively unsatisfactory for 'inbound/outbound logistics integration' except for the item of 'increase of long-term agreements with logistics service providers'.

5.5. Logistics and Global Sourcing Performances and Sustainable Competitive Advantage

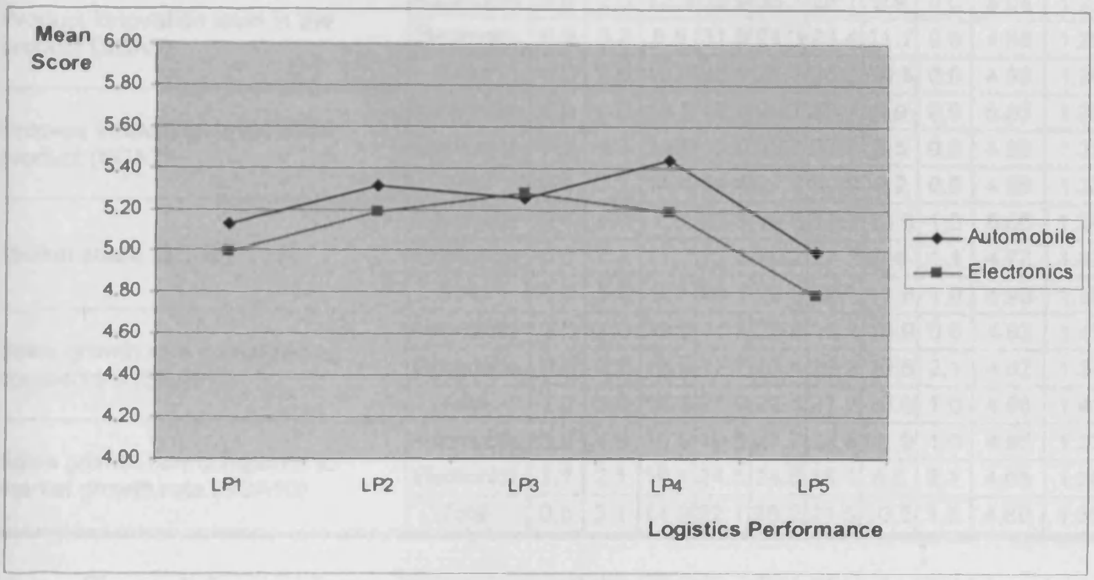
In order to understand logistics and global sourcing performances and sustainable competitive advantage, respondents were asked to rate how well their companies performed those activities compared to their major competitors, using a seven-point Likert scale ranging from 'much worse' (1) to 'much better' (7) and 'not available/applicable (N)'. Firstly, concerning logistics performance, the majority of companies from the two industries commonly indicated high points over 5.0 for the 4 items except for 'utilising just in time management' in the electronics industry.

Table 5.13. Descriptive Findings for the Logistics Performance

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Meeting accurately quoted or anticipated delivery dates and quantities on a consistent basis (LP1)	Automobile	0.0	1.0	5.9	23.8	23.8	37.6	6.9	1.0	5.13	1.11
	Electronics	0.0	2.1	8.5	20.2	31.9	30.9	6.4	0.0	5.00	1.15
	Total	0.0	1.5	7.2	22.1	27.7	34.4	6.7	0.5	5.07	1.12
Responding promptly to the needs and wants of key customers (LP2)	Automobile	0.0	1.0	5.9	18.8	18.8	45.5	9.9	0.0	5.32	1.13
	Electronics	0.0	2.1	5.3	17.0	31.9	34.0	9.6	0.0	5.19	1.13
	Total	0.0	1.5	5.6	17.9	25.1	40.0	9.7	0.0	5.26	1.13
Being flexible in terms of accommodating customers' special requests (LP3)	Automobile	0.0	2.0	9.9	12.9	20.8	44.6	9.9	0.0	5.26	1.22
	Electronics	0.0	3.2	4.3	11.7	35.1	34.0	11.7	0.0	5.28	1.15
	Total	0.0	2.6	7.2	12.3	27.7	39.5	10.8	0.0	5.27	1.18
Notifying customers in advance of delivery delays or product shortages (LP4)	Automobile	0.0	2.0	4.0	19.8	14.9	41.6	17.8	0.0	5.44	1.22
	Electronics	1.1	1.1	5.3	20.2	27.7	33.0	10.6	1.1	5.19	1.23
	Total	0.5	1.5	4.6	20.0	21.0	37.4	14.4	0.5	5.32	1.23
Utilising just-in-time management (LP5)	Automobile	1.0	0.0	12.9	21.8	19.8	35.6	7.9	1.0	5.00	1.26
	Electronics	1.1	1.1	18.1	27.7	13.8	25.5	10.6	2.1	4.78	1.43
	Total	1.0	0.5	15.4	24.6	16.9	30.8	9.2	1.5	4.90	1.35

The following graph shown in Figure 5.4 provides a comparison of the mean values for the five logistics performance items. The two industries present similar patterns for all the items while the mean values of the automobile and parts firms are slightly higher than those of the electronics companies except for one item. The findings would imply that Korean automobile (and parts) and electronics firms are well qualified for overall logistics performance.

Figure 5.4. Comparison of Logistics Performance between the Automobile (and parts) and Electronics Industry



Secondly, regarding sustainable competitive advantage, the majority of companies from the two industries commonly indicated high ratings over 5.0 for the four items and ratings of more than 4.5 for the remaining six items. Among them, the four items for 'quality' and 'flexibility' were ranked in top position while 'cost' and 'three measures for competitive position in market' had relatively lower points.

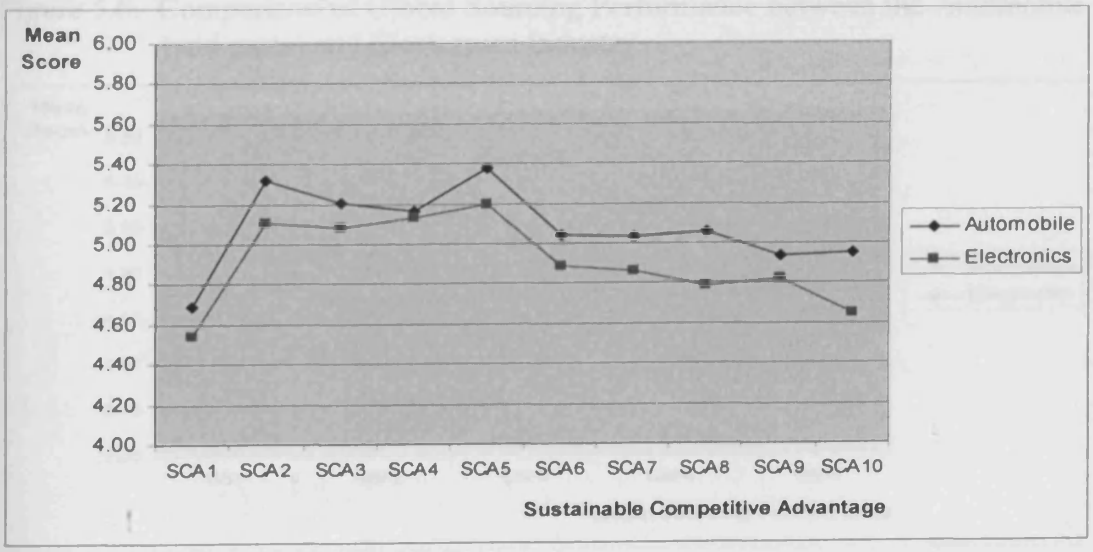
Table 5.14. Descriptive Findings for the Competitive Advantage

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Lower manufacturing cost (SCA1)	Automobile	1.0	4.0	13.9	20.8	26.7	22.8	5.9	5.0	4.69	1.32
	Electronics	1.1	4.3	19.1	28.7	16.0	19.1	8.5	3.2	4.54	1.45
	Total	1.0	4.1	16.4	24.6	21.5	21.0	7.2	4.1	4.62	1.38
Meeting customer's expectation for manufacturing quality (SCA2)	Automobile	1.0	0.0	6.9	10.9	32.7	34.7	12.9	1.0	5.32	1.15
	Electronics	0.0	0.0	7.4	22.3	36.2	20.2	13.8	0.0	5.11	1.13
	Total	0.5	0.0	7.2	16.4	34.4	27.7	13.3	0.5	5.22	1.14
Meeting customer's expectation for design quality (SCA3)	Automobile	1.0	3.0	5.0	11.9	32.7	34.7	9.9	2.0	5.20	1.22
	Electronics	0.0	2.1	9.6	22.3	25.5	23.4	14.9	2.1	5.09	1.32
	Total	0.5	2.6	7.2	16.9	29.2	29.2	12.3	2.1	5.15	1.27
Flexibility in production volume, changeover, and modification (SCA4)	Automobile	2.0	2.0	7.9	13.9	26.7	33.7	12.9	1.0	5.16	1.35
	Electronics	0.0	2.1	9.6	19.1	24.5	33.0	10.6	1.1	5.13	1.27
	Total	1.0	2.1	8.7	16.4	25.6	33.3	11.8	1.0	5.14	1.31

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Ability to deal with unexpected events (SCA5)	Automobile	0.0	3.0	5.0	13.9	22.8	38.6	15.8	1.0	5.38	1.23
	Electronics	0.0	0.0	10.6	17.0	28.7	28.7	12.8	2.1	5.19	1.22
	Total	0.0	1.5	7.7	15.4	25.6	33.8	14.4	1.5	5.29	1.22
Product innovation level in the product (SCA6)	Automobile	0.0	2.0	12.9	12.9	33.7	28.7	9.9	0.0	5.04	1.23
	Electronics	0.0	3.2	8.5	31.9	21.3	23.4	11.7	0.0	4.88	1.29
	Total	0.0	2.6	10.8	22.1	27.7	26.2	10.8	0.0	4.96	1.26
Process innovation level in the product (SCA7)	Automobile	1.0	2.0	13.9	12.9	26.7	33.7	9.9	0.0	5.03	1.33
	Electronics	0.0	4.3	14.9	16.0	28.7	27.7	8.5	0.0	4.86	1.32
	Total	0.5	3.1	14.4	14.4	27.7	30.8	9.2	0.0	4.95	1.33
Market share (SCA8)	Automobile	0.0	4.0	7.9	23.8	19.8	29.7	13.9	1.0	5.06	1.34
	Electronics	0.0	7.4	11.7	22.3	20.2	27.7	9.6	1.1	4.78	1.42
	Total	0.0	5.6	9.7	23.1	20.0	28.7	11.8	1.0	4.93	1.38
Sales growth rate compared to competitors (SCA9)	Automobile	2.0	4.0	13.9	14.9	20.8	33.7	10.9	0.0	4.93	1.47
	Electronics	0.0	3.2	12.8	27.7	23.4	20.2	10.6	2.1	4.82	1.34
	Total	1.0	3.6	13.3	21.0	22.1	27.2	10.8	1.0	4.88	1.41
Sales growth rate compared to market growth rate (SCA10)	Automobile	0.0	4.0	10.9	19.8	27.7	24.8	11.9	1.0	4.95	1.32
	Electronics	1.1	2.1	19.1	24.5	24.5	18.1	8.5	2.1	4.65	1.38
	Total	0.5	3.1	14.9	22.1	26.2	21.5	10.3	1.5	4.80	1.36

Figure 5.5 provides a comparison of the mean values for the ten sustainable competitive advantage indicators. Similar to the above cases, the two industries present an analogous trend for all the items while the mean values of the automobile and parts firms are slightly higher than those of the electronics companies except for one item.

Figure 5.5. Comparison of Competitive Advantage between the Automobile (and parts) and Electronics Industry

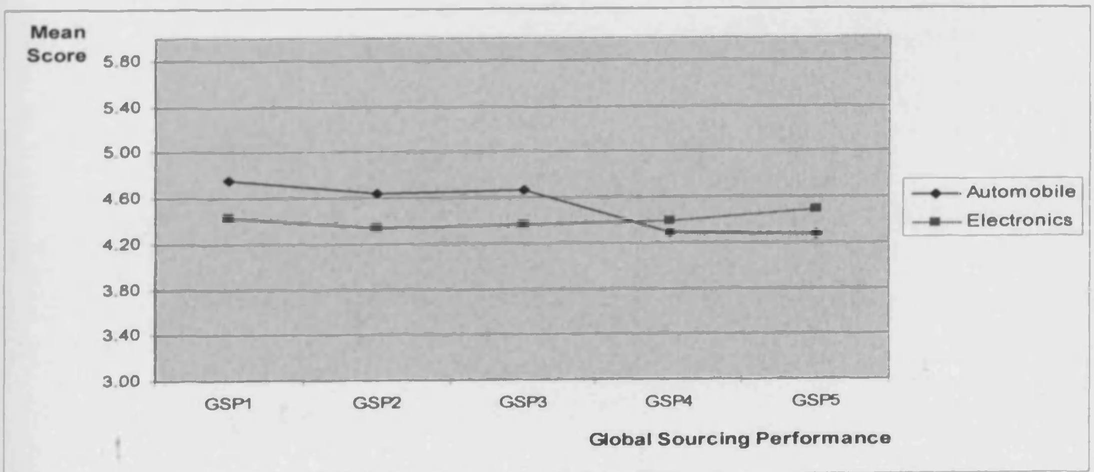


Finally, table 5.15 shows that the majority of companies from the two industries rated relative lower points for the five global sourcing performance indicators compared to the logistics performance and competitive advantage indexes. However, their points are higher than 4.0 and located between 4.28 and 4.75. They commonly indicated that firstly they had achieved lower factor cost (mean = 4.75 for automobile industry/ mean = 4.43 for electronics industry) through global sourcing activities. For the other items the two industries presented somewhat different ranks. Figure 5.6 presents a comparison of global sourcing performance between the industries.

Table 5.15. Descriptive Findings for the Global Sourcing Performance

Items		Response Scale (%)								Mean	SD
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(N)		
Achieving lower factor cost (GSP1)	Automobile	1.2	5.9	10.6	23.5	27.1	21.2	10.6	0.0	4.75	1.40
	Electronics	1.2	3.7	24.7	23.5	21.0	18.5	4.9	2.5	4.43	1.40
	Total	1.2	4.8	17.5	23.5	24.1	19.9	7.8	1.2	4.59	1.41
Access to advanced production technologies (GSP2)	Automobile	1.2	5.9	16.5	12.9	37.6	20.0	5.9	0.0	4.64	1.35
	Electronics	1.2	6.2	23.5	23.5	23.5	11.1	7.4	3.7	4.34	1.45
	Total	1.2	6.0	19.9	18.1	30.7	15.7	6.6	1.8	4.49	1.40
Penetrating local markets (GSP3)	Automobile	1.2	3.5	18.8	16.5	29.4	22.4	7.1	1.2	4.67	1.37
	Electronics	1.2	9.9	19.8	24.7	19.8	13.6	7.4	3.7	4.36	1.56
	Total	1.2	6.6	19.3	20.5	24.7	18.1	7.2	2.4	4.52	1.47
Reducing time delays involved in waiting for local suppliers to provide the requisite components (GSP4)	Automobile	2.4	9.4	11.8	30.6	27.1	10.6	5.9	2.4	4.29	1.38
	Electronics	1.2	6.2	11.1	37.0	24.7	12.3	3.7	3.7	4.39	1.29
	Total	1.8	7.8	11.4	33.7	25.9	11.4	4.8	3.0	4.34	1.33
Reducing local disadvantage/difficulties (GSP5)	Automobile	1.2	10.6	11.8	29.4	29.4	11.8	3.5	2.4	4.28	1.31
	Electronics	1.2	6.2	11.1	32.1	25.9	13.6	3.7	6.2	4.49	1.37
	Total	1.2	8.4	11.4	30.7	27.7	12.7	3.6	4.2	4.38	1.34

Figure 5.6. Comparison of Global Sourcing Performance between the Automobile (and parts) and Electronics Industry



5.6. Summary

This chapter has illustrated a basic descriptive analysis from a data set collected from a mail survey. Firstly, related to the research sample profile, the total response rate was 9.43% (195/2068) and non-response bias was not an issue in this study. Secondly, the characteristics of respondents showed that they had sufficient knowledge about their firm's activities and provided accurate and reliable information. Thirdly, the descriptive analysis of respondents' companies found that there was a reasonable spread of variation concerning firms' age, size, products, distribution channel and global sourcing activities. Fourthly, descriptive analysis for the integrated logistics and supply chain management capabilities showed that there were very similar patterns between the two industries in assessing the items throughout the questionnaire, while the mean values of the automobile and parts firms are slightly higher than those of the electronics companies except for several cases. Finally, all the respondents perceived that their firms' overall performance were better than those of their main competitors. In other words, both sectors rated over 4.0 points for all the performance indicators. In addition, the two industrial sectors presented an analogous trend throughout three performance categories, while in many cases the mean values of the automobile and parts firms are higher than those of electronics companies.

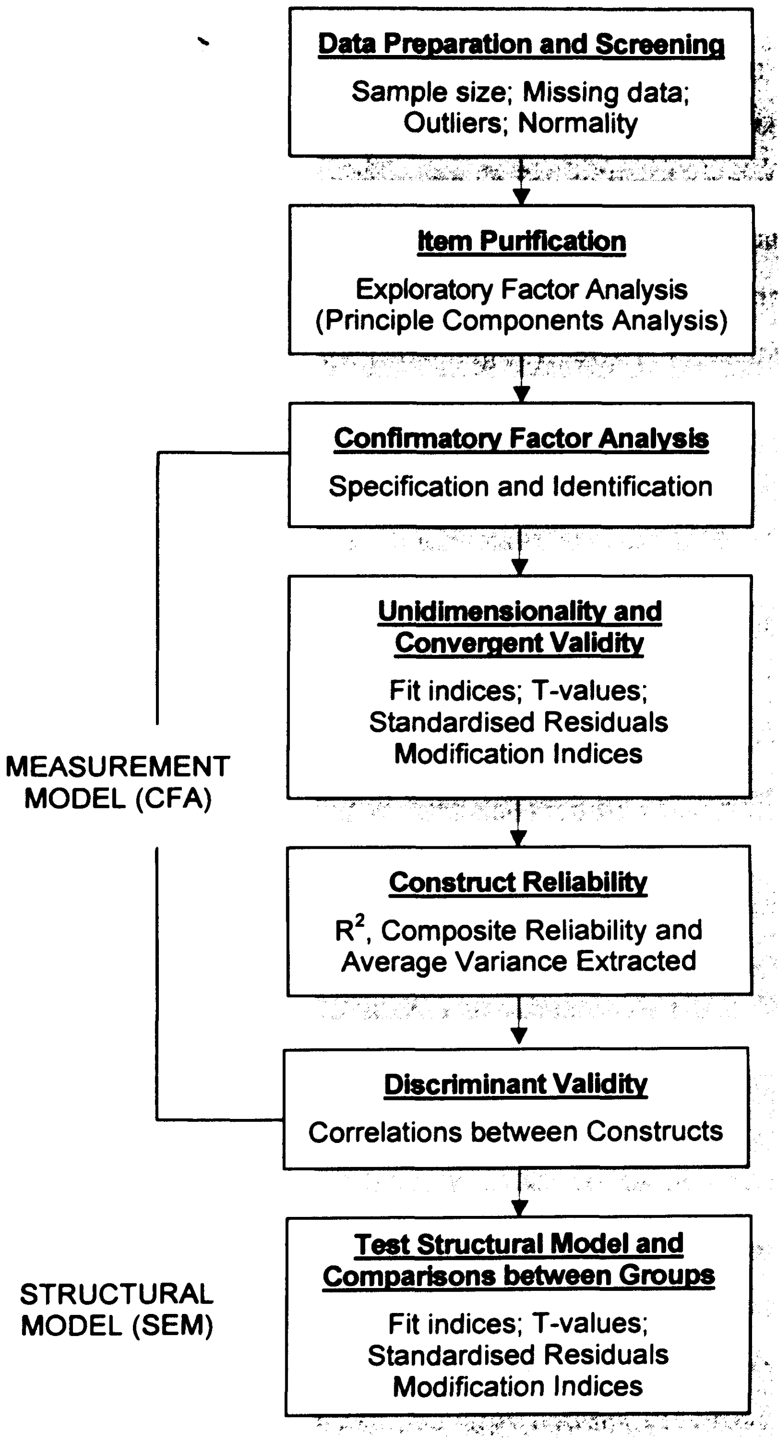
In the following chapter, structural equation modelling will be employed in order to draw conclusions about the research hypotheses by examining the validation issues and testing the hypotheses.

CHAPTER SIX

CHAPTER 6
STATISTICAL ANALYSIS OF RESEARCH HYPOTHESES

The focus of the previous chapter was to detail the findings of the descriptive analysis. The present chapter devotes its attention to the data analytical process adopting structural equation modelling (SEM). The current study uses the AMOS software package (version 5.0) for the main analysis. This chapter is organised into four sections. The first section deals with data preparation and screening procedures including the detection and treatment of missing data, outliers and normality. The second section concerns item purification. The 14 information and strategic planning capability items, 18 integrated logistics and supply chain management capability indexes and 20 performance measures are categorised into new latent constructs by exploratory factor analysis (EFA). In the third section, the measurement models generated from EFA are validated by confirmatory factor analysis (CFA). As explained in Chapter 4, the validation issue includes unidimensionality, convergent validity, discriminant validity and reliability. Finally, in the fourth section the hypothesised relationships between the latent variables are tested by structural equation models. This section deals with two main models – 'global sourcing excluded model (hereafter GSE model)' and 'global sourcing included model (hereafter GSI model)'. The GSE model involves 195 sample companies from the automobile and parts industry and the electronics industry while the GSI model includes 166 firms conducting global sourcing activities. After the analyses, the established models are employed for comparison between the two industries. The following Figure 6.1 illustrates the analytical flow of the current chapter.

Figure 6.1. Analytical Process in the Current Chapter



Source: Adapted from Koufteros (1999)

6.1. Data Preparation and Screening

Although multivariate analysis techniques such as multiple regression, factor analysis and SEM have an enormous analytical power to assist researchers to test their hypotheses, they still have some limitations or assumptions to be screened before conducting analysis (Tabachnick and Fidell, 2001). Data related problems could cause model estimation and fitting programmes to fail to yield a solution or to 'crash' (Kline, 1998). Hair *et al.* (1998) have indicated that the data examination is an essential part of any multivariate analysis. In this section, the data preparation and screening process will be conducted elaborating the three major issues: (1) missing data; (2) outliers; and (3) normality.

6.1.1. Missing Data

Missing data is one of the most pervasive problems in data analysis (Tabachnick and Fidell, 2001). The missing data would cause two main problems: (1) decreased statistical power; and (2) biased parameter estimates (Hair *et al.*, 1998; Roth, 1994). The significance of missing data depends on the pattern of data loss, such as missing at random or systematically and the amount or frequency of the missing values (Byrne, 2001; Kline, 1998; Tabachnick and Fidell, 2001). It is comprehensively acknowledged that when missing data has a systematic pattern, any remedies to deal with the incomplete data could yield biased results; on the contrary any technique employed for missing data occurring by chance is assumed to generate acceptable results (Arbuckle and Wothke, 1999; Hair *et al.*, 1998; Tabachnick and Fidell, 2001). Although the issue of how much of the incomplete data could be permitted has been debated for a long time, there have been no definite guidelines. However, Cohen and Cohen (1983) have posited that 5 per cent or even 10 per cent missing data on a particular variable is not large. Many authors have agreed that if the missing data is relatively small within a large dataset, the problem could be considered less serious and any procedure for treating the missing data may yield similar results (Hair *et al.*, 1998; Kline, 1998; Tabachnick and Fidell, 2001). According to Roth (1994), Monte Carlo experiments have demonstrated that whatever the pattern of missing data (missing at random or systematically), there is very little difference in the parameter estimates when the amount missing is less than 10%.

In general, there are three commonly applied strategies to treat the missing data problems: (1) listwise deletion; (2) pairwise deletion; and (3) imputation (Byrne, 2001; Tabachnick and Fidell, 2001; Kline, 1998; Rigdon, 1998). Firstly, listwise deletion means deleting all the cases that have missing data, which may result in a reduced sample size for the analysis and as a consequence, decreased statistical power (Arbuckle and Wothke, 1999; Byrne, 2001; Hair *et al.*, 1998; Kline, 1998; Rigdon, 1998). Secondly, pairwise deletion means cases having missing values are not entirely deleted, but excluded only when they are incomplete on the variables involved for the particular analysis (Arbuckle and Wothke, 1999; Kline, 1998). Therefore the sample size is inconsistent from analysis to analysis and may occasionally generate a covariance matrix that is not positively definite (Byrne, 2001; Kline, 1998; Roth, 1994). Finally, the imputation approach requires the researcher to estimate the missing data based on the valid values of other observations (Hair *et al.*, 1998; Tabachnick and Fidell, 2001). There are two popular mechanisms for calculating estimated scores for missing data: (1) mean imputation and (2) regression based substitution.

In the present study, the regression substitution approach is used for treating missing data for the following reasons. Firstly, imputation is the most logical course of action since given the minimal benefit of deleting cases and variables, the researcher is precluded from adopting this simple solution; moreover the complete case method would result in an inadequate sample size (Hair *et al.*, 1998). Secondly, regression substitution is better than mean imputation. Mean imputation is relatively easy to calculate, the mean for the entire dataset is consistent and the full dataset is retained for further analysis; however the estimated variances and covariances of the missing cases will be underestimated and as a result, the correlations between variables will also shrink (Byrne, 2001; Kline, 1998; Tabachnick and Fidell, 2001). On the contrary, regression based substitution has an advantage that it takes into account the respondent's set of scores and hence may yield accurate values (Kline 1998; Fichman and Cumming, 2003). Arbuckle and Wothke (1999) have suggested that mean imputation is not a recommended mechanism for SEM because it might have detrimental impacts on the variance and covariances on which SEM is based.

Finally, the amount of missing data on each variable as shown in Table 6.1 is very small (i.e. less than 5%). Roth (1994) suggested that regression substitution is a suitable method when the amount of missing data is less than 10 per cent. Table 6.1 contains the reasons for, frequency, and percentage of missing data on the entire items for the two target industries.

Table 6.1. Missing Data Analysis of Integrated Logistics and SCM Capabilities

Capabilities and Performance	Automobile			Electronics			Total		
	The reason why missing		Sum (%)	The reason Why missing		Sum (%)	The reason why missing		Sum (%)
	Did not know	Did not answer		Did not know	Did not answer		Did not know	Did not answer	
Info1	0	0	0 (0.0)	2	0	2 (2.1)	2	0	2 (1.0)
Info2	0	0	0 (0.0)	1	0	1 (1.1)	1	0	1 (0.5)
Info3	2	0	2 (2.0)	3	1	4 (4.3)	5	1	6 (3.1)
Info4	0	0	0 (0.0)	2	2	4 (4.3)	2	2	4 (2.1)
Info5	0	0	0 (0.0)	2	2	4 (4.3)	2	2	4 (2.1)
Info6	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)
Info7	1	1	2 (2.0)	1	0	1 (1.1)	2	1	3 (1.5)
SP1	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
SP2	2	0	2 (2.0)	2	1	3 (3.2)	4	1	5 (2.6)
SP3	1	1	2 (2.0)	2	0	2 (2.1)	3	1	4 (2.1)
SP4	1	1	2 (2.0)	0	0	0 (0.0)	1	1	2 (1.0)
SP5	2	0	2 (2.0)	2	1	3 (3.2)	4	1	5 (2.6)
SP6	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SP7	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SCM1	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)
SCM2	2	0	2 (2.0)	1	1	2 (2.1)	3	1	4 (2.1)
SCM3	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
SCM4	2	0	2 (2.0)	2	1	3 (3.2)	4	1	5 (2.6)
SCM5	0	0	0 (0.0)	1	1	2 (2.1)	1	1	2 (1.0)
SCM6	0	0	0 (0.0)	2	0	2 (2.1)	2	0	2 (1.0)
SCM7	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SCM8	2	1	3 (3.0)	2	0	2 (2.1)	4	1	5 (2.6)
SCM9	0	0	0 (0.0)	2	0	2 (2.1)	2	0	2 (1.0)
SCM10	1	1	2 (2.0)	1	0	1 (1.1)	2	1	3 (1.5)
SCM11	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)
SCM12	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
SCM13	2	0	2 (2.0)	1	0	1 (1.1)	3	0	3 (1.5)
SCM14	0	0	0 (0.0)	1	0	1 (1.1)	1	0	1 (0.5)
SCM15	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)

Capabilities and Performance	Automobile			Electronics			Total		
	The reason why missing		Sum (%)	The reason Why missing		Sum (%)	The reason why missing		Sum (%)
	Did not know	Did not answer		Did not know	Did not answer		Did not know	Did not answer	
SCM16	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
SCM17	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SCM18	1	0	1 (1.0)	2	0	2 (2.1)	3	0	3 (1.5)
LP1	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
LP2	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
LP3	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
LP4	0	0	0 (0.0)	1	0	1 (1.1)	1	0	1 (0.5)
LP5	1	0	1 (1.0)	1	1	2 (2.1)	2	1	3 (1.5)
SCA1	3	2	5 (5.0)	1	2	3 (3.2)	4	4	8 (4.1)
SCA2	1	0	1 (1.0)	0	0	0 (0.0)	1	0	1 (0.5)
SCA3	1	1	2 (2.0)	2	0	2 (2.1)	3	1	4 (2.1)
SCA4	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)
SCA5	1	0	1 (1.0)	1	1	2 (2.1)	2	1	3 (1.5)
SCA6	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SCA7	0	0	0 (0.0)	0	0	0 (0.0)	0	0	0 (0.0)
SCA8	1	0	1 (1.0)	1	0	1 (1.1)	2	0	2 (1.0)
SCA9	0	0	0 (0.0)	1	1	2 (2.1)	1	1	2 (1.0)
SCA10	1	0	1 (1.0)	2	0	2 (2.1)	3	0	3 (1.5)
GSP1	0	0	0 (0.0)	2	0	2 (2.1)	2	0	2 (1.0)
GSP2	0	0	0 (0.0)	2	1	3 (3.2)	2	1	3 (1.5)
GSP3	1	0	1 (1.0)	1	2	3 (3.2)	2	2	4 (2.1)
GSP4	2	0	2 (2.0)	2	1	3 (3.2)	4	1	5 (2.6)
GSP5	2	0	2 (2.0)	3	2	5 (5.3)	5	2	7 (3.6)

6.1.2. Outliers

Outliers are cases with scores that are distinctly different from other observations in the dataset (Hair *et al.*, 1998; Kline, 1998). Outliers can be identified as univariate or multivariate (Kline, 1998; Tabachnick and Fidell, 2001). Firstly, univariate outliers happen when cases have extreme values in a single variable (Hair *et al.*, 1998; Kline, 1998; Tabachnick and Fidell, 2001). Outliers may or may not be influential, a term which means that removal of the outlier could potentially cause substantial distortions in a specific analysis such as model fit estimates, parameter estimates and standard errors of a specific analysis (Bowerman and O'Connell, 1997; West *et al.*, 1995). Although there is no absolute definition of an 'extreme' point for the univariate outlier, it is widely accepted that scores more than three standard deviations away from the mean may be outliers (Kline, 1998). However the current study may have no need to identify univariate outliers since this study employs a seven point Likert scale for all the questionnaire items. Secondly, multivariate outliers are cases with an unusual combination of scores on two or more variables (Tabachnick and Fidell, 2001). Multivariate outliers can be diagnosed with the Mahalanobis D^2 distance (Byrne, 2001; Hair *et al.*, 1998; Tabachnick and Fidell, 2001), which is a measure of the distance in multidimensional space of each observation from the mean centre of the observations (Hair *et al.*, 1998). A large Mahalanobis distance score indicates a case as having outliers on one or more of the independent variables. Hair *et al.* (1998) and Tabachnick and Fidell (2001) have suggested that a very conservative level, such as 0.001, be used as the threshold value for designation as an outlier. In the current study, Mahalanobis distance was measured using the AMOS programme. The criterion for multivariate outliers is Mahalanobis distance at $P < 0.001$ as suggested by Hair *et al.* (1998) and Tabachnick and Fidell (2001). The results reveal that there are a few outlier cases; 5 companies among a total of 195 sample companies and 2 companies among 166 global sourcing companies (see Appendix G).

It is important to decide whether to retain or discard outliers from the data set. In the present study, all the cases have been retained for the following reasons. Firstly, there is insufficient proof to demonstrate that these outliers are not part of the population (Hair *et al.*, 1998; Kline, 1998; Tabachnick and Fidell, 2001). Secondly, the presence of a few outliers within a large sample size should be of trivial concern (Kline, 1998). Thirdly, as outliers are deleted, the researcher runs the risk of improving the multivariate analysis but limiting its generalisability (Hair *et al.*, 1998).

6.1.3. Normality

Normality is the most fundamental assumption in multivariate analysis and is characterised as the shape of the data distribution for an individual metric variable and its correspondence to the normal distribution, which is the benchmark for statistical methods (Hair *et al.*, 1998). As a matter of fact, estimation procedures that are widely used in SEM programmes typically assume that dependent and mediating variables are normally distributed for continuous variables (Kline, 1998). Normality could occur at univariate and multivariate level. Univariate normality concerns the distribution of each individual variable, whilst multivariate normality refers to each variable and all linear combinations of the variables being normally distributed (Tabachnick and Fidell, 2001). The multivariate normal distribution is a very critical and sensitive assumption, particularly with SEM (Byrne, 2001; Hair *et al.*, 1998; Kline, 1998; West *et al.*, 1995). For instance, non-normality will cause an inflated chi-square statistic and modestly underestimate the values of fit indexes such as the Tucker-Lewis index (TLI) and the comparative fit index (CFI) and standard errors of parameter estimates (Byrne, 2001; Hair *et al.*, 1998; West *et al.*, 1995).

Two characteristics of the distribution patterns are typically used to describe non-normality: skewness and kurtosis (Hair *et al.*, 1998; Tabachnick and Fidell, 2001; West *et al.*, 1995). "Skewness concerns the symmetry of the distribution; a skewed variable is a variable whose mean is not in the centre of the distribution. A positively skewed distribution has relatively few large values and tails off to the right, and a negatively skewed distribution has relatively few small values and tails off to the left. Skewness values falling outside the rage of -1 to +1 indicate a substantially skewed distribution (Hair *et al.*, 1998). Kurtosis refers to the peakedness of a distribution; a distribution is either too peaked (with long, thin tails) or too flat (with short, heavy tails). A positive value indicates a relatively peaked distribution, and a negative value indicates a relatively flat distribution" (Hair *et al.*, 1998). In a normal distribution, the values of skewness and kurtosis are zero. There are significance tests for both skewness and kurtosis that test the obtained value against a null hypothesis of zero. Multivariate kurtosis can be calculated by the AMOS programme. The following tables are the results of the normality tests of supply chain management capabilities and performance. Table 6.2 shows the results of the normality test for the Global Sourcing Excluded (GSE) model including 195 companies and reveals significant negative skewness on 7 items related to the integrated logistics and SCM capabilities and on 11 items for performance indexes. In addition, there is significant negative kurtosis on 7 items for information capability, 4 indexes for strategic planning capability and 7 items for SCM capability. The result of the multivariate kurtosis is also significant, which means the assumption of multivariate normality is offended.

Table 6.2. Normality of SCM Capabilities and Performance in GSE Model

Variable	Range		Skewness		Kurtosis	
	Min.	Max.	Statistic	Critical Ratio	Statistic	Critical Ratio
Info1	1	7	-0.110	-0.625	-0.845	-2.410*
Info2	1	7	-0.113	-0.645	-0.813	-2.318*
Info3	1	7	0.228	1.299	-0.730	-2.082*
Info4	1	7	0.295	1.683	-0.743	-2.117*
Info5	1	7	0.029	0.164	-0.829	-2.362*
Info6	1	7	-0.143	-0.817	-0.843	-2.402*
Info7	1	7	0.079	0.452	-0.922	-2.629*
SP1	1	7	-0.174	-0.992	-0.968	-2.759*
SP2	1	7	-0.076	-0.431	-0.787	-2.244*
SP3	1	7	-0.378	-2.153	-0.628	-1.789
SP4	2	7	-0.159	-0.909	-0.834	-2.377*
SP5	2	7	-0.286	-1.628	-0.881	-2.512*
SP6	1	7	-0.258	-1.471	-0.602	-1.715
SP7	1	7	0.129	0.735	-0.622	-1.774
SCM1	1	7	-0.836	-4.765*	-0.078	-0.221
SCM2	1	7	-0.287	-1.638	-0.733	-2.090*
SCM3	1	7	-0.448	-2.556*	-0.629	-1.793
SCM4	1	7	-0.208	-1.185	-0.779	-2.221*
SCM5	1	7	-0.349	-1.991*	-0.186	-0.529
SCM6	1	7	-0.173	-0.986	-0.201	-0.573
SCM7	1	7	-0.461	-2.630*	-0.231	-0.658
SCM8	1	7	-0.164	-0.934	-0.915	-2.608*
SCM9	1	7	0.031	0.176	-0.721	-2.055*
SCM10	1	7	0.005	0.026	-0.472	-1.347
SCM11	1	7	-0.114	-0.650	-0.586	-1.671
SCM12	1	7	-0.371	-2.118*	-0.901	-2.569*
SCM13	1	7	-0.462	-2.632*	-0.257	-0.733
SCM14	1	7	-0.024	-0.139	-0.854	-2.434*
sCM15	1	7	0.096	0.547	-0.861	-2.454*
SCM16	1	7	-0.222	-1.263	-0.653	-1.862
SCM17	1	7	-0.140	-0.796	-0.445	-1.267
SCM18	1	7	-0.594	-3.386*	-0.285	-0.812
LP1	2	7	-0.419	-2.389*	-0.352	-1.005
LP2	2	7	-0.602	-3.430*	-0.098	-0.278
LP3	2	7	-0.770	-4.387*	0.193	0.551
LP4	1	7	-0.653	-3.721*	0.16	0.455
LP5	1	7	-0.264	-1.506	-0.643	-1.833
SCA1	1	7	-0.144	-0.823	-0.505	-1.439
SCA2	1	7	-0.391	-2.231*	0.072	0.207
SCA3	1	7	-0.574	-3.271*	0.122	0.349
SCA4	1	7	-0.677	-3.861*	0.174	0.496
SCA5	2	7	-0.527	-3.005*	-0.289	-0.824
SCA6	2	7	-0.244	-1.392	-0.606	-1.728
SCA7	1	7	-0.490	-2.793*	-0.466	-1.329
SCA8	2	7	-0.347	-1.978*	-0.682	-1.945
SCA9	1	7	-0.362	-2.066*	-0.515	-1.467
SCA10	1	7	-0.173	-0.985	-0.588	-1.677
Multivariate					332.79	34.237*

* $p < 0.05$

Table 6.3 shows the results of the normality test for the Global Sourcing Included (GSI) model having 166 companies conducting global sourcing activities and reveals significant negative skewness on 5 items related to the integrated logistics and SCM capability and on 10 items for performance indexes. In addition, there is significant negative kurtosis on 6 items for information capability, 4 indexes for strategic planning capability, 4 items for SCM capability and 1 index for firm performance. There is no significant skewness and kurtosis on 5 global sourcing items. Result of the multivariate kurtosis is significant, which means the assumption of multivariate normality is offended.

Table 6.3. Normality of SCM Capabilities and Performance in GSI Model

Variable	Range		Skewness		Kurtosis	
	Min.	Max.	Statistic	Critical Ratio	Statistic	Critical Ratio
Info1	1	7	-0.051	-0.267	-0.889	-2.337*
Info2	1	7	-0.081	-0.428	-0.854	-2.246*
Info3	1	7	0.141	0.742	-0.753	-1.982*
Info4	1	7	0.309	1.624	-0.621	-1.633
Info5	1	7	0.066	0.346	-0.806	-2.119*
Info6	1	7	-0.145	-0.763	-0.910	-2.393*
Info7	1	7	0.064	0.337	-0.869	-2.286*
SP1	1	7	-0.164	-0.865	-0.986	-2.592*
SP2	1	7	-0.019	-0.098	-0.767	-2.018*
SP3	2	7	-0.349	-1.833	-0.720	-1.892
SP4	2	7	-0.097	-0.508	-0.840	-2.210*
SP5	2	7	-0.271	-1.427	-0.880	-2.313*
SP6	1	7	-0.270	-1.419	-0.617	-1.624
SP7	1	7	0.158	0.833	-0.595	-1.565
SCM1	1	7	-0.800	-4.207*	-0.117	-0.307
SCM2	1	7	-0.209	-1.100	-0.854	-2.246*
SCM3	1	7	-0.476	-2.504*	-0.556	-1.461
SCM4	1	7	-0.270	-1.420	-0.727	-1.913
SCM5	1	7	-0.281	-1.478	-0.307	-0.807
SCM6	1	7	-0.194	-1.022	-0.159	-0.419
SCM7	1	7	-0.463	-2.437*	-0.194	-0.510
SCM8	1	7	-0.109	-0.572	-0.963	-2.532*
SCM9	1	7	0.048	0.252	-0.665	-1.750
SCM10	1	7	0.033	0.175	-0.442	-1.163
SCM11	1	7	-0.111	-0.586	-0.482	-1.269
SCM12	1	7	-0.349	-1.836	-0.912	-2.398*
SCM13	1	7	-0.491	-2.584*	-0.278	-0.730
SCM14	1	7	-0.014	-0.076	-0.786	-2.068*
sCM15	1	7	0.091	0.476	-0.729	-1.916
SCM16	1	7	-0.247	-1.298	-0.602	-1.583
SCM17	1	7	-0.144	-0.757	-0.321	-0.844
SCM18	1	7	-0.602	-3.167*	-0.111	-0.292
LP1	2	7	-0.430	-2.263*	-0.298	-0.782
LP2	2	7	-0.662	-3.481*	0.037	0.096
LP3	2	7	-0.844	-4.440*	0.248	0.652
LP4	1	7	-0.685	-3.603*	0.258	0.679
LP5	1	7	-0.332	-1.746	-0.575	-1.512
SCA1	1	7	-0.091	-0.476	-0.586	-1.542

Variable	Range		Skewness		Kurtosis	
	Min.	Max.	Statistic	Critical Ratio	Statistic	Critical Ratio
SCA2	1	7	-0.459	-2.415*	0.221	0.582
SCA3	1	7	-0.545	-2.866*	0.152	0.401
SCA4	1	7	-0.656	-3.449*	0.110	0.289
SCA5	2	7	-0.509	-2.677*	-0.358	-0.941
SCA6	2	7	-0.265	-1.396	-0.581	-1.527
SCA7	1	7	-0.545	-2.865*	-0.380	-0.998
SCA8	2	7	-0.400	-2.102*	-0.650	-1.710
SCA9	1	7	-0.367	-1.930	-0.607	-1.596
SCA10	2	7	-0.139	-0.733	-0.760	-1.999*
GSP1	1	7	-0.141	-0.740	-0.567	-1.492
GSP2	1	7	-0.151	-0.796	-0.536	-1.409
GSP3	1	7	-0.107	-0.563	-0.649	-1.708
GSP4	1	7	-0.158	-0.830	0.054	0.143
GSP5	1	7	-0.222	-1.168	-0.058	-0.153
Multivariate					317.953	27.332*

* $p < 0.05$

Regarding non-normality, authors have recommended several remedies such as item parcels, transformations, asymptotically distribution free (ADF) estimator and bootstrapping. Among them the bootstrapping procedure has been recommended as an adequate approach (Arbuckle and Wothke, 1999; Byrne, 2001; West *et al.*, 1995). Byrne (2001) has stated that bootstrapping provides a mechanism for remedying the problems of non-normality or small sampling. Hair *et al.* (1998) have explained four steps of bootstrapping as follows. "Firstly, the original sample is designed to act as the population for sampling purposes. Secondly, the original sample is resampled a specified number of times (up to thousands of times) to generate a large number of new samples, each a random subset of the original sample. Thirdly, the model is estimated for each new sample and the estimated parameters are saved. Lastly, the final parameter estimates are calculated as the average of the parameter estimates across all of the samples. The important point is that a confidence interval is not estimated by sampling error, but instead is directly observed by examining the actual distribution of the parameter estimates around the mean. Therefore, the final parameter estimates and their confidence estimates are derived directly from multiple model estimations across separate samples and do not rely on assumptions as to the statistical distribution of the parameters." The current study employs the bootstrapping approach for remedying non-normality problems detected above.

6.2. Item and Scale Purification: Exploratory Factor Analysis

In this section, exploratory factor analysis (EFA) was employed to determine how and to what extent the observed variables are linked to their underlying factors: (1) 14 observed variables for information and strategic planning capabilities (i.e. two antecedents of integrated logistics and SCM); (2) 18 items for the integrated logistics and SCM capability (core competency); and (3) 20 indexes representing logistics performance, global sourcing performance and sustainable competitive advantage. Principle components analysis with varimax rotation was adopted for identifying the minimal number of factors that underlie co-variation among the observed variables. In the current study, any factor loading smaller than 0.4 was deleted as recommended by Hair *et al.* (1998). The EFA was conducted for both the Global Sourcing Excluded (GSE) model and the Global Sourcing Included (GSI) model respectively.

6.2.1. Global Sourcing Excluded Model

Firstly, concerning information and strategic planning capabilities, two latent variables were identified and found to account for approximately 65% of total variance based on the 14 significant observed variables larger than 0.4 (see Table 6.4). Specifically, two observed variables selected to measure strategic planning formality (SP1 and SP2) were identified possessing higher correlations with 7 information capability items than other strategic planning ones. The two latent variables identified were labelled according to the loaded items as 'Information and Planning Formality (IPF)' and 'Strategic Planning (SP)'.

Table 6.4. Exploratory Factor Analysis of Information and Strategic Planning Capabilities in the GSE Model

Items		Component	
		1	2
Information and Planning Formality (IPF)	Info4	0.843	
	Info3	0.795	
	Info7	0.774	
	Info2	0.757	
	Info5	0.739	
	SP1	0.681	
	SP2	0.641	
	Info1	0.607	
	Info6	0.595	

Items		Component	
		1	2
Strategic Planning (SP)	SP4		0.797
	SP5		0.795
	SP3		0.717
	SP6		0.696
	SP7		0.589
Eigenvalues		8.036	1.128
% of Variance		57.402	8.059
Cumulative %		57.402	65.460

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.934

Secondly, EFA of the items for the integrated logistics and SCM capability identified three latent variables accounting for approximately 65% of total variance based on the 17 significant observed variables except for one item (SCM5: flexible modification of the order size, volume, composition to key suppliers) less than 0.4 (see Table 6.5). Specifically, 4 items which had been classified as 'customer integration' through the literature review in Chapter 2 were allocated into internal integration and inbound/outbound logistics integration – 2 items representing customer relationship (SCM12: formal measurement of customer satisfaction; SCM13: maintenance of a high level of communication with customers) were identified as possessing high correlation with 4 internal integration items whilst the other 2 items representing customer service (SCM10: discrimination of logistics service strategies for different customers; SCM11: utilisation of flexible programmes providing special services for changing customer requirements) were identified as possessing higher correlation with inbound/outbound logistics integration items. This re-categorisation seems understandable since the two customer relationship items are basic and essential for planning, manufacturing, sales and marketing and thus could be involved in cross department tasks; in addition, the two customer service items could be related to logistics activities. Together with those items, one index chosen for inbound/outbound logistics integration (SCM18: increase of long-term agreements with logistics service providers) was allocated into supplier integration, which was understood as meaningful because logistics service providers could be recognised as one of the suppliers. The three latent variables identified were labelled according to the loaded items as 'Supplier Integration (SI)', 'Internal Integration and Customer Relationship (IICR)' and 'Logistics Integration and Customer Service (LICS)'.

Table 6.5. Exploratory Factor Analysis of Integrated Logistics and SCM Capabilities in the GSE Model

Items		Component 1	Component 2	Component 3
Supplier Integration (SI)	SCM3	0.839		
	SCM2	0.787		
	SCM4	0.739		
	SCM1	0.616		
	SCM18	0.535		
Internal Integration and Customer Relationship (IICR)	SCM13		0.716	
	SCM7		0.702	
	SCM12		0.668	
	SCM8		0.650	
	SCM6		0.621	
	SCM9		0.581	
Logistics Integration and Customer Service (LICS)	SCM15			0.830
	SCM10			0.746
	SCM16			0.734
	SCM14			0.710
	SCM17			0.665
	SCM11			0.591
Eigenvalues		8.627	1.358	1.039
% of Variance		50.745	7.991	6.112
Cumulative %		50.745	58.736	64.848

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.921

Finally, EFA of the performance indexes was conducted; however the 5 logistics performance indexes and 10 sustainable competitive advantage indexes were not mixed because these indexes should be identified independently to estimate the impact of integrated logistics and SCM on these different performance fields. The EFA of logistics performance identified just one component with the 5 significant observed variables whilst the EFA of sustainable competitive advantage identified two latent variables accounting for approximately 70% of total variance based on the 10 significant observed variables (see Table 6.6). The two latent variables identified were labelled according to the characteristics of loaded items as 'Sustainable Competitive Advantage (SCA)' and 'Competitive Position in the Market (CPM)'.

Table 6.6. Exploratory Factor Analysis of Sustainable Competitive Advantage in the GSE Model

Items		Component 1	Component 2
Sustainable Competitive Advantage (SCA)	SCA3	0.859	
	SCA2	0.826	
	SCA4	0.800	
	SCA7	0.740	
	SCA6	0.730	
	SCA5	0.711	
	SCA1	0.547	
Competitive Position in the Market (CPM)	CPM2 (SCA9)		0.880
	CPM3 (SCA10)		0.850
	CPM1 (SCA8)		0.754
Eigenvalues		5.872	1.171
% of Variance		58.720	11.710
Cumulative %		58.720	70.430

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.891

6.2.2. Global Sourcing Included Model

Firstly, EFA of the information and strategic planning capabilities shows very similar results to the previous analysis for the GSE model – two latent variables were identified and accounted for approximately 70% of total variance based on the 14 significant observed variables (see Table 6.7); in addition, two observed variables selected to measure strategic planning formality (SP1 and SP2) were identified as possessing higher correlations with 7 information capability items than other strategic planning ones. Accordingly, the two latent variables identified were also labelled as 'Information and Planning Formality (IPF)' and 'Strategic Planning (SP)'.

Table 6.7. Exploratory Factor Analysis of Information and Strategic Planning Capabilities in the GSI Model

Items		Component 1	Component 2
Information and Planning Formality (IPF)	Info4	0.846	
	Info2	0.802	
	Info3	0.800	
	Info7	0.765	
	Info5	0.742	
	SP1	0.692	
	SP2	0.686	
	Info1	0.635	
	Info6	0.585	

Items		Component	
		1	2
Strategic Planning (SP)	SP4		0.805
	SP5		0.780
	SP3		0.742
	SP6		0.712
	SP7		0.598
Eigenvalues		8.200	1.172
% of Variance		58.572	8.368
Cumulative %		58.572	66.940

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.934

Secondly, EFA of the items for the integrated logistics and SCM capability also represents almost the same results of the former analysis in the GSE model. Three latent variables were identified and accounted for approximately 66% of total variance based on the 17 significant observed variables except for one item (SCM5: flexible modification of the order size, volume, composition to key suppliers) (see Table 6.8). As with the former EFA for the integrated logistics and SCM capability, 2 items representing customer relationship (SCM12: formal measurement of customer satisfaction; SCM13: maintenance of a high level of communication with customers) were identified as possessing high correlation with 4 internal integration items whilst the other 2 items representing customer service (SCM10: discrimination of logistics service strategies for different customers; SCM11: utilisation of flexible programmes providing special services for changing customer requirements) were identified as possessing higher correlation with inbound/outbound logistics integration items. In addition, one item chosen for inbound/outbound logistics integration (SCM18: increase of long-term agreements with logistics service providers) was allocated into supplier integration. Therefore, the three latent variables were labelled with the same titles to the previous model – 'Supplier Integration (SI)', 'Internal Integration and Customer Relationship (IICR)' and 'Logistics Integration and Customer Service (LICS)'.

Table 6.8. Exploratory Factor Analysis of Integrated Logistics and SCM Capabilities in the GSI Model

Items		Component 1	Component 2	Component 3
Supplier Integration (SI)	SCM3	0.838		
	SCM2	0.817		
	SCM4	0.753		
	SCM1	0.610		
	SCM18	0.531		
Internal Integration and Customer Relationship (IICR)	SCM7		0.758	
	SCM8		0.695	
	SCM6		0.646	
	SCM13		0.596	
	SCM12		0.593	
	SCM9		0.542	
Logistics Integration and Customer Service (LICS)	SCM15			0.814
	SCM16			0.770
	SCM10			0.753
	SCM14			0.716
	SCM17			0.705
	SCM11			0.624
Eigenvalues		8.791	1.406	1.015
% of Variance		51.709	8.271	5.973
Cumulative %		51.709	59.981	65.953

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.915

Finally, three independent EFA of logistics performance indexes, global sourcing indexes and sustainable competitive advantage indexes were conducted. The EFA of logistics performance identified just one component with the 5 significant observed variables and EFA of global sourcing performance also identified only one factor with the 5 significant observed variables. However, almost the same as with the former analysis for the GSE model, the EFA of sustainable competitive advantage identified two latent variables accounted for approximately 71% of total variance based on the 10 significant observed variables (see Table 6.9). Thus, the two latent variables identified were also labelled as 'Sustainable Competitive Advantage (SCA)' and 'Competitive Position in the Market (CPM)'.

Table 6.9. Exploratory Factor Analysis of Sustainable Competitive Advantage in the GSI Model

Items		Component 1	Component 2
Sustainable Competitive Advantage (SCA)	SCA3	0.852	
	SCA4	0.847	
	SCA2	0.811	
	SCA6	0.732	
	SCA7	0.720	
	SCA5	0.715	
	SCA1	0.535	
Competitive Position in the Market (CPM)	CPM2 (SCA9)		0.888
	CPM3 (SCA10)		0.864
	CPM1 (SCA8)		0.750
Eigenvalues		5.790	1.270
% of Variance		57.895	12.697
Cumulative %		57.895	70.592

Kaiser-Meyer-Olkin Measure of Sampling Adequacy: 0.880

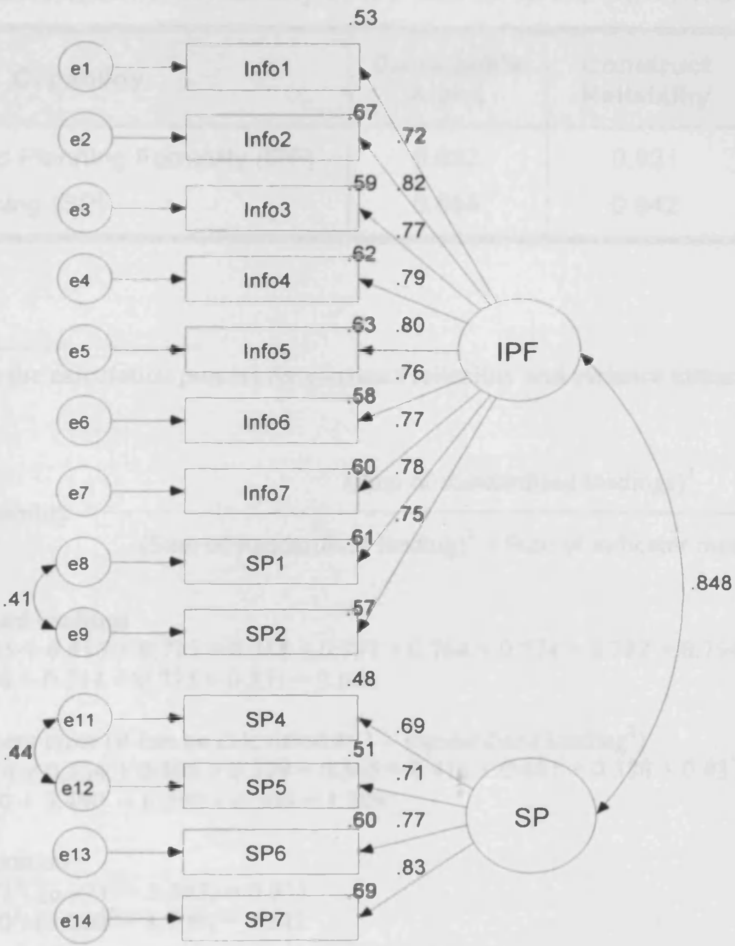
6.3. Measurement Model: Validity and Reliability

In this section, the validity and reliability tests are conducted using confirmatory factor analysis (CFA) for the GSE model and GSI model respectively. These tests are implemented for the three measurement models – information and strategic planning capabilities, integrated logistics and SCM capability and performance. For the validity and reliability tests, covariance matrices including all the observed variables are used as the input data (see Appendix H).

6.3.1. Global Sourcing Excluded Model

Firstly, a two-factor model composed of IPF (Information and Planning Formality) and SP (Strategic Planning) was tested to confirm the validity and reliability of these two constructs (see Figure 6.2). The two factors are inter-correlated, as indicated by the two-headed arrows. In addition, referring to the modified index, two error covariances between SP1 and SP2 and between SP4 and SP5 are applied to increase the model fit. The error covariances could be meaningful since those indicators are multi-measures for the same observed variables; i.e. SP1 (a formal planning system for the design of operating systems) and SP2 (a formal evaluation system for financial and logistical performance) measure the strategic planning formality and SP4 (a continual planning process incorporating feedback) and SP5 (planning process evaluating environmental constraints, firm resources and organisational goals) measure the strategic planning process. The minimum requirements for model identification are satisfied and bootstrapping is successful.

Figure 6.2. Measurement Model for Information and Strategic Planning Capability in the GSE Model



Following the analytical steps explained in Figure 6.1, unidimensionality and convergent validity are assessed by fit index, standardised residuals, factor loadings (λ) and t-value. Notably, one indicator (i.e. SP3: a decision making process based on total cost measurement) was deleted since the factor loading was less than 0.7. Except for this item, all the factor loadings (λ) are greater than 0.7 and their t-values are significant at 0.001 level. In addition, the criteria of fit indexes are satisfied (i.e. CFI = 0.930, TLI = 0.912, RMSEA = 0.101). Therefore, unidimensionality and convergent validity are satisfied. Reliability can be assessed by R^2 (item reliability), Cronbach's alpha and construct reliability/ variance extracted (scale reliability). Firstly, all the R^2 (the squared multiple correlations) values are greater than 0.5, thus item reliability is satisfied. Table 6.10 shows that scale reliability is verified because the values of Cronbach's alpha for the two factors are larger than 0.8 and all the values of construct reliability are greater than 0.7, in addition, all the values of variance extracted are greater than 0.5[1].

Table 6.10. Assessment of Reliability of IPF and SP in the GSE Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Information and Planning Formality (IPF)	0.932	0.931	0.601
Strategic Planning (SP)	0.855	0.842	0.573

[1] The following is the calculation process for construct reliability and variance extracted for IPF and SPP.

$$1)\ \text{Construct Reliability} = \frac{(\text{Sum of standardised loadings})^2}{(\text{Sum of standardised loading})^2 + \text{Sum of indicator measurement error}}$$

Sum of standardised loadings
IPF factors = 0.725 + 0.816 + 0.771 + 0.788 + 0.797 + 0.764 + 0.774 + 0.782 + 0.754 = 6.971
SP factors = 0.700 + 0.714 + 0.775 + 0.831 = 3.020

Sum of measurement error (it can be calculated as 1 – standardised loading^2)
IPF factors = 0.474 + 0.334 + 0.406 + 0.379 + 0.365 + 0.416 + 0.401 + 0.388 + 0.431 = 3.595
SP factors = 0.510 + 0.490 + 0.399 + 0.309 = 1.709

Reliability Computation
IPF factors = $6.971^2/ (6.971^2 + 3.595) = 0.931$
SP factors = $3.020^2/ (3.020^2 + 1.709) = 0.842$

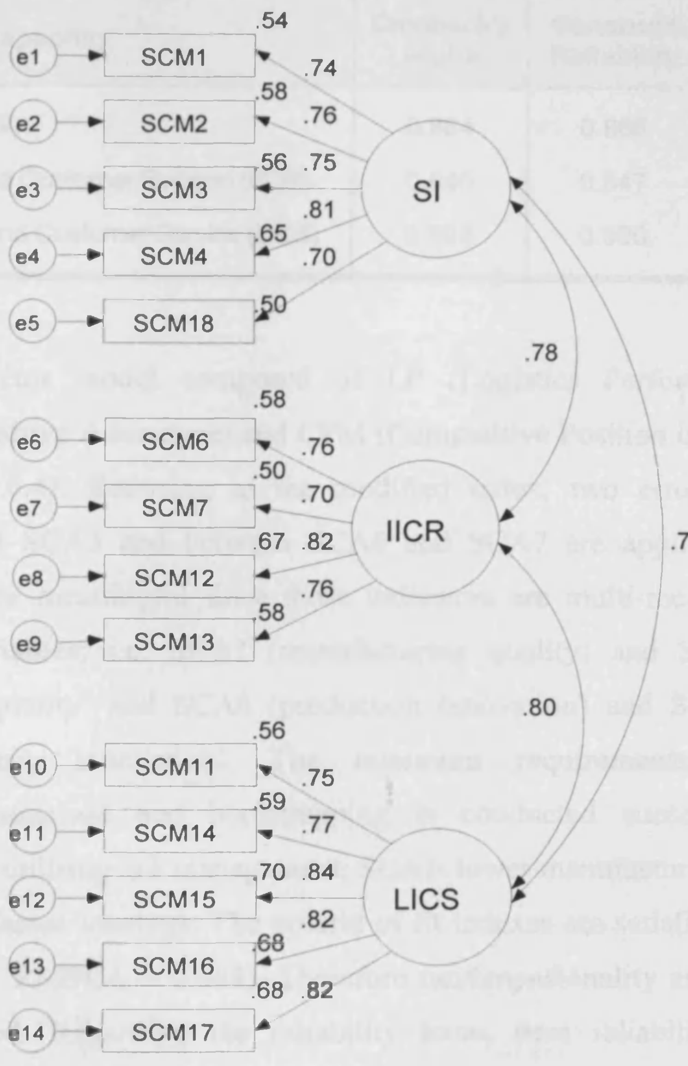
$$2)\ \text{Variance Extracted} = \frac{\text{Sum of squared standardised loadings}}{\text{Sum of squared standardised loadings} + \text{Sum of indicator measurement error}}$$

Sum of squared standardised loadings
IPF factors = $0.725^2 + 0.816^2 + 0.771^2 + 0.788^2 + 0.797^2 + 0.764^2 + 0.774^2 + 0.782^2 + 0.754^2 = 5.405$
SP factors = $0.700^2 + 0.714^2 + 0.775^2 + 0.831^2 = 2.291$

Variance Extracted Computation
IPF factors = 5.405/ (5.405 + 3.595) = 0.601
SP factors = 2.291/ (2.291 + 1.709) = 0.573

Secondly, a three-factor model composed of SI (Supplier Integration), IICR (Internal Integration and Customer Relation) and LICS (Logistics Integration and Customer Service) was tested by CFA (see Figure 6.3).

Figure 6.3. Measurement Model for Integrated Logistics and SCM Capability in the GSE Model



The minimum requirements for model identification are satisfied and bootstrapping is conducted successfully. Three indicators (i.e. SCM8: reduction of formal organisational structure; SCM9: operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation; SCM10: discrimination of logistics service strategies for different customers) were deleted because their factor loadings were less than 0.7. In addition, the criteria of fit indexes are satisfied (i.e. CFI = 0.926, TLI = 0.909, RMSEA = 0.093). Therefore unidimensionality and convergent validity are satisfied. Concerning reliability, item reliability and scale reliability are verified (see Table 6.11).

Table 6.11. Assessment of Reliability of SI, IICR and LICS in the GSE Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Supplier Integration (SI)	0.864	0.866	0.564
Internal Integration and Customer Relation (IICR)	0.845	0.847	0.581
Logistics Integration and Customer Service (LICS)	0.898	0.900	0.643

Finally, a three-factor model composed of LP (Logistics Performance), SCA (Sustainable Competitive Advantage) and CPM (Competitive Position in Market) was tested (see Figure 6.4). Referring to the modified index, two error covariances between SCA2 and SCA3 and between SCA6 and SCA7 are applied. The error covariances could be meaningful since those indicators are multi-measures for the same observed variables; i.e. SCA2 (manufacturing quality) and SCA3 (design quality) measure 'quality' and SCA6 (production innovation) and SCA7 (process innovation) measure 'innovation'. The minimum requirements for model identification are satisfied and bootstrapping is conducted successfully. Two indicators (i.e. LP5: utilising JIT management; SCA1: lower manufacturing cost) were deleted due to low factor loadings. The criteria of fit indexes are satisfied (i.e. CFI = 0.952, TLI = 0.937, RMSEA = 0.088). Therefore unidimensionality and convergent validity are satisfied. Regarding the reliability issue, item reliability and scale reliability are verified (see Table 6.12).

Figure 6.4. Measurement Model for Logistics Performance and Competitive Advantage in the GSE Model

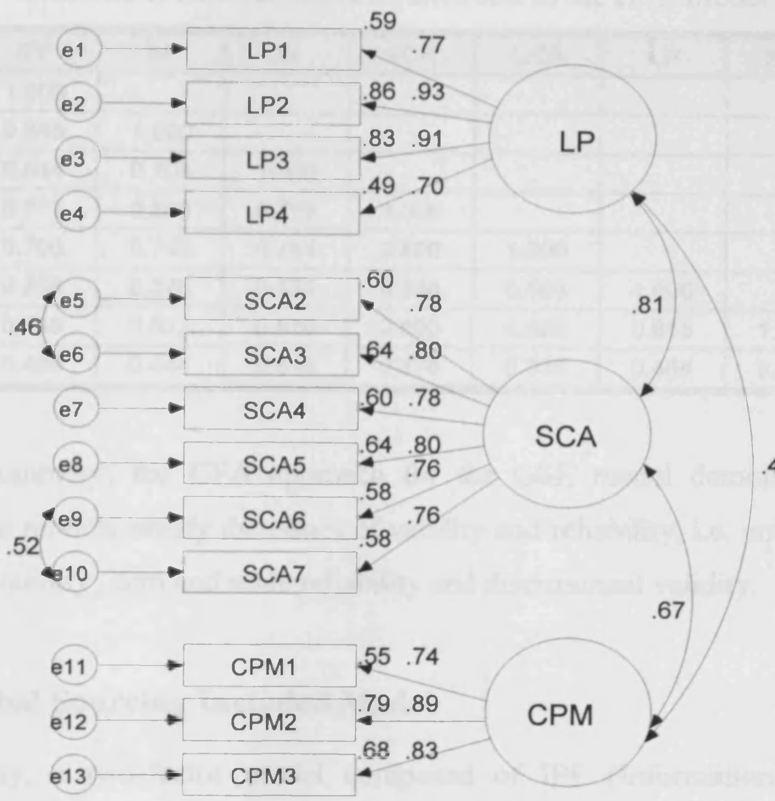


Table 6.12. Assessment of Reliability of LP, SCA and CPM in the GSE Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Logistics Performance (LP)	0.891	0.898	0.690
Sustainable Competitive Advantage (SCA)	0.912	0.903	0.608
Competitive Position in Market (CPM)	0.853	0.860	0.673

After the test of unidimensionality, convergent validity and reliability, the final step is to establish the level of discriminant validity between the multi-measures composing the latent constructs. The initial method of assessing discriminant validity is to examine the intercorrelations among the 8 constructs purified by EFA and confirmed by CFA. A correlation matrix in Table 6.13 shows that most of the correlation coefficients do not exceed the cut-off point of 0.85 suggested by Kline (1998), which means that the discriminant validity among the 8 factors examined in the current study is initially supported.

Table 6.13. Correlations between Latent Constructs in the GSE Model

	IPF	SP	SI	IICR	LICS	LP	SCA	CPM
IPF	1.000							
SP	0.848	1.000						
SI	0.644	0.708	1.000					
IICR	0.617	0.806	0.779	1.000				
LICS	0.706	0.785	0.744	0.808	1.000			
LP	0.258	0.378	0.431	0.538	0.503	1.000		
SCA	0.440	0.522	0.576	0.690	0.628	0.815	1.000	
CPM	0.408	0.444	0.448	0.378	0.336	0.464	0.675	1.000

In summary, the CFA approach for the GSE model demonstrates that the measurement models satisfy the issues of validity and reliability, i.e. unidimensionality, convergent validity, item and scale reliability and discriminant validity.

6.3.2. Global Sourcing Included Model

Firstly, a two-factor model composed of IPF (Information and Planning Formality) and SP (Strategic Planning) was tested to confirm the validity and reliability of these two constructs (see Figure 6.5). As with the case of the GSE model, an error covariance between SP1 and SP2 was applied. The minimum requirements for model identification are satisfied and bootstrapping is successfully conducted. Notably, two indicators (i.e. SP3: a decision making process based on total cost measurement; SP4: a continual planning process incorporating feedback) were deleted because the factor loadings were less than 0.7. Except for these items, all the factor loadings (λ) are greater than 0.7 and their t-values are significant at 0.001 level. In addition, the criteria of fit indexes are marginally satisfied (i.e. CFI = 0.925, TLI = 0.904, RMSEA = 0.112). Therefore unidimensionality and convergent validity are satisfied. Reliability can be assessed by R^2 (item reliability), Cronbach's alpha and construct reliability/ variance extracted (scale/construct reliability). The item reliability is satisfied and scale reliability is also verified (see Table 6.14).

Figure 6.5. Measurement Model for Information and Strategic Planning Capability in the GSI Model

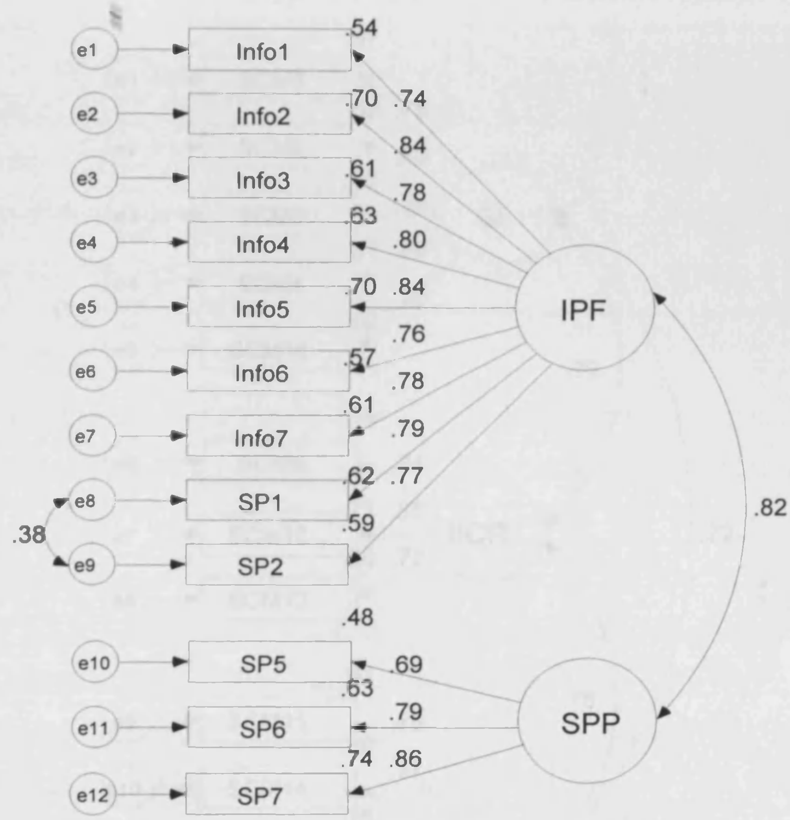
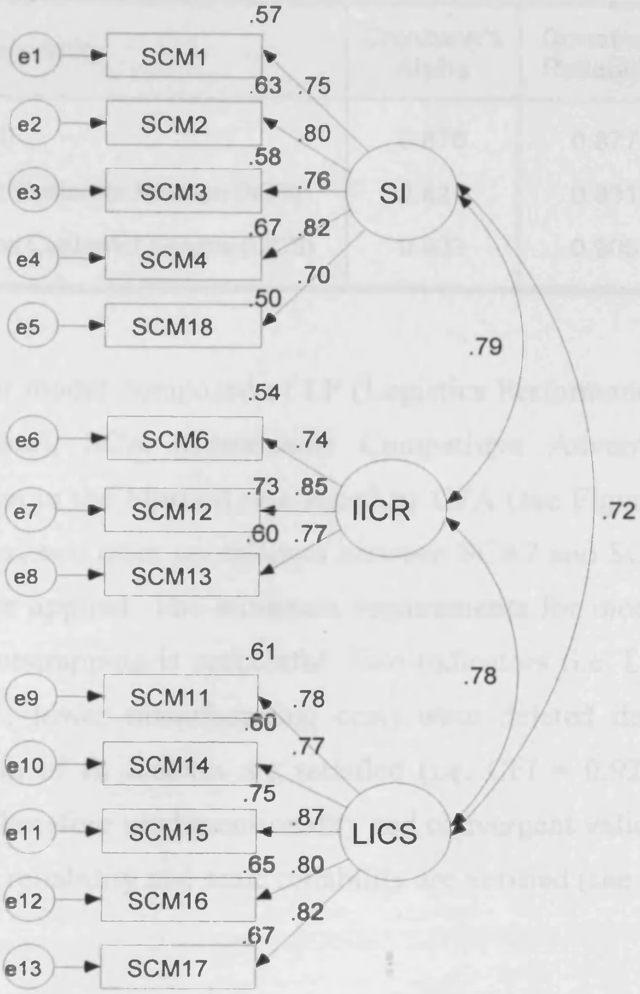


Table 6.14. Assessment of Reliability of IPF and SP in the GSI Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Information and Planning Formality (IPF)	0.936	0.936	0.620
Strategic Planning (SP)	0.821	0.826	0.615

Secondly, a three-factor model composed of SI (Supplier Integration), IICR (Internal Integration and Customer Relation) and LICS (Logistics Integration and Customer Service) was tested (Figure 6.6).

Figure 6.6. Measurement Model for Integrated Logistics and SCM Capability in the GSI Model



The minimum requirements for model identification are satisfied and bootstrapping is successful. Similar to the case of the GSE model, four indicators (i.e. SCM7: adherence to established operational and administrative policies and procedures; SCM8: reduction of formal organisational structure; SCM9: operation of active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation; SCM10: discrimination of logistics service strategies for different customers) were discarded because their factor loadings were less than 0.7. In addition, the criteria of fit indexes are marginally satisfied (i.e. CFI = 0.925, TLI = 0.905, RMSEA = 0.101). Therefore unidimensionality and convergent validity are satisfied. Concerning the reliability, item reliability and scale reliability are verified (see Table 6.15).

Table 6.15. Assessment of Reliability of SI, IICR and LICS in the GSI Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Supplier Integration (SI)	0.876	0.877	0.588
Internal Integration and Customer Relation (IICR)	0.824	0.831	0.623
Logistics Integration and Customer Service (LICS)	0.903	0.905	0.656

Finally, a four-factor model composed of LP (Logistics Performance), GSP (Global sourcing Performance), SCA (Sustainable Competitive Advantage) and CPM (Competitive Position in the Market) was tested by CFA (see Figure 6.7). Referring to the modified index, two error covariances between SCA2 and SCA3 and between SCA6 and SCA7 are applied. The minimum requirements for model identification are satisfied and bootstrapping is successful. Two indicators (i.e. LP5: utilising JIT management; SCA1: lower manufacturing cost) were deleted due to low factor loadings. The criteria of fit indexes are satisfied (i.e. CFI = 0.921, TLI = 0.904, RMSEA = 0.095). Therefore unidimensionality and convergent validity are satisfied. In addition, the item reliability and scale reliability are verified (see Table 6.16).

Figure 6.7. Measurement Model for Logistics Performance, Global Sourcing Performance and Competitive Advantage in the GSI Model

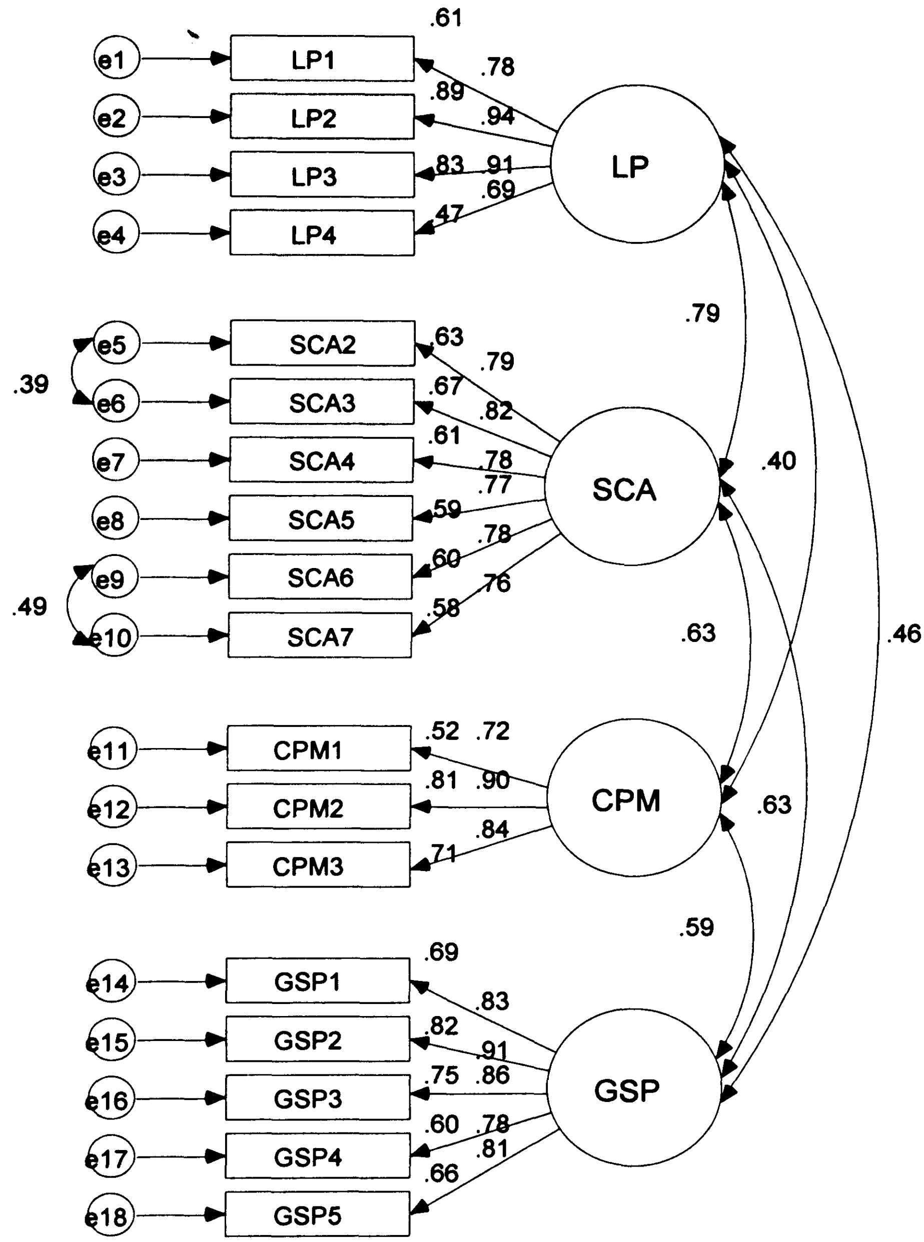


Table 6.16. Assessment of Reliability of LP, SCA and CPM in the GSI Model

Capability	Cronbach's Alpha	Construct Reliability	Variance Extracted
Logistics Performance (LP)	0.893	0.904	0.704
Sustainable Competitive Advantage (SCA)	0.912	0.905	0.614
Competitive Position in Market (CPM)	0.856	0.864	0.681
Global Sourcing Performance (GSP)	0.922	0.922	0.704

Concerning discriminant validity, the correlations coefficient among the 9 constructs do not exceed the cut-off point of 0.85; therefore, discriminant validity is initially supported.

Table 6.17. Correlations between Latent Constructs in the GSI Model

	IPF	SP	SI	IICR	LICS	LP	SCA	CPM	GSP
IPF	1.000								
SP	0.830	1.000							
SI	0.613	0.686	1.000						
IICR	0.595	0.751	0.802	1.000					
LICS	0.706	0.756	0.719	0.801	1.000				
LP	0.251	0.335	0.456	0.504	0.495	1.000			
SCA	0.432	0.486	0.589	0.701	0.642	0.785	1.000		
CPM	0.451	0.475	0.475	0.377	0.347	0.404	0.624	1.000	
GSP	0.613	0.646	0.603	0.608	0.632	0.460	0.621	0.592	1.000

In summary, the CFA approach for the GSI model demonstrates that the modified measurement models satisfy the issues of validity and reliability, i.e. unidimensionality, convergent validity, item and scale reliability and discriminant validity.

6.4. Structural Model

In this section, the hypothesised relationships between latent variables were tested using structural Models. It should be noted that 10 competitive advantage items were categorised into two constructs (i.e. sustainable competitive advantage and competitive position in the market) through EFA and confirmed by CFA in the previous section. Therefore, the five hypotheses initially proposed in Chapter 3 were adjusted to involve the new relationships caused by those constructs. One important point is that it was assumed that the sustainable competitive advantage might be revealed by their competitive position in the market places. The revised hypotheses are as follows.

***Hypothesis** 1*: Information capability has a positive influence on strategic planning capability and integrated logistics and supply chain management capability.

***Hypothesis** 2*: Strategic planning capability has a positive influence on integrated logistics and supply chain management capability.

Hypothesis 3: Integrated logistics and supply chain management capability has a positive influence on logistics performance, global sourcing performance, sustainable competitive advantage and competitive position in the market.

Hypothesis 4a: Superior logistics performance and/or global sourcing performance exert a positive influence on a firm's sustainable competitive advantage and its competitive position in the market.

Hypothesis 4b: Logistics performance has a positive influence on global sourcing performance while sustainable competitive advantage has a positive influence on competitive position in the market.

Before the main analysis, it should be noted that some observed variables presented in the measurement model in the previous section were summed and transformed into arithmetic average values in the structural model in order to avoid complexity and multicollinearity problems. For instance, initially there are 9 measurements for 'Information and Planning Formality (IPF)' and 5 measurements for 'Strategic Planning (SP)'. However, as shown in Table 6.18 (also see Table 4.2 in Chapter 4), the 9 indicators for IPF can be reduced into 4 observed variables (i.e. Information Technology; Information Contents; Information Sharing; and Strategic Planning Formality), and the 5 indicators for SP can also be simplified to 2 observed variables (i.e. Strategic Planning Process; and Strategic Planning Sharing) since those items are the multi-measures for a specific observed variable. For example, the first two measurements in Table 6.18 (continual investment in IT; tailored information system for SCM) are multi-measures for the Information Technology and thus their mean score can be used for the observed value of information technology. For the same reason, the observed values of 'Responsiveness' among logistics performance index and 'Quality', 'Flexibility' and 'Innovation' in sustainable competitive advantage index were substituted with the arithmetic average values of their multi-measures. This simplification can be reasonable as the error covariances between those items were adopted in the measurement models. Table 6.18 presents the final version of constructs and observed variables purified by EFA and confirmed through the CFA approach. For the structural models, covariance matrices including the simplified observed variables are employed as the input data (see Appendix I).

Table 6.18. Construct and Observed Variables in Structural Model

Category	Construct	Observation variable (Indicator)	
Antecedents for Integrated Logistics and SCM	Information and Planning Formality (IPF)	Information Technology (IT)	• Continual investments in IT • Tailored information system for SCM
		Information Contents (IC)	• Usefulness of strategy-related information • Usefulness of manufacturing related information • Usefulness of logistics related information
		Information Sharing (IS)	• Design of information system for the information sharing between departments • Design of information system for the information sharing with suppliers/customers
		Strategic Planning Formality (SPF)	• A formal planning system for the design of operating system • A formal evaluation system for financial and logistical Performance
	Strategic Planning (SP)	Strategic Planning Process (SPP)	• A decision making process based on total cost measurement • A continual planning process incorporating feedback • Planning process evaluating environmental constraints, firm resources and organisational goals
		Strategic Planning Sharing (SPS)	• Participation of all functional staff in strategy development • Integration of logistics strategy with other strategic plans
Integrated Logistics and SCM	Supplier Integration (SI)	• Increase of long-term agreements with key suppliers **(SCM1)** • Sharing of technical resources, R&D costs with key suppliers **(SCM2)** • Key suppliers' participation in the development and design of new products **(SCM3)** • Formal evaluation of suppliers' performance **(SCM4)** • Increase of long-term agreements with logistics service providers **(SCM18)**	
	Internal Integration and Customer Relationship (IICR)	• Establishment of cross functional policies and procedures **(SCM6)** • Adherence to established operational and administrative policies and procedures **(SCM7)** • Formal measurement of customer satisfaction **(SCM12)** • Maintenance of a high level of communication with customers **(SCM13)**	
	Logistics Integration and Customer Service (LICS)	• Utilisation of flexible programmes providing special services for changing customer requirements **(SCM11)** • Integrated logistical operations under single control **(SCM14)** • Utilisation of total transportation chain performance measurement **(SCM15)** • Flexible multimodal transportation management **(SCM16)** • Coordination of inbound/outbound transportation **(SCM17)**	
Performance	Logistics Performance (LP)	• Meeting accurately quoted or anticipated delivery dates and quantities on a consistent basis (Reliability) **(RELIA)**	
		Responsiveness (RESP)	• Responding promptly to the needs and wants of key customers • Being flexible in terms of accommodating customers' special requests
		• Notifying customers in advance of delivery delays or product shortages (Pre-notification) **(PRNO)**	
	Global Sourcing Performance (GSP)	• Achieving lower factor cost (comparative advantage) **(LFC)** • Access to advanced production technologies **(APT)** • Penetrating local markets **(PLM)** • Reducing time delays involved in waiting for local suppliers to provide the requisite components **(RTD)** • Reducing local disadvantages/difficulties **(RLD)**	

Category	Construct	Observation variable (Indicator)	
	Sustainable Competitive Advantage **(SCA)**	Quality **(QUAL)**	• Meeting customer's expectation for manufacturing quality • Meeting customer's expectation for design quality
		Flexibility **(FLEX)**	• Flexibility in production volume, changeover, modification • Ability to deal with unexpected events
		Innovation **(INNO)**	• Product innovation level in the product • Process innovation level in the product
	Competitive Position in Market **(CPM)**	• Market share **(MS)** • Sales growth rate compared to competitors **(SGRC)** • Sales growth rate compared to market growth rate **(SGRM)**	

Note: SCM5, SCM10, JIT management and low product cost items were deleted through CFA approach.

The following Table 6.19 provides a glossary to the abbreviations of the construct and observed variables used in the structural models.

Table 6.19. Glossary to Abbreviations used in the Structural Models

Abbreviations		Variables
GSE Model		Global Sourcing Excluded Model
GSI Model		Global Sourcing Included Model
IPF		Information and Planning Formality
	IT	Information Technology
	IC	Information Contents
	IS	Information Sharing
	SPF	Strategic Planning Formality
SP		Strategic Planning
	SPP	Strategic Planning Process
	SPS	Strategic Planning Sharing
SI		Supplier Integration
IICR		Internal Integration and Customer Relationship
LICS		Logistics Integration and Customer Service
LP		Logistics Performance
	RELIA	Reliability
	RESP	Responsiveness
	PRNO	Pre-notification
GSP		Global Sourcing Performance
	LFC	Lower Factor Cost
	APT	Access to Production Technology
	PLM	Penetrating Local Market
	RTD	Reducing Time Delay
	RLD	Reducing Local Differences
SCA		Sustainable Competitive Advantage
	QUAL	Quality
	FLEX	Flexibility
	INNO	Innovation
CPM		Competitive Position in Market
	MS	Market Share
	SGRC	Sales Growth Rate compared to Competitors
	SGRM	Sales Growth Rate compared to Market

6.4.1. Global Sourcing Excluded Model

In this subsection, the hypothesised relationships between 8 latent variables – IPF (Information and Planning Formality); SP (Strategic Planning); SI (Supplier Integration); IICR (Internal Integration and Customer Relationship); LICS (Logistics Integration and Customer Service); LP (Logistics Performance); SCA (Sustainable Competitive Advantage); and CPM (Competitive Position in the Market) – were explored. The full structural equation model is presented in Figure 6.8. The minimum requirements for model identification were satisfied and bootstrap samples were successful as well. The fit indexes (χ^2/df = 1.848, CFI = 0.923, TLI = 0.913, RMSEA = 0.66) are acceptable compared with the criteria presented in Table 4.9 in Chapter 4, implying that the estimated model is an adequately fitted model. Table 6.20 presents the parameter estimates of the full structural model in Figure 6.8.

Firstly, strategic planning (SP) is significantly predicted by information and planning formality (IPF) (0.725) and 88.1% (R^2) of the variance associated with strategic planning is accounted for by its only predictor, information and planning formality.

Secondly, supplier integration (SI) is significantly predicted by information and planning formality (-0.646) and strategic planning (1.728). However, notably, there is a negative relationship between IPF and SI, which is the opposite result to the hypothesised one. A total of 68.8% of the variance associated with supplier integration is explained by its two predictors. Internal integration and customer relationship (IICR) is also significantly predicted by information and planning formality (-1.137) and strategic planning (2.271). As with the case of supplier integration, there is a negative relationship between IPF and IICR, which is opposite to the initial anticipation. A total of 93.6% of the variance associated with internal integration and customer relation is accounted for by its two predictors. Likewise, logistics integration and customer service (LICS) is significantly predicted by information and planning formality (-0.529) and strategic planning (1.590), but there is a negative relationship between IPF and LICS. A total of 75.8% of the variance associated with logistics integration and customer service is explained by its two predictors. Concerning these unanticipated results the descriptive findings in Table 5.10 and Table 5.11 may provide a clue. The mean values of three measures of information contents (i.e. usefulness of strategy related information, 3.71;

usefulness of manufacturing related information, 3.72; and usefulness of logistics related information, 3.94) and one measure of information sharing (design of information system for the information sharing with suppliers/customers, 3.80) are below point 4 on the seven-point scale; in other words these capabilities are evaluated as unsatisfactory. In contrast, the mean values of 17 items among the 18 items of the integrated logistics and SCM capabilities are presented above point 4. These descriptive findings may imply that the two manufacturing companies have achieved satisfactory integrated SCM capability in spite of the inferior information contents and information sharing capability.

Next, logistics performance (LP) is only significantly predicted by internal integration and customer relationship (0.439) among three types of supply chain integration activities. In other words, supplier integration (SI) and logistics integration and customer service (LICS) have no significant influence on the logistics performance. 36.0% (R^2) of the variance associated with logistics performance is accounted for by its predictors. Concerning sustainable competitive advantage, the three types of integrated logistics and SCM capabilities have no significant influence; however logistics performance gives a significant impact (0.759) on sustainable competitive advantage factor. 79.7% of the variance associated with sustainable competitive advantage is accounted for by its predictors.

Finally, competitive position in the market is significantly predicted by supplier integration (0.308) and sustainable competitive advantage (1.163); however internal integration and customer relationship (IICR), logistics integration and customer service (LICS) and logistics performance (LP) have no significant effect upon the construct of competitive position in the market. A total of 54.9% of the variance associated with competitive position in the market is explained by its predictors.

In summary, of the 19 causal paths specified in the hypothesised model, the 11 hypothesised paths (IPF → SPP; IPF → SI; IPF → IICR, IPF → LICS; SPP → SI; SPP → IICR; SPP → LICS; IICR → LP; LP → SCA; SI → CPM; SCA → CPM) were found to be statistically significant although 3 paths among them (IPF → SI; IPF → IICR, IPF → LICS) showed negative signs. The other 7 hypothesised paths (SI → LP; LICS → LP; SI → SCA; IICR → SCA; LICS → SCA; IICR → CPM; LICS → CPM) appeared to be insignificant.

Figure 6.8. Structural Model and Significant Coefficients (solid lines) in the GSE Model

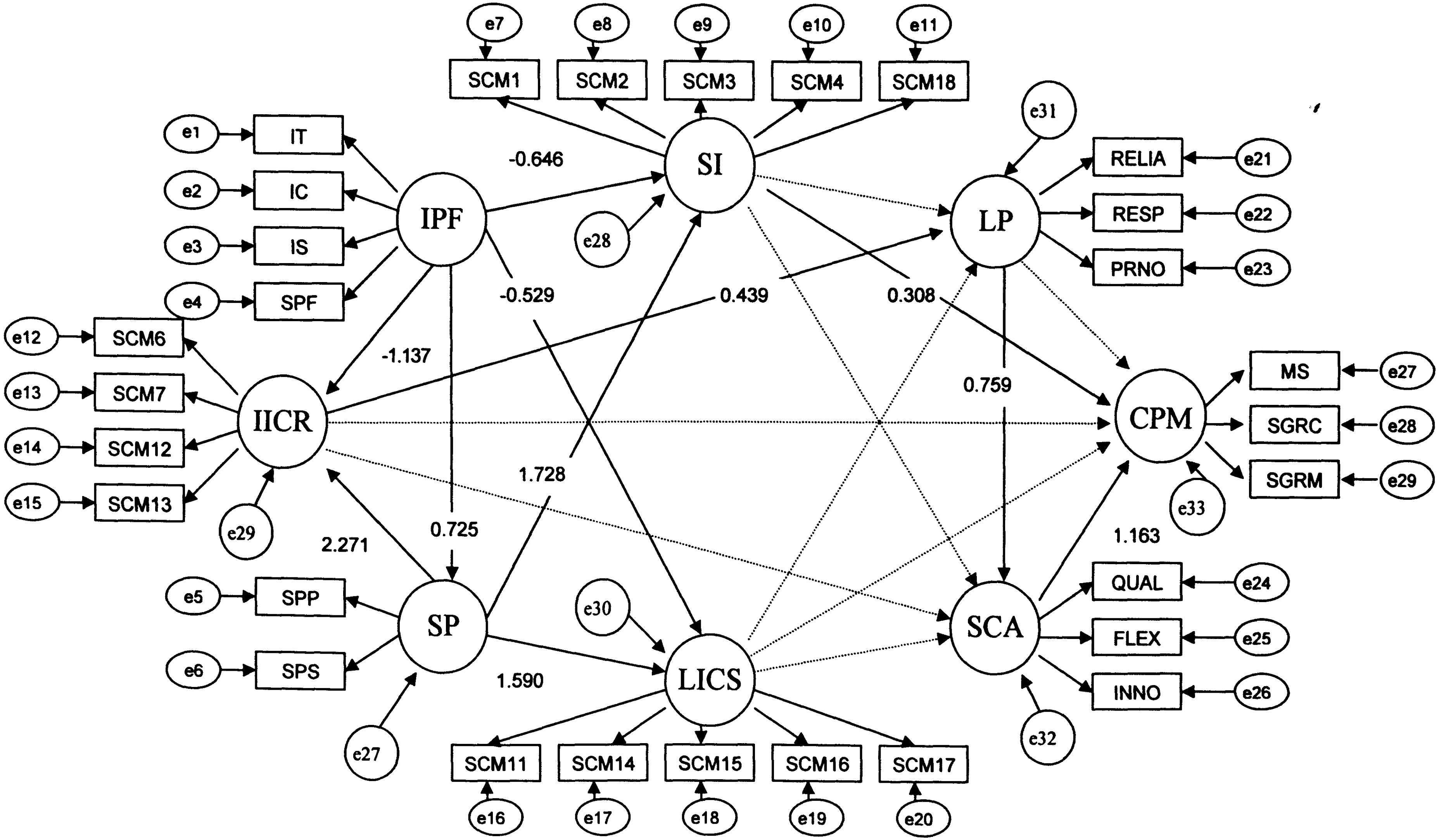


Table 6.20. Parameter Estimates of Structural Model in the GSE Model

Construct and Observed Variables			Estimate	t-value	R^2
Regression Weights (Standardised Regression Weights):					
SP (Strategic Planning)	←	IPF (Information and Planning Formality)	0.725 (0.938)	11.367***	0.881
SI (Supplier Integration)	←	IPF (Information and Planning Formality)	-0.646 (-0.703)	-2.512*	0.688
SI (Supplier Integration)	←	SP (Strategic Planning)	1.728 (1.453)	4.912***	
IICR (Internal Integration and Customer Relationship)	←	IPF (Information Planning Formality)	-1.137 (-1.390)	-3.473***	0.936
IICR (Internal Integration and Customer Relationship)	←	SP (Strategic Planning)	2.271 (2.144)	5.147***	
LICS (Logistics Integration and Customer Service)	←	IPF (Information and Planning Formality)	-0.529 (-0.611)	-2.352*	0.758
LICS (Logistics Integration and Customer Service)	←	SP (Strategic Planning)	1.590 (1.418)	5.140***	
LP (Logistics Performance)	←	SI (Supplier Integration)	-0.016 (-0.021)	-.154	0.360
LP (Logistics Performance)	←	IICR (internal Integration and Customer Relationship)	0.439 (0.508)	2.805**	
LP (Logistics Performance)	←	LICS (Logistics Integration and Customer Service)	0.105 (0.129)	.887	
SCA (Sustainable Competitive Advantage)	←	SI (Supplier Integration)	0.062 (0.075)	0.769	0.797
SCA (Sustainable Competitive Advantage)	←	IICR (Internal Integration and Customer Relationship)	0.110 (0.118)	-.887	
SCA (Sustainable Competitive Advantage)	←	LICS (Logistics Integration and Customer Service)	0.095 (0.108)	1.056	
SCA (Sustainable Competitive Advantage)	←	LP (Logistics Performance)	0.759 (0.702)	8.388***	
CPM (Competitive Position in Market)	←	SI (Supplier Integration)	0.308 (0.345)	2.468*	0.549
CPM (Competitive Position in Market)	←	IICR (Internal Integration and Customer Relationship)	-0.276 (-0.275)	-1.466	
CPM (Competitive Position in Market)	←	LICS (Logistics Integration and Customer Service)	-0.160 (-0.169)	-1.177	
CPM (Competitive Position in Market)	←	LP (Logistics Performance)	-0.421 (-0.362)	-1.820	
CPM (Competitive Position in Market)	←	SCA (Sustainable Competitive Advantage)	1.163 (1.081)	4.488***	
IT (Information Technology)	←	IPF (Information and Planning Formality)	1.000 (0.836)		0.699
IC (Information Contents)	←	IPF (Information and Planning Formality)	0.960 (0.845)	14.345***	0.714
IS (information Sharing)	←	IPF (Information and Planning Formality)	0.970 (0.851)	14.506***	0.725
SPF (Strategic Planning Formality)	←	IPF (Information and Planning Formality)	1.032 (0.841)	14.235***	0.707
SPP(Strategic Planning Process)	←	SP (Strategic Planning)	1.000 (0.756)		0.572
SPS (Strategic Planning Sharing)	←	SP (Strategic Planning)	1.074 (0.794)	11.681***	0.630
SCM1 (Increase of long-term agreements with key suppliers)	←	SI (Supplier Integration)	1.000 (0.737)		0.543
SCM2 (Sharing of technical resources with key suppliers)	←	SI (Supplier Integration)	1.046 (0.757)	10.227***	0.573

Table 6.20. Parameter Estimates of Structural Model in the GSE Model

Construct and Observed Variables			Estimate	t-value	R^2
SCM3 (Key suppliers' participation in the development and design of new products)	←	SI (Supplier Integration)	0.998 (0.743)	10.033***	0.552
SCM4 (Formal evaluation of suppliers' performance)	←	SI (Supplier Integration)	1.015 (0.807)	10.915***	0.651
SCM18 (Increase of long-term agreements with logistics service providers)	←	SI (Supplier Integration)	0.923 (0.702)	9.458***	0.492
SCM6 (Establishment of cross functional policies and procedures)	←	IICR (Internal Integration and Customer Relationship)	1.000 (0.780)		0.609
SCM7 (Adherence to established operational and administrative policies and procedures)	←	IICR (Internal Integration and Customer Relationship)	0.880 (0.712)	10.179***	0.507
SCM12 (Formal measurement of customer satisfaction)	←	IICR (Internal Integration and Customer Relationship)	1.225 (0.798)	11.681***	0.636
SCM13 (Maintenance of a high level of communication with customers)	←	IICR (Internal Integration and Customer Relationship)	1.045 (0.754)	10.874***	0.568
SCM11 (Utilisation of flexible programmes providing special services for changing customer requirements)	←	LICS (Logistics Integration and Customer Service)	1.000 (0.759)		0.576
SCM14 (Integrated logistical operations under single control)	←	LICS (Logistics Integration and Customer Service)	1.039 (0.759)	10.889***	0.576
SCM15 (Utilisation of total transportation chain performance measurement)	←	LICS (Logistics Integration and Customer Service)	1.108 (0.828)	11.449***	0.685
SCM16 (Flexible multimodal transportation management)	←	LICS (Logistics Integration and Customer Service)	1.059 (0.823)	12.037***	0.677
SCM17 (Coordination of inbound/outbound transportation)	←	LICS (Logistics Integration and Customer Service)	1.033 (0.835)	12.160***	0.698
RELIA (Reliability)	←	LP (Logistics Performance)	1.000 (0.781)		0.609
RESP (Responsiveness)	←	LP (Logistics Performance)	1.131 (0.887)	12.833***	0.787
PRNO (Pre-notification)	←	LP (Logistics Performance)	1.032 (0.746)	10.705***	0.556
QUAL (Quality)	←	SCA (Sustainable Competitive Advantage)	1.000 (0.838)		0.702
FLEX (Flexibility)	←	SCA (Sustainable Competitive Advantage)	1.027 (0.866)	14.810***	0.750
INNO (Innovation)	←	SCA (Sustainable Competitive Advantage)	1.042 (0.805)	13.268***	0.649
MS (Market Share)	←	SCA (Sustainable Competitive Advantage)	1.000 (0.741)		0.548
SGRC (Sales Growth Rate compared to Competitors)	←	SCA (Sustainable Competitive Advantage)	1.206 (0.886)	11.591***	0.784
SGRM (Sales Growth Rate compared to Market)	←	SCA (Sustainable Competitive Advantage)	1.080 (0.828)	11.124***	0.685

*** Significant at p<0.001 (t ≥±3.29)
** Significant at p<0.01 (t ≥±2.57)
* Significant at p<0.05 (t ≥±1.96)

Table 6.21 presents the direct effects determining the results of the hypotheses test, indirect effects created through mediate constructs and total effects composed of the direct and indirect effects.

Firstly, *hypothesis 1* is partially supported because there is statistically significant positive relationship between information and planning formality (IPF) and strategic planning (SP); however there exist negative relationships between information and planning formality (IPF) and the three types of logistics integration, i.e. supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS). These direct negative relationships between IPF and SI, IICR, LICS are opposite to the hypothesis; however the total effects including indirect effects through strategic planning appear positive.

Secondly, *hypothesis 2* is supported since there are significant positive relationships between strategic planning and three types of integration factors.

Thirdly, *hypothesis 3* is partially supported. Concerning the hypothesised relationships between three types of integrated logistics and SCM capabilities and logistics performance (LP), only one factor, internal integration and customer relationship (IICR) has a significant positive effect. Regarding the hypothesised relationships between three integrated logistics and SCM capabilities and sustainable competitive advantage (SCA), none of the three types of integrated logistics and SCM capabilities has a significant effect. However, supplier integration (SI) appears to have a significant positive influence upon competitive position in the market places (CPM).

Next, *hypothesis 4a* is partially supported since it appears that the logistics performance (LP) has a significant positive effect upon sustainable competitive advantage (SCA) construct; while it has no significant influence on competitive position in the market (CPM).

Finally *hypothesis 4b* is fully supported because the firm's competitive position in the market (CPM) is significantly predicted by its sustainable competitive advantage (SCA).

Notably, information and planning formality (IPF), strategic planning (SP) and internal integration and customer relationship (IICR) have significant indirect positive influence upon logistics performance (LP), sustainable competitive advantage (SCA) and competitive position in market (CPM) through the following path: IPF → SP → IICR → LP → SCA → CPM. In addition, information and planning formality (IPF) and strategic planning (SP) exert significant indirect positive impacts on the competitive position (CPM) in the market through supplier integration (SI).

Table 6.21. The Results of the Hypotheses Test and the Total Effect between Hypothesised Relationships in the GSE Model

Hypothesised Relationships				Direct Effect	Results of test	Indirect Effect	Total Effect
H1	Information and Planning Formality	→	Strategic Planning	0.725 (0.938)	Supported	-	0.725 (0.938)
	Information and Planning Formality	→	Supplier Integration	-0.646 (-0.703)	Not Supported [1]	1.253 (1.363)	0.607 (0.660)
	Information and Planning Formality	→	Internal Integration and Customer Relationship	-1.137 (-1.390)	Not Supported [1]	1.646 (2.012)	0.509 (0.622)
	Information and Planning Formality	→	Logistics Integration and Customer Service	-0.529 (-0.611)	Not Supported [1]	1.153 (1.331)	0.623 (0.719)
H2	Strategic Planning	→	Supplier Integration	1.728 (1.453)	Supported	-	1.728 (1.453)
	Strategic Planning	→	Internal Integration and Customer Relationship	2.271 (2.144)	Supported	-	2.271 (2.144)
	Strategic Planning	→	Logistics Integration and Customer Service	1.590 (1.418)	Supported	-	1.590 (1.418)
H3	Supplier Integration	→	Logistics Performance	-0.016 (-0.021)	Not Supported [1,2]	-	-0.016 (-0.021)
	Internal Integration and Customer Relationship	→	Logistics Performance	0.439 (0.508)	Supported	-	0.439 (0.508)
	Logistics Integration and Customer Service	→	Logistics Performance	0.105 (0.129)	Not Supported [2]	-	0.105 (0.129)
	Supplier Integration	→	Sustainable Competitive Advantage	0.062 (0.075)	Not Supported [2]	-0.012 (-0.015)	0.050 (0.060)
	Internal Integration and Customer Relationship	→	Sustainable Competitive Advantage	0.110 (0.118)	Not Supported [2]	0.333 (0.357)	0.443 (0.474)
	Logistics Integration and Customer Service	→	Sustainable Competitive Advantage	0.095 (0.108)	Not Supported [2]	0.080 (0.090)	0.175 (0.198)
	Supplier Integration	→	Competitive Position in Market	0.308 (0.345)	Supported	0.065 (0.072)	0.373 (0.417)
	Internal Integration and Customer Relationship	→	Competitive Position in Market	-0.276 (-0.275)	Not Supported [1,2]	0.331 (0.329)	0.055 (0.054)
	Logistics Integration and Customer Service	→	Competitive Position in Market	-0.160 (-0.169)	Not Supported [1,2]	0.159 (0.168)	-0.001 (-0.001)
H4a	Logistics Performance	→	Sustainable Competitive Advantage	0.759 (0.702)	Supported	-	0.759 (0.702)
	Logistics Performance	→	Competitive Position in Market	-0.421 (-0.362)	Not Supported [1,2]	0.883 (0.759)	0.462 (0.397)
H4b	Sustainable Competitive Advantage	→	Competitive Position in Market	1.163 (1.081)	Supported		1.163 (1.081)

Total Effect = Direct Effect + Indirect Effect
( ) Standardised effects
1: Opposite (negative) sign/2: Non significant Coefficient

6.4.2. Global Sourcing Included Model

In this subsection, the hypothesised relationships between 9 latent variables – IPF (Information and Planning Formality); SP (Strategic Planning); SI (Supplier Integration); IICR (Internal Integration and Customer Relationship); LICS (Logistics Integration and Customer Service); LP (Logistics Performance); GSP (Global Sourcing Performance); SCA (Sustainable Competitive Advantage); and CPM (Competitive Position in the Market) – were explored. The full structural equation model is presented in Figure 6.9. The minimum requirements for model identification were satisfied and bootstrap samples were successful. The fit indexes (χ^2/df = 1.664, CFI = 0.922, TLI = 0.913, RMSEA = 0.063) are acceptable. Table 6.22 presents the parameter estimates of the full structural model in Figure 6.9. It should be noted that the model includes an error covariance between two global sourcing performance items (reducing time delays involved in waiting for local suppliers to provide the requisite components; reducing local disadvantage/difficulties) in order to increase model fit.

Firstly, strategic planning is significantly predicted by information and planning formality (0.719) and 88.6% (R^2) of the variance associated with strategic planning is accounted for by its only predictor, information and planning formality.

Secondly, supplier integration is significantly predicted by information and planning formality (-0.779) and strategic planning (1.904). However, as with the case of the GSE model explored in the previous subsection, there is a negative relationship between IPF and SI, which is the opposite result to the hypothesised one. A total of 69.5% of the variance associated with supplier integration is explained by its two predictors. Internal integration and customer relation is also significantly predicted by information and planning formality (-1.279) and strategic planning (2.426). As with the case of supplier integration, there is a negative relationship between IPF and IICR. A total of 97.4% of the variance associated with internal integration and customer relation is accounted for by its predictors. Likewise, logistics integration and customer service is significantly predicted by information and planning formality (-0.520) and strategic planning (1.589), but there is a negative relationship between IPF and LICS. A total of 74.5% of the variance associated with logistics integration and customer service is explained by its two predictors. Concerning these results, a similar explanation to the one used in the previous case of the GSE model would be helpful. The mean values of two measures of information contents (i.e. usefulness of strategy related information, 3.74; and usefulness of manufacturing related information, 3.76)[2] and one measure of information sharing (design of information system for the information sharing with suppliers/customers, 3.87) are below point 4 on the seven-point scale. In contrast, the mean values of 17 items among the 18 items of the integrated logistics and SCM capabilities are presented above point 4. It may imply that two manufacturing companies conducting global sourcing activities possess the satisfactory integrated SCM capability in spite of the inferior information contents and information sharing capability.

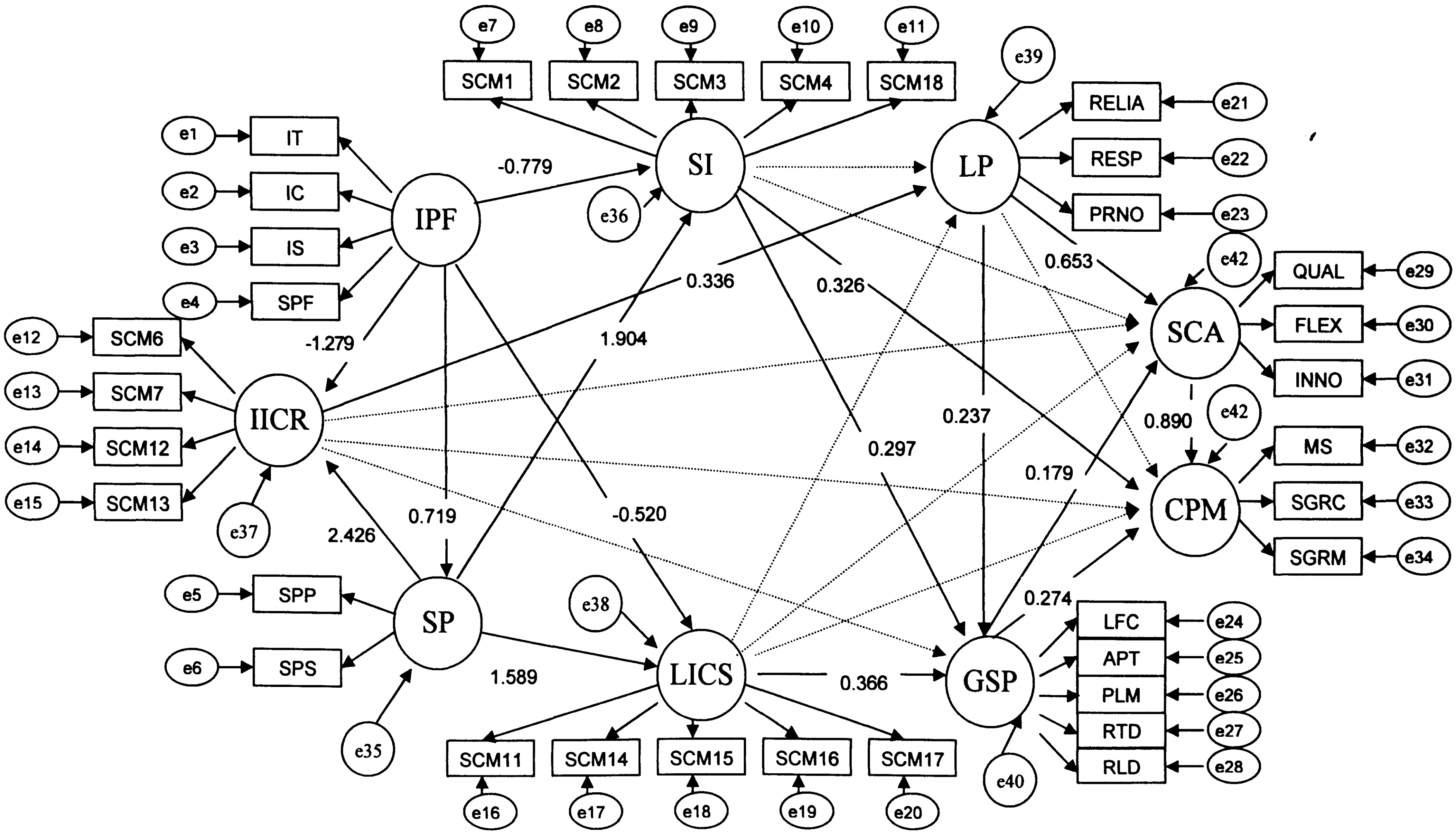
Thirdly, logistics performance is only significantly predicted by internal integration (0.336) among three types of supply chain integration activities. In other words, supplier integration (SI) and logistics integration and customer service (LICS) have no significant influence on the logistics performance. 32.5% (R^2) of the variance associated with logistics performance is accounted for by its predictors. Next, global sourcing performance is significantly predicted by supplier integration (0.297) and logistics integration and customer service (0.366) and logistics performance (0.237). A total of 47.5% of the variance associated with global sourcing performance is accounted for by its predictors. Concerning sustainable competitive advantage, the three types of integrated logistics and SCM capabilities have no significant influence; however logistics performance (0.653) and global sourcing performance (0.179) exert significant impact on the sustainable competitive advantage factor. 80.8% of the variance associated with sustainable competitive advantage is accounted for by its predictors.

Finally, competitive position in the market is significantly predicted by supplier integration (0.326), global sourcing performance (0.274) and sustainable competitive advantage (0.890); however internal integration and customer relation (IICR), logistics integration and customer service (LICS) and logistics performance (LP) have no significant effect upon the construct of competitive position in the market. A total of 57.5% of the variance associated with competitive position in the market is explained by its predictors.

[2] The mean score of 'usefulness of logistics related information' is 4.03

In summary, of the 25 causal paths specified in the hypothesised model, the 16 hypothesised paths (IPF → SPP; IPF → SI; IPF → IICR; IPF → LICS; SPP → SI; SPP → IICR; SPP → LICS; IICR → LP; SI → GSP; LICS → GSP; LP → GSP; LP → SCA; GSP → SČA; SI → CPM; GSP → CPM; SCA → CPM) were found to be statistically significant; however among them, 3 paths among them (IPF → SI; IPF → IICR; IPF → LICS) showed negative signs. The other 9 hypothesised paths (SI → LP; LICS → LP; IICR → GSP; SI → SCA; IICR → SCA; LICS → SCA; IICR → CPM; LICS → CPM; LP → CPM) appeared to be insignificant.

Figure 6.9. Structural Model and Significant Coefficients (solid lines) in the GSI Model



Error covariances between e27 and e28

Table 6.22. The Parameter Estimates of Structural Model in the GSI Model

Construct and Observed Variables			Estimate	t-value	R^2
Regression Weights (Standardised Regression Weights):					
SP (Strategic Planning)	←	IPF (Information and Planning Formality)	0.719 (0.942)	9.632 ***	0.886
SI (Supplier Integration)	←	IPF (Information and Planning Formality)	-0.779 (-0.848)	-2.531 **	0.695
SI (Supplier Integration)	←	SP (Strategic Planning)	1.904 (1.581)	4.441 ***	
IICR (Internal Integration and Customer Relation)	←	IPF (Information Planning Formality)	-1.279 (-1.621)	-3.262 **	0.974
IICR (Internal Integration and Customer Relation)	←	SP (Strategic Planning)	2.426 (2.348)	4.496 ***	
LICS (Logistics Integration and Customer Service)	←	IPF (Information and Planning Formality)	-0.520 (-0.603)	-2.060 *	0.745
LICS (Logistics Integration and Customer Service)	←	SP (Strategic Planning)	1.589 (1.407)	4.510 ***	
LP (Logistics Performance)	←	SI (Supplier Integration)	0.061 (0.081)	0.524	0.325
LP (Logistics Performance)	←	IICR (internal Integration and Customer Relation)	0.336 (0.383)	1.960 *	
LP (Logistics Performance)	←	LICS (Logistics Integration and Customer Service)	0.113 (0.141)	0.941	
GSP (Global Sourcing Performance)	←	SI (Supplier Integration)	0.297 (0.303)	2.239 *	0.475
GSP (Global Sourcing Performance)	←	IICR (internal Integration and Customer Relation)	-0.041 (-0.036)	-0.206	
GSP (Global Sourcing Performance)	←	LICS (Logistics Integration and Customer Service)	0.366 (0.351)	2.661 **	
GSP (Global Sourcing Performance)	←	LP (Logistics Performance)	0.237 (0.182)	2.131 *	
SCA (Sustainable Competitive Advantage)	←	SI (Supplier Integration)	-0.069 (-0.085)	-0.779	0.808
SCA (Sustainable Competitive Advantage)	←	IICR (Internal Integration and Customer Relation)	0.232 (0.245)	1.773	
SCA (Sustainable Competitive Advantage)	←	LICS (Logistics Integration and Customer Service)	0.059 (0.068)	0.635	
SCA (Sustainable Competitive Advantage)	←	LP (Logistics Performance)	0.653 (0.604)	7.434 ***	
SCA (Sustainable Competitive Advantage)	←	GSP (Global Sourcing Performance)	0.179 (0.215)	2.839 **	
CPM (Competitive Position in Market)	←	SI (Supplier Integration)	0.326 (0.389)	2.470 *	0.575
CPM (Competitive Position in Market)	←	IICR (Internal Integration and Customer Relation)	-0.339 (-0.438)	-1.716	
CPM (Competitive Position in Market)	←	LICS (Logistics Integration and Customer Service)	-0.205 (-0.229)	-1.573	
CPM (Competitive Position in Market)	←	LP (Logistics Performance)	-0.365 (-0.328)	-1.814	
CPM (Competitive Position in Market)	←	GSP (Global Sourcing Performance)	0.274 (0.321)	2.762 **	
CPM (Competitive Position in Market)	←	SCA (Sustainable Competitive Advantage)	0.890 (0.865)	3.526 ***	

Table 6.22. The Parameter Estimates of Structural Model in the GSI Model

Construct and Observed Variables			Estimate	t-value	R^2
IT (Information Technology)	←	IPF (Information and Planning Formality)	1.000 (0.847)		0.718
IC (Information Contents)	←	IPF (Information and Planning Formality)	0.953 (0.870)	14.274***	0.757
IS (information Sharing)	←	IPF (Information and Planning Formality)	0.930 (0.851)	13.748***	0.723
SPF (Strategic Planning Formality)	←	IPF (Information and Planning Formality)	0.998 (0.849)	13.703***	0.721
SPP(Strategic Planning Process)	←	SP (Strategic Planning)	1.000 (0.696)		0.485
SPS (Strategic Planning Sharing)	←	SP (Strategic Planning)	1.047 (0.782)	9.576***	0.611
SCM1 (Increase of long-term agreements with key suppliers)	←	SI (Supplier Integration)	1.000 (0.758)		0.574
SCM2 (Sharing of technical resources with key suppliers)	←	SI (Supplier Integration)	1.045 (0.793)	10.350***	0.629
SCM3 (Key suppliers' participation in the development and design of new products)	←	SI (Supplier Integration)	0.979 (0.760)	9.880***	0.578
SCM4 (Formal evaluation of suppliers' performance)	←	SI (Supplier Integration)	0.990 (0.813)	10.645***	0.661
SCM18 (Increase of long-term agreements with logistics service providers)	←	SI (Supplier Integration)	0.847 (0.696)	8.958***	0.485
SCM6 (Establishment of cross functional policies and procedures)	←	IICR (Internal Integration and Customer Relation)	1.000 (0.783)		0.613
SCM7 (Adherence to established operational and administrative policies and procedures)	←	IICR (Internal Integration and Customer Relation)	0.859 (0.694)	9.157***	0.482
SCM12 (Formal measurement of customer satisfaction)	←	IICR (Internal Integration and Customer Relation)	1.232 (0.804)	10.887***	0.646
SCM13 (Maintenance of a high level of communication with customers)	←	IICR (Internal Integration and Customer Relation)	1.071 (0.767)	10.294***	0.588
SCM11 (Utilisation of flexible programmes providing special services for changing customer requirements)	←	LICS (Logistics Integration and Customer Service)	1.000 (0.791)		0.625
SCM14 (Integrated logistical operations under single control)	←	LICS (Logistics Integration and Customer Service)	0.977 (0.761)	10.598***	0.579
SCM15 (Utilisation of total transportation chain performance measurement)	←	LICS (Logistics Integration and Customer Service)	1.075 (0.853)	12.297***	0.728
SCM16 (Flexible multimodal transportation management)	←	LICS (Logistics Integration and Customer Service)	1.008 (0.807)	11.435***	0.652
SCM17 (Coordination of inbound/outbound transportation)	←	LICS (Logistics Integration and Customer Service)	0.992 (0.830)	11.863***	0.689

Table 6.22. The Parameter Estimates of Structural Model in the GSI Model

Construct and Observed Variables			Estimate	t-value	R^2
RELIA (Reliability)	←	LP (Logistics Performance)	1.000 (0.793)		0.628
RESP (Responsiveness)	←	LP (Logistics Performance)	1.127 (0.902)	12.252***	0.813
PRNO (Pre-notification)	←	LP (Logistics Performance)	1.007 (0.727)	9.777***	0.529
LFC (Low factor cost)	←	GSP (Global Sourcing Performance)	1.000 (0.838)		0.702
APT (Access to production technology)	←	GSP (Global Sourcing Performance)	1.083 (0.915)	15.198***	0.838
PLM (Penetrating local market)	←	GSP (Global Sourcing Performance)	1.067 (0.876)	14.210***	0.768
RTD (Reducing Time Delay)	←	GSP (Global Sourcing Performance)	0.806 (0.724)	10.627***	0.525
RLD (Reducing Local Disadvantage)	←	GSP (Global Sourcing Performance)	0.834 (0.769)	11.583***	0.591
QUAL (Quality)	←	SCA (Sustainable Competitive Advantage)	1.000 (0.854)		0.730
FLEX (Flexibility)	←	SCA (Sustainable Competitive Advantage)	0.963 (0.846)	13.585***	0.716
INNO (Innovation)	←	SCA (Sustainable Competitive Advantage)	1.035 (0.816)	12.804***	0.665
MS (Market Share)	←	CPM (Competitive Position in Market)	1.000 (0.723)		0.522
SGRC (Sales Growth Rate compared to Competitors)	←	CPM (Competitive Position in Market)	1.244 (0.895)	10.627***	0.801
SGRM (Sales Growth Rate compared to Market)	←	CPM (Competitive Position in Market)	1.125 (0.848)	10.293***	0.719
Error Covariance (Correlation):					
e27 (PDT)	↔	e28 (LD)	0.455 (0.644)	6.173***	

*** Significant at p<0.001 (t ≥±3.29)
** Significant at p<0.01 (t ≥±2.57)
* Significant at p<0.05 (t ≥±1.96)

Table 6.23 presents the results of the hypotheses test and the direct, indirect and total effects.

Firstly, *hypothesis 1* is partially supported because there is statistically significant positive relationship between information and planning formality (IPF) and strategic planning (SP); however negative relationships exist between information and planning formality (IPF) and the three types of supply chain integration. These direct negative relationships between IPF and SI, IICR, LICS are contrary to the hypothesis; however the total effects including indirect effects through strategic planning appear positive.

Secondly, *hypothesis 2* is supported since there are significant positive relationships between strategic planning (SP) and three types of integration factors.

Thirdly, *hypothesis 3* is partially supported. Concerning the hypothesised relationships between three types of integrated logistics and SCM capabilities and logistics performance, only one factor, internal integration and customer relationship (IICR) has significant positive effect. Regarding hypothesised relationships between three integrated logistics and SCM capabilities and global sourcing performance (GSP), supplier integration (SI) and logistics integration and customer service (LICS) have significant positive effects. However, those three integration capabilities have no significant direct influence on the sustainable competitive advantage (SCA) and competitive position in the market (CPM) except for supplier integration (SI), which appears having a significant positive influence upon firms' competitive position in their market places (CPM).

Next, *hypothesis 4a* is partially supported because it appears that logistics performance (LP) has a significant positive effect upon only sustainable competitive advantage (SCA) constructs; but not upon competitive position in the market (CPM). However, the global sourcing performance (GSP) exerts a significant positive influence on sustainable competitive advantage (SCA) and competitive position in the market (CPM).

Finally *hypothesis 4b* is fully supported since logistics performance (LP) has a statistically significant positive effect upon the global sourcing performance (GSP) and furthermore, the firm's competitive position in the market places (CPM) is significantly predicted by its sustainable competitive advantage (SCA).

Notably, information and planning formality (IPF) and strategic planning (SP) have significant indirect positive influence upon global sourcing performance (GS), sustainable competitive advantage (SCA) and competitive position in the market (CPM) through supplier integration (SI) and logistics integration and customer service (LICS) as follows: (1) IPF → SP → SI → GSP → CPM; (2) IPF → SP → SI → GSP → SCA → CPM; (3) IPF → SP → LICS → GSP → CPM; (4) IPF → SP → LICS → GSP → SCA → CPM. In addition, information and planning formality (IPF), strategic planning (SP) and internal integration and customer relationship (IICR) have significant indirect positive influence upon logistics performance (LP), global sourcing performance (GSP), sustainable competitive advantage (SCA) and competitive position in the market (CPM) thorough the following three paths: (1) IPF → SP → IICR → LP → SCA → CPM; (2) IPF → SP → IICR → LP → GSP → CPM; (3) IPF → SP → IICR → LP → GSP → SCA → CPM.

Table 6.23. The Results of the Hypotheses Test and the Total Effect between Hypothesised Relationships in the GSI Model

Hypothesised Relationships				Direct Effect	Results of test	Indirect Effect	Total Effect
H1	Information and Planning Formality	→	Strategic Planning	0.719 (0.942)	Supported	-	0.719 (0.942)
	Information and Planning Formality	→	Supplier Integration	-0.779 (-0.848)	Not Supported[1]	1.369 (1.489)	0.589 (0.641)
	Information and Planning Formality	→	Internal Integration and Customer Relationship	-1.279 (-1.621)	Not Supported[1]	1.744 (2.210)	0.465 (0.590)
	Information and Planning Formality	→	Logistics Integration and Customer Service	-0.520 (-0.603)	Not Supported[1]	1.142 (1.325)	0.622 (0.722)
H2	Strategic Planning	→	Supplier Integration	1.904 (1.581)	Supported	-	1.904 (1.581)
	Strategic Planning	→	Internal Integration and Customer Relationship	2.426 (2.348)	Supported	-	2.426 (2.348)
	Strategic Planning	→	Logistics Integration and Customer Service	1.589 (1.407)	Supported	-	1.589 (1.407)
H3	Supplier Integration	→	Logistics Performance	0.061 (0.081)	Not Supported[1,2]	-	0.061 (0.081)
	Internal Integration and Customer Relationship	→	Logistics Performance	0.336 (0.383)	Supported	-	0.336 (0.383)
	Logistics Integration and Customer Service	→	Logistics Performance	0.113 (0.141)	Not Supported[2]	-	0.113 (0.141)
	Supplier Integration	→	Global Sourcing Performance	0.297 (0.303)	Supported	0.014 (0.015)	0.312 (0.318)
	Internal Integration and Customer Relationship	→	Global Sourcing Performance	-0.041 (-0.036)	Not Supported[1,2]	0.079 (0.070)	0.039 (0.034)
	Logistics Integration and Customer Service	→	Global Sourcing Performance	0.366 (0.351)	Supported	0.027 (0.026)	0.393 (0.376)
	Supplier Integration	→	Sustainable Competitive Advantage	-0.069 (-0.085)	Not Supported[1,2]	0.095 (0.117)	0.026 (0.032)
	Internal Integration and Customer Relationship	→	Sustainable Competitive Advantage	0.232 (0.245)	Not Supported[2]	0.226 (0.238)	0.458 (0.483)
	Logistics Integration and Customer Service	→	Sustainable Competitive Advantage	0.059 (0.068)	Not Supported[2]	0.144 (0.166)	0.203 (0.233)
	Supplier Integration	→	Competitive Position in Market	0.326 (0.389)	Supported	0.086 (0.103)	0.413 (0.492)
	Internal Integration and Customer Relationship	→	Competitive Position in Market	-0.339 (-0.348)	Not Supported[1,2]	0.296 (0.303)	-0.403 (-0.044)
	Logistics Integration and Customer Service	→	Competitive Position in Market	-0.205 (-0.229)	Not Supported[1,2]	0.247 (0.277)	0.042 (0.047)
H4a	Logistics Performance	→	Sustainable Competitive Advantage	0.653 (0.604)	Supported	0.042 (0.039)	0.696 (0.643)
	Logistics Performance	→	Competitive Position in Market	-0.365 (-0.328)	Not Supported[1,2]	0.684 (0.614)	0.319 (0.287)
	Global Sourcing Performance	→	Sustainable Competitive Advantage	0.179 (0.215)	Supported	-	0.179 (0.215)
	Global Sourcing Performance	→	Competitive Position in Market	0.274 (0.321)	Supported	0.159 (0.186)	0.433 (0.506)
H4b	Logistics Performance	→	Global Sourcing Performance	0.237 (0.182)	Supported	-	0.237 (0.182)
	Sustainable Competitive Advantage	→	Competitive Position in Market	0.890 (0.865)	Supported	-	0.890 (0.865)

Total Effect = Direct Effect + Indirect Effect
( ) Standardised effects
1: opposite (negative) sign/ 2: Non significant coefficient

6.4.3. Comparisons Between Industries

In this subsection, two comparisons between the automobile and parts industry and electronics industry were conducted. The first comparison was implemented adopting the GSE structural model presented in Figure 6.8 to the two industries independently. The hypothesised relationships between 8 latent variables – IPF; SP; SI; IICR; LICS; LP; SCA; and CPM – were explored. The full structural equation models of the two industries are presented in Figure 6.10 and Figure 6.11 respectively. The minimum requirements for model identification were satisfied and bootstrap samples were successful. However the fit indexes of the automobile and parts industry (χ^2/df = 1.699, CFI = 0.859, TLI = 0.840, RMSEA = 0.084) are only marginally acceptable. Likewise, the fit indexes of the electronics industry (χ^2/df = 1.598, CFI = 0.884, TLI = 0.869, RMSEA = 0.080) are marginally adequate. This means that each industry may have its own model fitted more adequately. However, in the current study the initial 'GSE model' was adopted to compare the industries in parallel. The structural equation coefficients and their significance are summarised in Table 6.24 and the main findings are as follows.

Firstly, strategic planning (SP) is significantly predicted by information and planning formality (IPF) in both industries.

Secondly, information and planning formality (IPF) has no significant influence on the three types of integrated logistics and SCM capabilities in both industries. This result is different from the one of the GSE model estimated by both industries, in which the estimates have significant negative signs. Concerning the relationships between strategic planning (SP) and integrated logistics and SCM, the strategic planning capability has significant positive influence upon supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS) in both industries.

Thirdly, logistics performance (LP) is only significantly predicted by internal integration and customer relationship (IICR) in the automobile and parts industry, while only significantly predicted by logistics integration and customer service (LICS) in the electronics industry.

Fourthly, the three types of integrated logistics and SCM capabilities have no significant direct influence on sustainable competitive advantage (SCA) in both industries, while logistics performance (LP) has a significant impact on this construct. However, the internal integration and customer relationship (IICR) in the automobile and parts industry and the logistics integration and customer service (LICS) in the electronics industry have significant indirect effects on the sustainable competitive advantage (SCA) construct through the logistics performance (LP). These results are exactly the same as the previous model involving those two industries.

Finally, competitive position in the market (CPM) is only significantly predicted by sustainable competitive advantage (SCA). In other words, integration logistics and SCM capability and logistics performance have no significant direct effect upon the construct of competitive position in the market. However, the internal integration and customer relations (IICR) in the automobile and parts industry and the logistics integration and customer service (LICS) in the electronics industry have significant indirect effects on the competitive position in the market (CPM) through the logistics performance (LP) and sustainable competitive advantage (SCA) construct. In addition, IPF and SP have a significant indirect positive influence on LP, SCA and CPM through IICR or LICS.

Table 6.24. Comparison between Sample Industries using the GSE Model

Hypothesised Relationships			Estimate		Critical Ratio		Significance ($p<0.05$)	
			Auto.	Elec.	Auto.	Elec.	Auto.	Elec.
SP	←	IPF	0.866	0.534	6.962	5.550	Yes	Yes
SI	←	IPF	-1.391	0.114	-1.734	0.466	No	No
SI	←	SP	2.220	1.119	2.505	2.650	Yes	Yes
IICR	←	IPF	-1.537	-0.293	-1.825	-0.869	No	No
IICR	←	SP	2.265	1.784	2.444	2.980	Yes	Yes
LICS	←	IPF	-0.799	0.003	-1.446	0.011	No	No
LICS	←	SP	1.542	1.349	2.483	3.104	Yes	Yes
LP	←	SI	0.189	-0.045	1.265	-0.252	No	No
LP	←	IICR	0.481	0.046	2.509	0.145	Yes	No
LP	←	LICS	-0.063	0.477	-0.396	2.192	No	Yes
SCA	←	SI	0.009	0.088	0.079	0.658	No	No
SCA	←	IICR	0.139	-0.026	0.936	-0.109	No	No
SCA	←	LICS	0.195	0.157	1.632	0.935	No	No
SCA	←	LP	0.641	0.627	5.036	5.961	Yes	Yes
CPM	←	SI	0.312	0.123	1.557	0.655	No	No
CPM	←	IICR	-0.477	0.363	-1.675	1.074	No	No
CPM	←	LICS	-0.334	-0.423	-1.322	-1.681	No	No
CPM	←	LP	-0.500	-0.312	-1.006	-1.244	No	No
CPM	←	SCA	1.485	1.174	2.160	3.208	Yes	Yes

Figure 6.10. Structural Model and Significant Coefficients (solid lines) in the Automobile and Parts Industry (GSE Model)

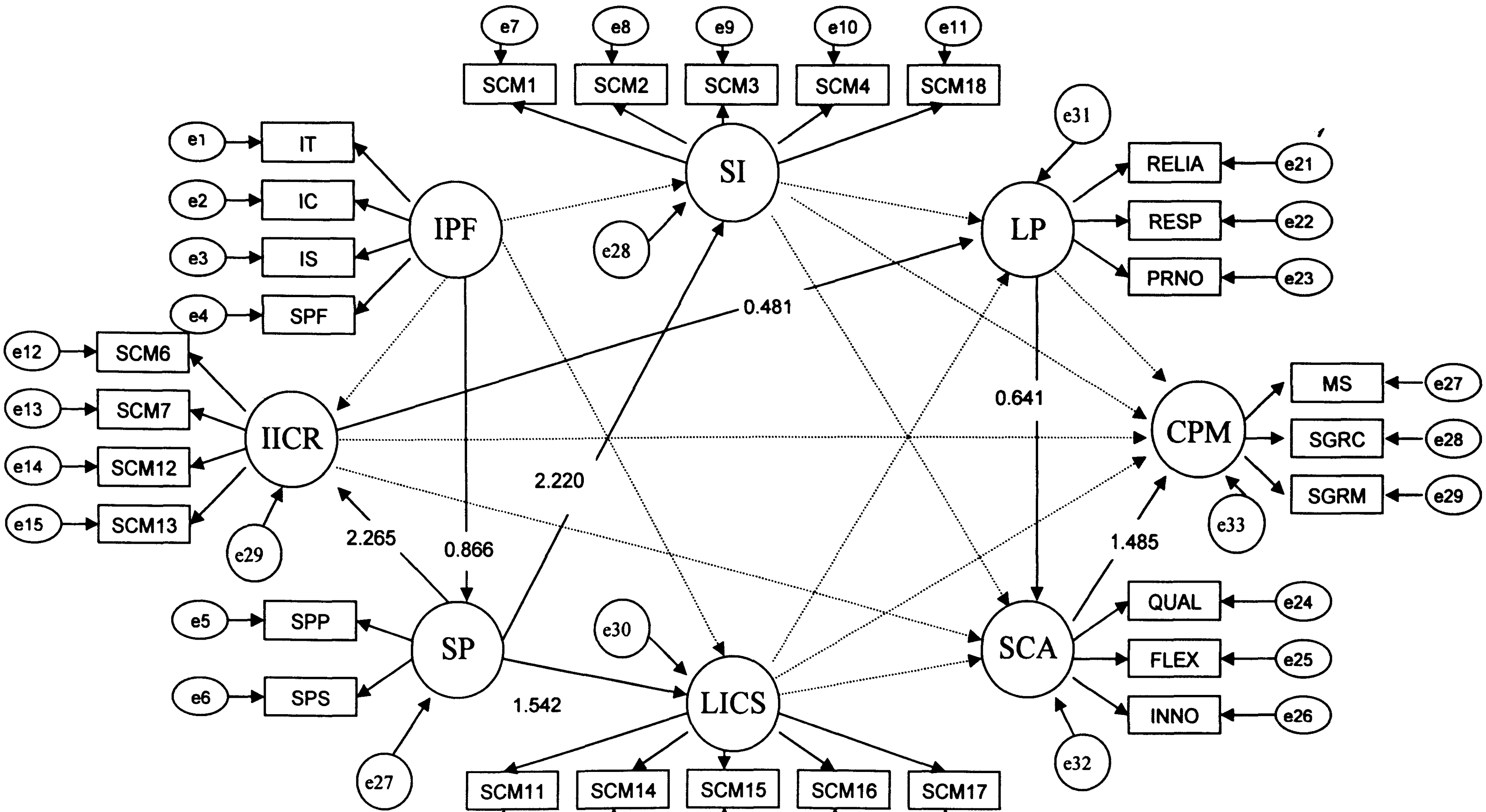
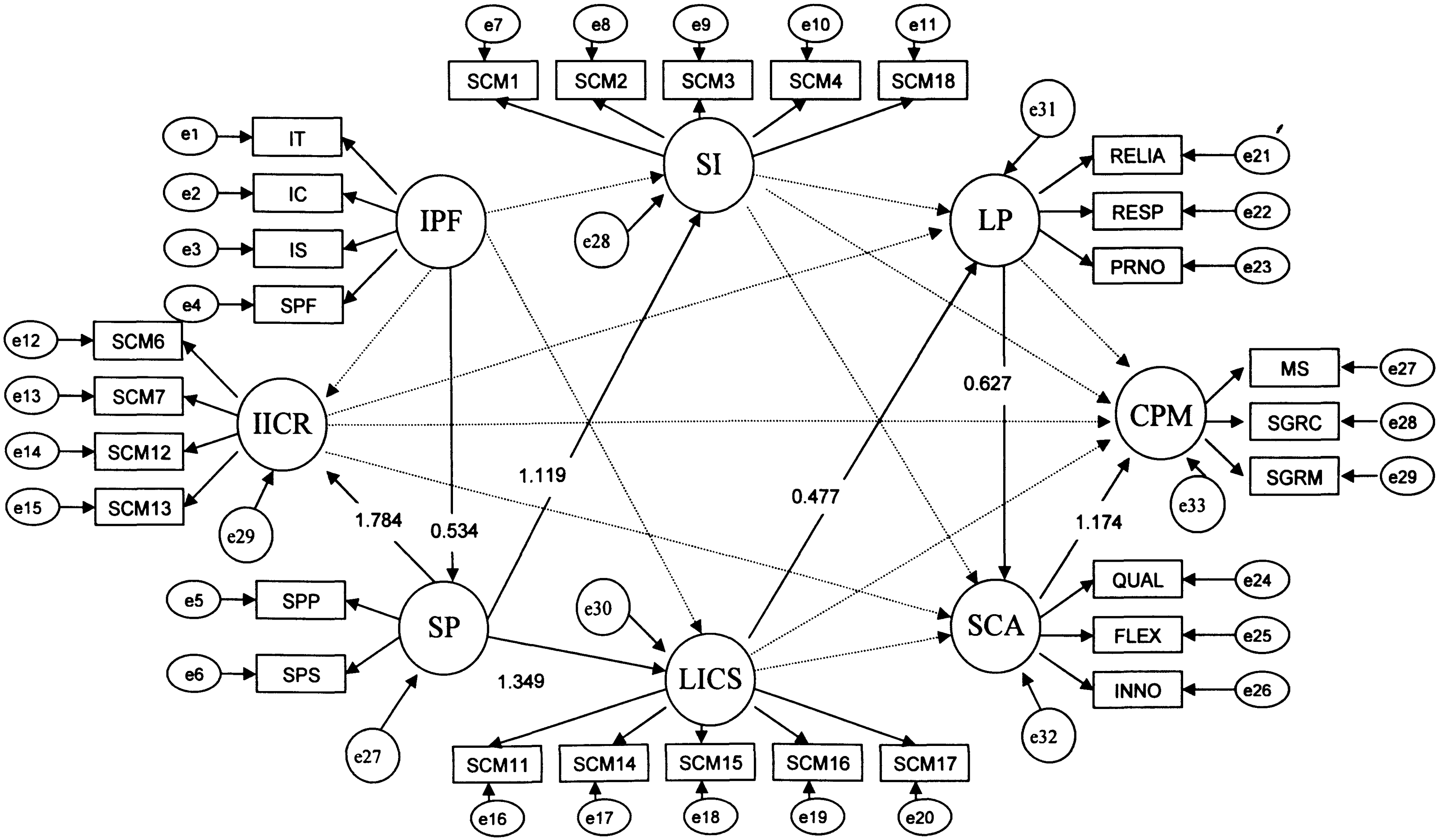


Figure 6.11. Structural Model and Significant Coefficients (solid lines) in the Electronics Industry (GSE Model)



The second comparison was implemented adopting the GSI structural model presented in Figure 6.9 to the two industries independently. In this subsection, the hypothesised relationships between 9 latent variables – IPF; SP; SI; IICR; LICS; LP; GSP; SCA; and CPM – were explored. The full structural equation models of the two industries are presented in Figure 6.12 and Figure 6.13 respectively. The minimum requirements for model identification were satisfied and bootstrap samples were successful as well. However the fit indexes of the automobile and parts industry (χ^2/df = 1.711, CFI = 0.844, TLI = 0.825, RMSEA = 0.092) and the electronics industry (χ^2/df = 1.590, CFI = 0.871, TLI = 0.856, RMSEA = 0.086) are only marginally acceptable. However, in the current study the initial 'GSI model' was adopted to compare the industries in parallel. The structural equation coefficients and their significance are summarised in Table 6.25 and the main findings are as follows.

Firstly, strategic planning (SP) is significantly predicted by information and planning formality (IPF) in the both industries.

Secondly, information and planning formality (IPF) has significant negative influence on supplier integration (SI) in the automobile and parts industry; but no significant impact in the electronics industry. Meanwhile, IPF has a significant negative influence on internal integration and customer relationship (IICR) in both industries; but no significant impact on logistics integration and customer service (LICS) capability in the both industries. Concerning the relationships between strategic planning (SP) and integrated logistics and SCM, the strategic planning capability has a significant positive influence upon supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS) in both industries.

Thirdly, logistics performance (LP) is significantly predicted by only internal integration and customer relationship (IICR) in the automobile and parts industry, and is significantly predicted by only logistics integration and customer service (LICS) in the electronics industry.

Fourthly, the three types of integrated logistics and SCM capabilities have no significant influence on global sourcing performance (GSP) except for the logistics integration and customer service (LICS) in the automobile and parts industry. Notably, the logistics performance (LP) also appears to have no significant impact on the global sourcing performance (GSP), which is a different result from the hypothesis and the GSI model in the previous subsection.

Fourthly, the three types of integrated logistics and SCM capabilities have no significant direct influence on sustainable competitive advantage (SCA) in both industries, while logistics performance (LP) and global sourcing performance (GSP) have a significant impact on this construct. However, the internal integration and customer relationship (IICR) and the logistics integration and customer service (LICS) in the automobile and parts industry and the logistics integration and customer service (LICS) in the electronics industry have significant indirect effects on the sustainable competitive advantage (SCA) construct through the logistics performance (LP) and global sourcing performance (GSP).

Next, competitive position in the market (CPM) is significantly predicted by IICR in the automobile industry and by IICR and LICS in the electronics industry; however, such predictors have negative signs except for the case of IICR in the electronics industry. In other words, IICR has a significant negative influence on CPM in the automobile and parts industry while LICS has a significant negative influence on CPM in the electronics industry. Those negative signs are unexpected and difficult to explain clearly. However, the following aspects could be taken into account. Firstly, companies may invest a considerable amount in establishing 'internal integration and customer relationship' and 'logistics integration and customer service', especially under the context of global sourcing or a global manufacturing system without corresponding returns . The above idea could be supported by the fact that those negative relationships are not found in the previous comparison study adopting the global sourcing excluded model. In particular, in the present comparison study, the three types of integrated logistics and supply chain management capabilities have no significant influence on global sourcing performance except in the case of LICS in the automobile and parts industry, which means the investment for the integrated logistics and supply chain management have not created positive effects for a global sourcing strategy when those relationships are sought at industrial level – especially in the cases of two sample industries. Secondly, the observed variables of IICR and LICS may lack direct relationships with those observed variables belonging to CPM, i.e.

market share or sales growth rate. Therefore, the influential relationships between those integration capabilities and competitive market position are not realised directly but indirectly through their significant positive effects on logistics performance or global sourcing performance. In another instance, under the context of the global manufacturing system, the large amount of investment needed to establish superior integrated logistics and supply chain management capability might restrict, for the time being, the firm's investment in the other activities directly related to the expansion of market share or increase of sales growth rate.

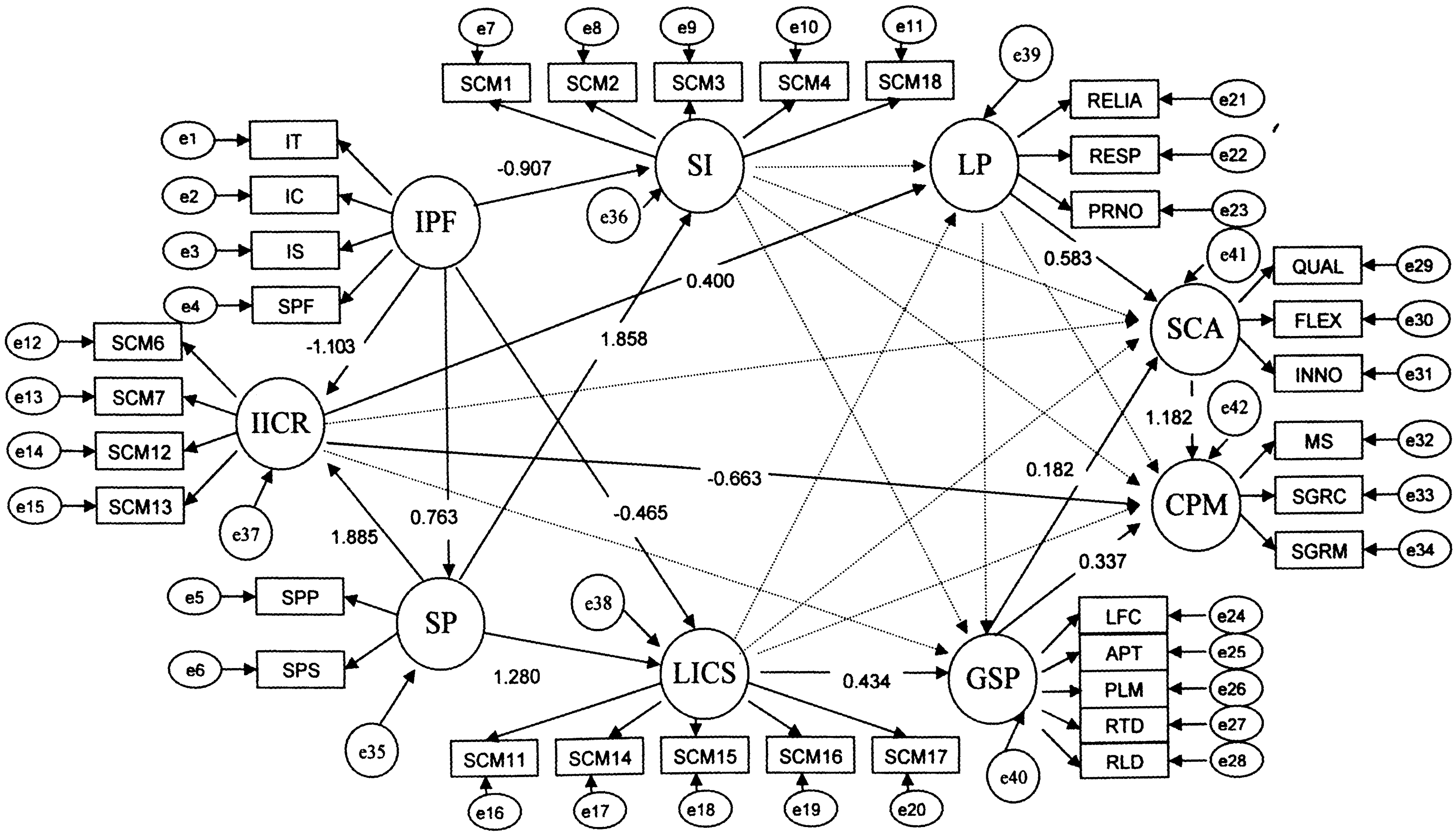
Finally, competitive position in the market (CPM) is significantly predicted by global sourcing performance (GSP) in the automobile industry and significantly predicted by sustainable competitive advantage (SCA) in the both industry.

However, in the automobile and parts industry, the internal integration and customer relationship (IICR) has a significant indirect effect on the competitive position in the market (CPM) through the logistics performance (LP) and sustainable competitive advantage (SCA) factors. In addition, the logistics integration and customer service (LICS) has a significant indirect influence upon the firms' competitive position in their market places (CPM) through the global sourcing performance (GSP) and sustainable competitive advantage (SCA). In addition, IPF and SP have a significant indirect positive influence on LP, GSP, SCA and CPM through IICR or LICS.

Table 6.25. Comparison between Sample Industries using the GSI Model

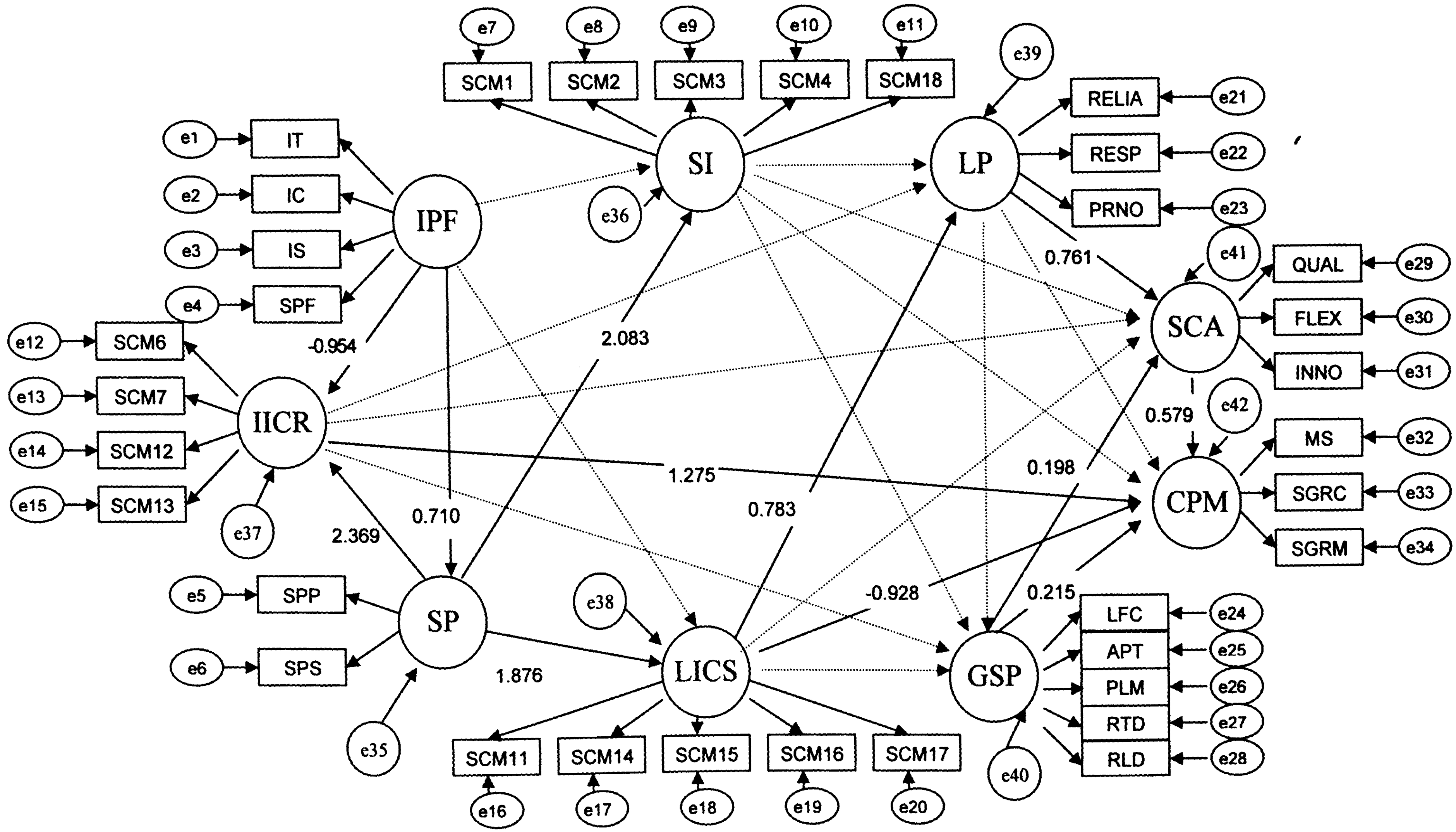
Hypothesised Relationships			Estimate		Critical Ratio		Significance ($p < 0.05$)	
			Auto.	Elec.	Auto.	Elec.	Auto.	Elec.
SP	<---	IPF	0.763	0.710	7.721	6.382	Yes	Yes
SI	<---	IPF	-0.907	-0.831	-2.064	-1.749	Yes	No
SI	<---	SP	1.858	2.083	3.281	3.105	Yes	Yes
IICR	<---	IPF	-1.103	-0.954	-2.453	-1.813	Yes	No
IICR	<---	SP	1.885	2.369	3.270	3.215	Yes	Yes
LICS	<---	IPF	-0.465	-0.606	-1.504	-1.448	No	No
LICS	<---	SP	1.280	1.876	3.151	3.212	Yes	Yes
LP	<---	SI	0.223	0.168	1.683	0.591	No	No
LP	<---	IICR	0.400	-0.508	2.273	-0.939	Yes	No
LP	<---	LICS	-0.129	0.783	-0.894	2.463	No	Yes
GSP	<---	SI	0.215	0.042	1.334	0.127	No	No
GSP	<---	IICR	0.063	0.711	0.290	1.115	No	No
GSP	<---	LICS	0.434	-0.165	2.403	-0.429	Yes	No
GSP	<---	LP	0.213	0.243	1.200	1.556	No	No
SCA	<---	SI	-0.090	-0.040	-0.900	-0.188	No	No
SCA	<---	IICR	0.240	0.190	1.767	0.458	No	No
SCA	<---	LICS	0.131	-0.015	1.150	-0.062	No	No
SCA	<---	LP	0.583	0.761	4.530	5.961	Yes	Yes
SCA	<---	GSP	0.182	0.198	2.202	2.239	Yes	Yes
CPM	<---	SI	0.330	-0.312	1.924	-0.999	No	No
CPM	<---	IICR	-0.663	1.275	-2.580	2.028	Yes	Yes
CPM	<---	LICS	-0.302	-0.928	-1.586	-2.384	No	Yes
CPM	<---	LP	-0.476	-0.029	-1.390	-0.124	No	No
CPM	<---	GSP	0.337	0.215	2.200	1.753	Yes	No
CPM	<---	SCA	1.182	0.579	2.477	2.286	Yes	Yes

Figure 6.12. Structural Model and Significant Coefficients (solid lines) in the Automobile and Parts Industry (GSI Model)



Error covariances between e27 and e28

Figure 6.13. Structural Model and Significant Coefficients (solid lines) in the Electronics Industry (GSI Model)



Error covariances between e27 and e28

6.5. Summary

This chapter dealt with the main analytical process of the current study employing structural equation modelling. Firstly, the missing data, outliers and normality were detected. The amount of missing data was very small and the regression substitution approach was used for treating this problem. There are a few outlier cases – 5 companies amongst 195 sample companies and 2 firms amongst 166 global sourcing companies, and all the cases were determined to be retained. The results of the normality test revealed many numbers of significant negative skewness and kurtosis on the capability and performance items. In addition, the assumption of multivariate normality was also offended. In order to remedy the non-normality problems the bootstrapping approach was employed through the measurement models and full structural models.

Secondly, the 14 information and strategic planning capability items, 18 integrated logistics and supply chain management capability indexes and 20 performance measures are categorised into new latent constructs by exploratory factor analysis (EFA). As a result, 14 information and strategic planning items were categorised into two components – information and planning formality (IPF) and strategic planning (SP); 18 integrated logistics and SCM indexes were re-categorised into three integration constructs – supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS). The 20 performance measures were divided into 4 performance factors – logistics performance (LP), global sourcing performance (GSP), sustainable competitive advantage (SCA) and competitive position in market (CPM).

In the third section, the constructs and measures generated from EFA were validated by confirmatory factor analysis (CFA). Each measurement model satisfied the validation issue including unidimensionality, convergent validity, reliability and discriminant validity.

Next, the hypothesised relationships between the latent variables were tested by structural equation models. Notably the four hypotheses initially proposed in Chapter 3 were adjusted to involve the new relationships caused by CPM generated by EFA and confirmed by CFA. The GSE model showed that the hypothesised relationships between IPF and SP was supported but the relationships between IPF and the three types of integrated logistics and SEM capabilities – SI, IICR and LICS – were not. The relationship between IPF and SP was strongly supported. The hypothesised relationships between the three types of integrated logistics and SCM capabilities and logistics performance (LP) were partially supported; only IICR had a significant positive influence on LP. The relationships between integrated logistics and SCM capabilities and sustainable competitive advantage (SCA) were not supported; none of the three types of integration factors had significant impact on the construct. The hypothesised relationships between integrated logistics and SCM capability and competitive position in the market (CPM) were partially supported; only SI has a significant positive influence on CPM. The relationships between LP and SCA and between SCA and CPM were supported. However, LP revealed no significant impact on CPM. The GSI model presented that the hypothesised relationships between IPF and SP were supported but the relationships between IPF and the three types of integrated logistics and SEM capabilities were not supported. The relationship between IPF and SP was strongly supported. The hypothesised relationships between the three types of integrated logistics and SCM capabilities and logistics performance (LP) were partially supported; only IICR had a significant positive influence on LP. The relationships between integrated logistics and SCM capabilities and sustainable competitive advantage (SCA) were not supported; none of the three types of integration factors had a significant impact on the construct. The hypothesised relationships between integrated logistics and SCM capability and competitive position in the market (CPM) were partially supported; only SI had a significant positive influence on CPM. The hypothesised relationships between integrated logistics and SCM capability and global sourcing performance (GSP) were partially supported; SI and LICS revealed significant positive influences on GSP. The relationships between LP and GSP and between LP and SCA were supported; but the relationship between LP and CPM was not supported. The relationships between GSP and SCA and between GSP and CPM were strongly supported. In addition, SCA appeared to have a significant positive influence upon CPM.

Finally, the cross industry comparison showed a few difference between the automobile and parts industry and electronics industry. The comparisons entirely supported the hypothesised relationships between IPF and SP, SP and SI, SP and IICR, SP and LICS, LP and SCA, GSP and SCA, SCA and CPM. The influence of integrated logistics and SCM capabilities on LP, GSP, SCA and CPM revealed significant or insignificant according to the industries.

CHAPTER SEVEN

CHAPTER 7
RESEARCH CONCLUSIONS

The primary objectives of this research are: (1) to specify the major capabilities of integrated logistics and supply chain management; (2) to examine the impact of integrated logistics and supply chain management on the firm's logistics performance, global sourcing performance, and sustainable competitive advantage; and (3) to define the interrelationships between those performance areas. In order to answer those questions, firstly a literature review was conducted on strategic management theories, integrated logistics and supply chain management, global sourcing strategy and logistics performance. Through the literature review, resource based theory was selected as the main theoretical basis for the study and 'integrated logistics and supply chain management' was considered to be a firm's crucial capability to achieve superior logistics and global sourcing performance and further sustainable competitive advantage (Chapter 2). Then, the 14 information and strategic planning capability items, 18 integrated logistics and supply chain management capability indexes and 20 performance measures were deliberately identified from the literature review and subsequently the research model and five hypotheses were established (Chapter 3). A comprehensive research design and methodology process was adopted to find an effective data collection method and to validate and test the hypotheses using rigorous statistics techniques. As a result, a postal questionnaire survey method was selected for the data collection and a structural equation modelling technique was employed as the main analytical tool for the empirical research (Chapter 4). Next, the current situation of integrated logistics and supply chain management capability (core competency) in the automobile and parts industry and electronics industry of Korea was described and in addition, those firms' perceived performance level was illustrated (Chapter 5). Finally, information and strategic planning capabilities, integrated logistics and SCM capability and performance measures were purified and categorised by exploratory factor analysis and confirmed by confirmatory factor analysis. In consequence, the hypothesised relationships between those latent constructs were examined by structural equation modelling (Chapter 6).

This final chapter of the current study is composed of three sections as follows. The first section summarises the empirical findings and explains their implications on the relevant theory and practice. The second section describes the contributions of the current research to the academic and empirical areas. The final section points out some limitations of the study and considerable issues for the further research.

7.1. Research Findings and Implications

The main findings and their implications will be detailed according to the five following hypotheses.

Hypothesis 1: Information capability has a positive influence on strategic planning capability and integrated logistics and supply chain management capability.

Hypothesis 2: Strategic planning capability has a positive influence on integrated logistics and supply chain management capability.

Hypothesis 3: Integrated logistics and supply chain management capability has a positive influence on logistics performance, global sourcing performance, sustainable competitive advantage and competitive position in the market.

Hypothesis 4a: Superior logistics performance and/or global sourcing performance exert a positive influence on firms' sustainable competitive advantage and competitive position in the market.

Hypothesis 4b: Logistics performance has a positive influence on global sourcing performance while sustainable competitive advantage has a positive influence on competitive position in the market.

7.1.1. Relationships between Information, Strategic Planning and Integrated Logistics and SCM (Hypotheses 1 & 2)

Firstly, there commonly exists a significant positive relationship between information and planning formality (IPF) and strategic planning (SP) in the GSE model, GSI model and the comparisons between the two target industries. This result implies that information capability is central to successful strategic planning (Akers and Porter, 1995). Therefore, manufacturing companies should effectively utilise the information capability for improved strategic decision making. For instance, it is important for the company to evaluate internal and external information in order to identify opportunities, challenges, and priorities (Roger *et al.*, 1996).

Secondly, there is no direct positive relationship between information and planning formality (IPF) and the three types of logistics integration, i.e. supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS). Rather, the direct relationships reveal significant negative signs in many cases[1]. As pointed out in the statistical analysis in Chapter 6, these results could be due to inferior information content and unsatisfactory information connectivity with suppliers and customers in spite of the high level of integrated logistics and SCM capabilities. In other words, all the items measuring information contents (i.e. usefulness of strategy related information; manufacturing related information; and logistics related information) appear to be poor and as a result, a firm's information contents could not be directly adopted or utilised for the integration of logistics and supply chain management but only indirectly through strategic planning capability; and a lack of information connectivity could obstruct the effective use of information. In another case, "improvement in information capability could lead to an excess availability of information – a state of information overload and paralysis" (Fawcett *et al.*, 2000). Another possible reason for this result could be a lack of direct linkages between available information and supply chain integration. The information content items employed in the present research encompass general information categories thus, the real availability of logistics strategy related information would not be captured. Considering those aspects, the negative relationships between information capability and integrated logistics and SCM capability could not predict that the inferior information capability would lead to superior integration in logistics and supply chain management. Rather, it could be expected that improved and 'readily available' information contents and information connectivity would support integrated logistics and supply chain management, since

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[1] However the total effects including indirect effects through strategic planning appear positive.

information capability has been recognised to facilitate internal and external integration (Porter and Millar, 1985) and it has helped make possible the concept of supply chain management (Roger *et al.*, 1996). It should be noted that information sharing is of greater important than IT as without the existence of a cooperative spirit amongst firms regarding information sharing, the arrangement will fail whether or not the technology is available (Bowersox *et al.*, 1999).

Thirdly, concerning the relationships between strategic planning (SP) and integrated logistics and SCM, the strategic planning capability has significant positive influence upon supplier integration (SI), internal integration and customer relationship (IICR) and logistics integration and customer service (LICS) in both industries and both cases of the GSE model and GSI model. This result strongly implies that the development and maintenance of an integrated logistics and supply chain is greatly supported when supply chain management capability is combined and coordinated by strategic planning capability. Therefore, manufacturing firms should strengthen their strategic planning capability based on a comprehensive planning process (e.g. total cost management, continual feedback system, evaluation system) and integrated planning development procedures.

It should be noted that in the GSE model, IPF a nd SP exert significant indirect positive influences upon CPM through SI and also have significant indirect positive impacts on LP, SCA and CPM through the IICR. Similarly, in the GSI model, IPF and SP have significant indirect positive influence upon GS, SCA and CPM through SI and LICS, and have significant indirect positive impact on LP, GSP, SCA and CPM through IICR. Those indirect relationships imply that the firm's ability to capture information for use in the planning process is critical to selecting and developing appropriate capabilities (Fawcett *et al.*, 2000) and strategic planning helps managers select the correct capabilities and then allocate their resources to develop them (Fawcett *et al.*, 2000; Stalk *et al.*, 1992). In particular, strategic planning of the supply chain is critical to determine the long-term survival and prosperity of companies (Koutsoukis *et al.* 2000).

7.1.2. Influence of Integrated Logistics and SCM capability on Logistics Performance, Global Sourcing Performance, Sustainable Competitive Advantage and Competitive Position in the Market (Hypothesis 3)

Firstly, concerning the hypothesised relationships between three types of integrated logistics and SCM capabilities and logistics performance (LP), only one factor, internal integration and customer relationship (IICR) has significant positive effect commonly in the GSE model and GSI model; this result is the same as the automobile and parts industry in the comparisons between the industries[2]. This finding shows that IICR is the most essential and effective strategy for the development of integrated logistics and SCM capability. As a matter of fact, the current empirical survey shows that the two Korean industries have concentrated on IICR (4.68; 4.67) relatively compared with SI (4.61; 4.64) and LICS (4.24; 4.24)[3]. Regarding this phenomenon, Fawcett and Magnan (2002) have explained that "although SCM has obtained a high degree of credibility as a viable competitive practice, in the real world, many companies place most of their SCM emphasis on improving integration just within the organisation." In addition, Bowersox and Closs (1996) have asserted that intra-organisational integration is a preliminary requirement for subsequent successful inter-organisational integration with suppliers and customers. The insignificant relationship between SI and LP may imply that the Korean companies could not take into account the efficient and effective inbound logistical flow when they develop and maintain supplier integration. This view could be supported by the fact that in the current empirical study, the logistics related index for supplier integration (i.e. flexible modification of the order size, volume, and composition to key supplier) was deleted by exploratory factor analysis due to low correlations with other measures. Meanwhile, the insignificant relationship between LICS and LP may imply that the items involved in logistics integration and customer service would be very basic activities that could not make any significant logistical differences between companies. In fact, more than half of the respondent companies outsource their logistical activities, thus they could be provided with more than

[2] The only significant factor which predicts logistics performance (LP) in the electronics industry is logistics integration and customer service (LICS).

[3] Mean scores of the measures for three types of integrated logistics and SCM capability in the global sourcing excluded model and global sourcing included model.

standardised logistics service. Notably, this empirical study discarded 'just-in-time management', an innovative logistics performance item due to the low factor loading through confirmatory factor analysis. Therefore most of all, manufacturing companies should develop effective internal integration and customer relationship. In addition, they should make efforts to design elaborate and flexible logistics flow with their key suppliers and to develop differentiated and distinctive inbound and outbound logistics integration with their logistics partners.

Secondly, the empirical study reveals that supplier integration (SI) and logistics integration and customer service (LICS) have significant positive effects upon global sourcing performance (GSP). This result seems reasonable because global sourcing itself is strongly related to the suppliers and in addition, effective logistics support such as logistics integration has been considered one of the most critical issues for the global sourcing activities by the previous research (Min and Galle, 1991; Fawcett and Birou 1992; Frear, 1992; Petersen *et al.*, 2000). Global sourcing requires the integration of requirements, in order to identify common purchases, processes, technologies and suppliers that can be coordinated (Bozarth *et al.*, 1998), where transport and logistics processes play a key role in the development of global sourcing business capabilities (Petersen *et al.* 2000). In contrast, the internal integration and customer relationship (IICR) presents no significant relationship with global sourcing performance. This result implies that supplier integration and logistics integration are more critical to global sourcing than internal integration. Meanwhile, the comparison study presents an insignificant relationship between SI and GSP, and between LP and GSP. This result implies that the hypothesised relationships are not determined according to the industrial characteristics.

Thirdly, none of the three types of integrated logistics and SCM capabilities has significant influence on sustainable competitive advantage (SCA). Similarly, among the hypothesised relationships between integrated logistics and SCM capabilities and competitive position in the market (CPM), only supplier integration (SI) presents a significant impact on the construct. This result implies that integrated logistics SCM capabilities have no direct influence on manufacturing and design quality, logistical and operational flexibility and product and process innovation.

However, supplier integration contributes to increased market share and sales volume. It implies that sharing of technical resources, R&D costs with key suppliers; key suppliers' participation in the new product development; formal evaluation of suppliers' performance; and long-term agreements with key suppliers and logistics service providers significantly influence upon firms' market share and sales growth rate.

It should be noted that IICR has a significant indirect positive influence upon LP, GSP, SCA and CPM. In addition, SI and LICS exert significant positive impacts upon GSP, SCA and CPM indirectly[4]. Therefore, all the three types of integrated logistics and SCM capabilities have their own merits and advantages; consequently, they should be developed and maintained in balance and can be a core competency that is valuable, rare, inimitable and difficult to substitute.

7.1.3. Relationships between Logistics Performance, Global Sourcing Performance, Sustainable Competitive Advantage and Competitive Position in the Market (Hypothesis 4a, 4b)

Firstly, it appears that the logistics performance (LP) has a significant positive effect upon global sourcing performance (GSP) and sustainable competitive advantage (SCA); however it has no significant influence on competitive position in the market (CPM) in both models. This result implies that manufacturing companies should consider the importance of logistical capability when they conduct global sourcing activities and when they establish a long-term plan.

Secondly, global sourcing performance (GSP) has a significant positive influence on sustainable competitive advantage (SCA) and competitive position in the market (CPM). This result implies that superior global sourcing capability can be a strategically critical tool for the manufacturing firms to increase their market share and sales volume and further their successful long term survival. This result also

[4] Concerning industry comparison study, in the global sourcing excluded model, the IICR in automobile and parts industry and LICS in electronics industry have significant indirect effects on the SCA and CPM constructs through the LP. In the global sourcing included model, the IICR and LICS in automobile and parts industry and the LICS in electronics industry have significant indirect effects on the SCA and CPM constructs through the LP and GSP.

supports the previous research (Kotabe and Murray 1990, 1996; Kotabe and Omura 1989; Murray *et al.* 1995) focusing on the relationships between global sourcing strategy and various dimensions of market performance.

Finally, competitive position in the market (CPM) is significantly predicted by sustainable competitive advantage (SCA). This relationship implies that the company pursuing superior quality in manufacturing and design, flexibility in logistics and operations, and innovation of product and process could successfully realise dominant market share and continual growth.

In addition, logistics performance (LP) has significant indirect positive influence on sustainable competitive advantage (SCA) and competitive position in the market (CPM) through global sourcing performance (GSP). In addition, logistics performance (LP) and global sourcing performance (GSP) have significant positive influence on competitive position in the market (CPM) through sustainable competitive advantage (SCA) indirectly.

7.2. Contributions of the Research

This thesis can be of benefit to the logistics and supply chain management theory and industry – specifically sample industries. The current study may be viewed as having made some contributions as follows.

7.2.1. Contribution for Logistics and SCM Theory

Firstly, the present study has adopted resource based theory to explore causal relationships between firms' specific capabilities and their performance. In this study, resource based theory has successfully established testable hypotheses and validated them comprehensively and subsequently provided useful explanations of the firm's strategic behaviours and its influences. Through the empirical study, the integrated logistics and supply chain management capability presents critical strategic value accomplishing superior logistics performance, global sourcing performance, sustainable competitive advantage and competitive market position. Therefore, it is possible for the firm to develop an 'integrated logistics and supply chain management capability' into a 'core competency' level through a unique and innovative synthesis of the firm's strategic capability and relevant activities. In summary, the resource based theory effectively explains the characteristics of a firm's capabilities and their influences upon various performance areas; therefore, the resource based theory has been proved to be acceptable in the current study.

Secondly, to the best of the author's knowledge, the current study is the first research to simultaneously explore the influential relationships between logistics and supply chain integration, logistics performance, global sourcing performance and sustainable competitive advantage. In particular, the current study categorised inbound and outbound logistics integration as one of the supply integration capabilities and examined its influence upon various performance area.

Thirdly, the study has employed a more comprehensive and rigorous methodological process utilising EFA, CFA and SEM to assess validation issues and test the hypothesised relationships between constructs, which can reinforce the reliability for the explanation and implication of findings. Although there are several limitations concerning the SEM method, the SEM itself is a credible technique if the research model is established on a rigorous theoretical base and the collected data can represent the population. As explained previously, SEM provides the confirmatory factor analysis approach to test the validity and reliability of the measurement models (Gerbing and Anderson, 1988) is able to take account of measurement error (Rigdon, 1998). Compared with other statistical techniques, SEM can simultaneously estimate the hypothesised relationships between latent constructs including direct and indirect influences (Hair *et al.*, 1998). In contrast, multiple regression or factor analysis can examine only a single relationship at a time. In addition, even though multivariate analysis of variance (MANOVA) and canonical correlation analysis can provide the estimation of multiple dependent variables, they calculate only a single relationship between the dependent and independent variables at any one time (Hair *et al.*, 1998).

Fourthly, the current study presents which integration component (i.e. supplier integration; internal integration and customer relationship; logistics integration and customer service) has a significant influence on logistics performance, global sourcing performance, sustainable competitive advantage and competitive position in the market; i.e. each integrated logistics and supply chain management capability appears to have its unique impact on the firm's performance areas.

Fifthly, the research shows the indirect relationships and their influential paths between 9 latent constructs – (1) information capability; (2) strategic planning capability; (3) suppler integration; (4) internal integration and customer relationship; (5) logistics integration and customer service; (6) logistics performance; (7) global sourcing performance; (8) sustainable competitive advantage; and (9) competitive position in the market – as well as direct and total effects. These indirect effects support the importance of all the three types of integrated logistics and supply chain management.

Next, this thesis clearly presents that the superior logistics capability and global sourcing capability can significantly influence the firm's long-term sustainable competitive advantage and their competitive position in the market place.

Finally, the current study tried to make comparisons between two target industries and shows that many hypothesised relationships between latent variables are also supported at industrial level.

7.2.2. Contribution for Industry

The automobile and parts companies and electronics firms could adopt the research results when they establish the information and strategic planning capability and pursue their integrated logistics and supply chain management.

Firstly, this research shows that information and planning formality capability has a significant positive influence on strategic planning capability and sequentially strategic planning capability exerts significant positive influence on integrated logistics and supply chain management capability. Those findings suggest that manufacturing firms should improve their information and strategic planning capabilities to establish and maintain a high level of integrated logistics and supply chain management capability. However, information capability presents a positive influence on integrated logistics and supply chain management capability only indirectly through strategic planning capability, which means the investment and design of information capability does not automatically deliver effective integrated supply chain management; rather, poor information availability or contents and unwillingness of information sharing with channel members may prevent the firms from establishing and improving integrated logistics and SCM capability. Therefore, the firms should make efforts to generate and accumulate more 'readily available information' required for the supply chain integration. Meanwhile, the results of this empirical research suggest that it is critical for the firms to generate and reinforce supreme strategic planning capability because even if information contents and connectivity are in poor condition, firms could effectively utilise their information resources or ability for establishing firms' critical capability through superior strategic planning capability.

Secondly, this thesis shows the effectiveness of integrated logistics and supply chain management for the manufacturing firms to achieve better logistics and global sourcing performance and moreover long-term competitive advantage. In particular, the three types of integrated logistics and supply chain management (i.e. SI, IICR and LICS) have different direct and indirect influences on firms' various performance areas through different paths. For instance, in order to obtain a higher level of logistics performance the firm should reinforce its 'internal integration and customer relationship' capability, while in order to achieve superior global sourcing performance the firm should strengthen its 'supplier integration' capability and 'logistics integration and customer service' capability. In addition, 'supplier integration' functions as a useful capability to achieve a competitive market position. Therefore, the companies, especially logistics directors or managers can refer to those results selectively according to their strategic needs, priorities and time span.

Thirdly, the results of the present study recommend that a firm should make efforts to build a superior logistics capability and/or global sourcing capability in order to effectively obtain and/or reinforce its competitive market position and long-term survival and success. In particular, the research shows that logistics performance has significant influences upon the three performance areas through direct and indirect paths, which suggests the firm should recognise the strategic value of logistics management and should endeavour to build a more responsive and innovative logistics capability.

Finally, the comparison research shows several different causal relationships between constructs. For example, in order to obtain superior logistics performance, 'internal integration and customer relationship' can be a useful capability for the Automobile and parts companies while 'logistics integration and customer service' is important for the electronics firms. Therefore, the present study provides 'tailored information' for each target industry.

7.3. Limitations and Further Research

There are some unavoidable limitations in the current study, which should be remembered when discussing the conclusions.

7.3.1. Sampling and Methodology

Firstly, the study uses two sample industries in Korea, which means it would be difficult to generalise the results and adopt the implications to other industries or other countries without careful consideration. Therefore the ethnographical research including more than 2 countries with various industries could be an interesting issue for further study.

Secondly, although SEM is one of the most powerful statistical tools, researchers should bear in mind the following point: "the most critical error in developing theoretically based SEM models is the omission of key variables" (Hair *et al.*, 1998). Concerning the present research, it would be possible to consider several additional constructs as predictive and performance variables. For instance, this study proposed the information capabilities and strategic planning capability as the main antecedents supporting or stimulating supply chain integration. However, some other variables could exert influence on the firms' supply chain management and global sourcing strategy. For instance, firms' specific organisational culture, human resource management strategy, R&D strategy or foreign direct investment strategy might provide additional explanations for the subjects. This study has not included financial performance indexes except the sales growth rate. Financial performance could be related to logistics performance, global sourcing performance and competitive advantage. In addition, this research has assumed there is a one way influential direction from the logistics performance to the global sourcing performance. However, in some cases, the firm's global sourcing strategy could influence its logistics strategy and performance. Therefore it would be meaningful to involve those variables and causal relationships in future study.

Thirdly, the results of the current study have not been cross checked with multiple methods; in other words, the triangulation approach has not been adopted. Denzin and Lincoln (1998) have defined 'triangulation' as "the use of multiple methods in the study of the same object". The use of triangulation may involve data collection, investigation techniques, theories or methods when conducting research. In order to conduct a triangulation approach, several techniques such as case study or focus group discussion are adoptable. The case study strategy has considerable ability to generate answers to the 'what', 'how' and furthermore 'why' questions. For instance, the empirical study presents significant negative signs between 'information and planning formality capability' and 'integrated logistics and supply chain management capability' in many cases. For this situation, a rigorous case study could provide comprehensive insights and explanations for the process and reasons of the influential relationships between the constructs. In addition, the focus group technique could provide interaction between participants in the discussion and make it possible for the researcher to compare the respondent companies' specific capability and their various performance levels. Therefore, it is recommended that those triangulation approaches should be included in any future study.

Fourthly, the postal questionnaire survey is one of the most general and popular approach to collect the data to be used in SEM; however, it is impossible to ascertain whether respondents truthfully and thoughtfully answered the questions. For instance, in the present study, 5 questionnaires were discarded since the respondents marked all the questionnaire items with the same answer. Moreover, the average score for 27 items from the total of 32 integrated logistics and SCM capability items and all the performance items was above point 4, which implies that the respondents considered their firms were superior to their competitors. For this problem, a data 'triangulation' approach is useful to cross check the collected data. To conduct the triangulation approach, several techniques such as in-depth interviews or focus group discussions are worth considering. An in-depth interview can make the questions clear to respondents and allow their answers to the questionnaire to be justified (Sykes, 1991).

In particular, the focus group technique could make it possible for the researcher to compare the respondents' perspectives and responses to the relevant questions.

However, the time, distance and cost constraints inherent in Ph.D. research made this impossible to carry out at this time.

7.3.2. Others

Firstly, in the current study, the types and degrees of integration such as interaction, cooperation, coordination and collaboration were not distinguished. Some previous research (Kahn and Mentzer, 1996, 1998; Kemppainen and Vepsäläinen, 2003; Spekman *et al.*, 1998; Stank *et al.*, 1999) has presented the different effects between those integration types. Therefore, it would be meaningful to involve this categorisation in the survey design in any further research.

Secondly, as explained in the literature review, global sourcing strategy has a four stage evolutionary process – (1) domestic purchasing only; (2) foreign buying based on need; (3) foreign buying as part of procurement strategy; and (4) integration of global procurement strategy. Therefore it would be useful to compare the companies conducting strategic global sourcing and the other companies conducting foreign buying based on need. The current study could not compare the two groups due to a low response rate.

Thirdly, more than half of the sample companies outsource their logistics service from third party logistics providers. Thus it would be meaningful to explore the different effects on firm performance between two groups, which would also require a large sample.

Next, this research targets the logistics integration of manufacturing companies only. Therefore, it would be interesting to explore the case of transport or logistics companies, especially third party logistics companies, for instance the impact of logistics service providers' capabilities upon the logistics service demander's performance area.

Finally, the present study discarded some measurements, in particular 'just-in-time management' in the logistics performance and 'manufacturing cost advantage' in the sustainable competitive advantage. Therefore the impacts of integrated logistics and supply chain management and global sourcing activities on those performance indexes could not be observed. Any further study may involve them to define the hypothesised relationships more clearly.

Despite these limitations, this thesis has laid the foundations for future research and it is hoped that opportunities will arise to develop the work further in the future.

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APPENDIX A

QUESTIONNAIRE IN ENGLISH

Integrated Logistics and Supply Chain Management and Competitive Advantage

Dear Sir/Madam,

I am a senior researcher of the Korea Maritime Institute (www.kmi.re.kr) sponsored by the Korean Government, in the field of maritime and international logistics studies.

I am currently engaged in a Ph.D. study in the Logistics and Operations Management Section at Cardiff Business School (www.cardiff.ac.uk) in the UK. My research mainly explores the relationships between integrated logistics and supply chain management capability, logistics performance, global sourcing performance, and sustainable competitive advantage in the manufacturing industry especially automobile and electronics industries in Korea.

International procurement capabilities and logistics competencies have become crucial for a firm's survival. In particular, global sourcing and integrated logistics and supply chain management have been recognised as critical strategic tools to achieve superior performance or competitive advantage by reducing firm's manufacturing/ logistics costs and satisfying customer demand.

For these reasons, I sincerely invite you to participate in my empirical study. There are no "right" or "wrong" answers. Please answer all the questions from the perspective of a manufacturing firm.

This questionnaire was designed as multiple choice type to help you answer simply. It should take around 15 minutes to complete all the questions.

The survey frame adopts an ANONYMOUS style. Any information provided is in the strictest confidence and will be aggregated into overall industry trends. No specific details about companies or respondents will be reported. The results of this survey will be utilised only for academic purposes and a summary of these will be provided to you on completion of the research if you wish.

Your support is the most important factor for the success of my research. Please kindly return this completed questionnaire in the "Freepost" envelope provided. Thank you very much for your kind cooperation.

Yours faithfully,

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SECTION A. THE RESPONDENT PROFILE

1. How many years have you worked in this industry? _____ Years

2. How many years have you worked for your company? _____ Years

3. What is your job title? ______________________________

4. If your company had a job grade system where would your job be on the following scale? (Clerk = 10, President/CEO = 20) (Please tick ☑ only one box.)

10	11	12	13	14	15	16	17	18	19	20

SECTION B. THE COMPANY PROFILE

If your company manages independent business units operating their own production lines, please answer the following questions relating to your business unit activities (Please tick ☑ appropriate box.).

1. For how many years has your company or business unit been established?

   ❑ Less than 5 years ❑ 5 to 8 years ❑ 9 to 12 years
   ❑ 13 to 16 years ❑ 17 to 20 years ❑ More than 20 years

2. What was the approximate total sales value in your company or business unit in 2003 (Unit: Hundred Million Korean Won)?

   ❑ Less than 10 ❑ 10 to 50 ❑ 51 to 100
   ❑ 101 to 250 ❑ 251 to 500 ❑ 501 to 1000
   ❑ 1001 to 2500 ❑ 2501 to 5000 ❑ More than 5000

3. What is the approximate number of full-time employees in your company or business unit?

   ❑ Less than 100 ❑ 100 to 300 ❑ 301 to 500
   ❑ 501 to 1000 ❑ 1001 to 2000 ❑ More than 2000

4. What are your main products?

   ❑ Home electronics ❑ Wire telecom equipment ❑ Portable cellular phone
   ❑ Computer ❑ Semi-conductor ❑ Heavy electric equipment
   ❑ Electric wire ❑ Automobile ❑ Automobile parts
   ❑ Trailer ❑ Others (please specify) ______________________

5. Which type of distribution channel does your company or your business unit use?

- ❑ Your own account/Entirely in house
- ❑ Wholly owned sales subsidiary
- ❑ Joint venture with local partner
- ❑ Outsourcing to logistics company

6. In general "global sourcing strategy" follows an evolutionary process from "domestic purchasing only" to "integration of global procurement strategy". What is your company's global sourcing stage?

   (a) Domestic purchasing only ❑

   (b) Foreign buying based on need ❑

   (c) Foreign buying as part of procurement strategy ❑

   (d) Integration of global procurement strategy ❑

☞ *If you answered* "(a) Domestic purchasing only" *above, go straight to* ***SECTION C*** *of the questionnaire, otherwise please continue.*

7. What are your main global sourcing locations?

❑ China	❑ Japan	❑ Taiwan	❑ Hong Kong
❑ Singapore	❑ ASEAN	❑ North America	❑ South America
❑ Western Europe	❑ Eastern Europe	❑ Caribbean Basin	❑ Middle East
❑ Africa	❑ Australia	❑ Others (please specify) ____________	

8. Between intra-firm trade and inter-firm trade, which type of global sourcing does your company or business unit conduct mainly? If you conduct both types, please represent the approximate percentage based on the value of items.

   ❑ Intra-firm trade (%) ❑ Inter-firm trade (%)

9. What are your main terms of trade as expressed by "Incoterms" for global sourcing items? Please select all the "Incoterms" you are frequently using. Please refer to ***appendix*** for the full names.

<Import>

❑ EXW	❑ FAS	❑ FOB	❑ FCA	❑ CFR	❑ CIF	❑ CPT
❑ CIP	❑ DAF	❑ DES	❑ DEQ	❑ DDU	❑ DDP	

<Export>

❑ EXW	❑ FAS	❑ FOB	❑ FCA	❑ CFR	❑ CIF	❑ CPT
❑ CIP	❑ DAF	❑ DES	❑ DEQ	❑ DDU	❑ DDP	

SECTION C. SUPPLY CHAIN INTEGRATION CAPABILITY PROFILE

Please indicate your level of agreement with the following statements concerning integrated logistics and supply chain management capabilities which your company or business unit has accomplished: 1. strongly disagree, 2. disagree, 3. slightly disagree, 4. neutral, 5. slightly agree, 6. agree, 7. strongly agree, N. not available/applicable (Please tick ☑ appropriate box.)

Integrated Logistics and Supply Chain Management Capability	1 (Strongly Disagree)	2	3	4	5	6	7 (Strongly Agree)	N
1. My firm has made continual investments in information technology specific to the needs of global operation.	❑	❑	❑	❑	❑	❑	❑	❑
2. My firm's information systems are tailored to meet the unique requirements of logistics and supply chain management.	❑	❑	❑	❑	❑	❑	❑	❑
3. My firm's information system provides *useful* strategy-related information (e.g. global technology development, foreign law and tax system, etc.).	❑	❑	❑	❑	❑	❑	❑	❑
4. My firm's information system provides *useful* production-related information (e.g. production cost, process control information, etc.).	❑	❑	❑	❑	❑	❑	❑	❑
5. My firm's information system provides *useful* logistics-related information (e.g. transportation cost, total logistics cost, etc.).	❑	❑	❑	❑	❑	❑	❑	❑
6. My firm's information systems are designed to *effectively* share operational information between departments.	❑	❑	❑	❑	❑	❑	❑	❑
7. My firm's information systems are designed to *effectively* share operational information externally with selected suppliers and/or customers.	❑	❑	❑	❑	❑	❑	❑	❑
8. My firm uses *formal* planning systems for the design of operating system (e.g.purchasing/materials management system, logistics/physical distribution system, etc.).	❑	❑	❑	❑	❑	❑	❑	❑
9. My firm has established *formal* evaluation systems for financial and logistical performance.	❑	❑	❑	❑	❑	❑	❑	❑
10. My firm's decision making process is based on *total* cost measurement.	❑	❑	❑	❑	❑	❑	❑	❑
11. My firm uses a continual planning process that incorporates feedback from past experience.	❑	❑	❑	❑	❑	❑	❑	❑
12. My firm uses a continual planning process evaluating environmental constraints, firm resources and organisational goals (e.g. SWOT [Strength, Weakness, Opportunity, Threat] Analysis).	❑	❑	❑	❑	❑	❑	❑	❑
13. My firm *jointly* develops strategic plans involving all functional staffs.	❑	❑	❑	❑	❑	❑	❑	❑
14. My firm's logistics strategy is highly integrated with the strategic plans of other areas.	❑	❑	❑	❑	❑	❑	❑	❑
15. My firm has increased *long-term* agreements (more than one year) with key suppliers in the past five years.	❑	❑	❑	❑	❑	❑	❑	❑

Integrated Logistics and Supply Chain Management Capability	Strongly Disagree 1	2	3	4	5	6	Strongly Agree 7	N
16. My firm shares technical resources, research and development costs with key suppliers.	❑	❑	❑	❑	❑	❑	❑	❑
17. My firm's key suppliers participate in the development and design of new products.	❑	❑	❑	❑	❑	❑	❑	❑
18. My firm formally evaluates suppliers' performance.	❑	❑	❑	❑	❑	❑	❑	❑
19. My firm flexibly modifies the order size, volume or composition to key suppliers during logistics operation.	❑	❑	❑	❑	❑	❑	❑	❑
20. My firm has established cross functional policies and procedures to facilitate synchronous operations.	❑	❑	❑	❑	❑	❑	❑	❑
21. My firm adheres to established operational and administrative policies and procedures.	❑	❑	❑	❑	❑	❑	❑	❑
22. My firm has reduced formal organisational structure to more fully integrate operations in the past five years.	❑	❑	❑	❑	❑	❑	❑	❑
23. My firm uses active programmes to capture the experience and expertise of individuals and transfer this knowledge throughout the organisation.	❑	❑	❑	❑	❑	❑	❑	❑
24. My firm has established different logistics service strategies for different customers.	❑	❑	❑	❑	❑	❑	❑	❑
25. My firm uses a flexible programme providing special services that can be matched to changing customer requirements.	❑	❑	❑	❑	❑	❑	❑	❑
26. My firm formally measures customer satisfaction.	❑	❑	❑	❑	❑	❑	❑	❑
27. My firm maintains high level of communication with customers.	❑	❑	❑	❑	❑	❑	❑	❑
28. My firm uses integrated logistical operations under *single* control (e.g. transportation, distribution, collection, consolidation/de-consolidation, etc.).	❑	❑	❑	❑	❑	❑	❑	❑
29. My firm uses total transportation chain performance measurement.	❑	❑	❑	❑	❑	❑	❑	❑
30. My firm's multimodal transportation management is flexible in terms of time, items, quantity, location, or delivery sequencing.	❑	❑	❑	❑	❑	❑	❑	❑
31. My firm successfully coordinates inbound and outbound transportation.	❑	❑	❑	❑	❑	❑	❑	❑
32. My firm has increased long-term agreements (more than one year) with logistics service providers in the past five years.	❑	❑	❑	❑	❑	❑	❑	❑

SECTION D. PERFORMANCE PROFILE

Please indicate how well your company or business unit perform, ***compared to your major competitors***, in the following performance area: 1. much worse, 2. worse, 3. slightly worse, 4. no difference, 5. slightly better, 6. better, 7. much better, N. not available/applicable (Please tick ☑ appropriate box.). All respondents should answer ***question one to fifteen***. In addition, companies involved in global sourcing should also answer ***question sixteen to twenty***.

Performance and Competitive Advantage	1 (Much Worse)	2	3	4	5	6	7 (Much Better)	N
1. Meeting accurately quoted or anticipated delivery dates and quantities on a consistent basis	❑	❑	❑	❑	❑	❑	❑	❑
2. Responding promptly to the needs and wants of key customers	❑	❑	❑	❑	❑	❑	❑	❑
3. Flexible in terms of accommodating customers' special requests	❑	❑	❑	❑	❑	❑	❑	❑
4. Notifying customers in advance of delivery delays or product shortages	❑	❑	❑	❑	❑	❑	❑	❑
5. Utilising Just-In-Time (JIT) management	❑	❑	❑	❑	❑	❑	❑	❑
6. Producing main products with lower manufacturing cost compared to major competitors	❑	❑	❑	❑	❑	❑	❑	❑
7. Meeting customer's expectation for manufacturing quality consistently	❑	❑	❑	❑	❑	❑	❑	❑
8. Meeting customer's expectation for design quality consistently	❑	❑	❑	❑	❑	❑	❑	❑
9. Flexible in terms of production volume, changeover, and modification	❑	❑	❑	❑	❑	❑	❑	❑
10. Dealing with unexpected events or situations	❑	❑	❑	❑	❑	❑	❑	❑
11. Product innovation level in the product (i.e. the set of innovative ideas involved in the products)	❑	❑	❑	❑	❑	❑	❑	❑
12. Process innovation level in the product (i.e. the set of innovative ideas involved in the manufacturing process)	❑	❑	❑	❑	❑	❑	❑	❑
13. Market share in the last year compared to major competitors	❑	❑	❑	❑	❑	❑	❑	❑
14. Sales growth rate in the past five years compared to major competitors	❑	❑	❑	❑	❑	❑	❑	❑
15. Sales growth rate compared to market growth rate itself (not compared to major competitors)	❑	❑	❑	❑	❑	❑	❑	❑
☞ ***If your company conducts a global sourcing strategy, please answer questions below.***								
16. Achieving lower factor cost through global sourcing	❑	❑	❑	❑	❑	❑	❑	❑
17. Accessing to advanced production technologies through global sourcing	❑	❑	❑	❑	❑	❑	❑	❑
18. Penetrating local markets through global sourcing	❑	❑	❑	❑	❑	❑	❑	❑
19. Reducing time delays involved in waiting for local suppliers to provide the requisite components through global sourcing	❑	❑	❑	❑	❑	❑	❑	❑
20. Reducing local disadvantage/difficulties (e.g. trade barriers) through global sourcing	❑	❑	❑	❑	❑	❑	❑	❑

Do you wish to receive a summary of the results of this survey? ❑ YES ❑ NO

If YES, please return your business card or provide your e-mail address with completed questionnaire.

(A) Business Card enclosed ❑

(B) E-mail Address: ______________________________

Thank you very much for your participation in this study

Please kindly return this completed questionnaire in the "FREEPOST" envelope provided.

Yours faithfully,
Sang-Yoon Lee
Sylee505@hotmail.com/LeeSY2@cf.ac.uk
Tel: +44 (0)29 2087 5001 (UK)/ +82 (0)2 2105 2820 (Korea)

<Appendix: Explanation of Incoterms>

INCOTERMS	DENOMINATION	SELLER'S OBLIGATIONS	PURCHASER'S OBLIGATIONS	APPLICATION
EXW	Ex Works	1	2-11	Multipurpose
FCA	Free Carrier	1-4	5-11	Maritime
FAS	Free Alongside Ship	1-3	4-11	Multipurpose
FOB	Free On Board	1-5	5-11	Maritime
CFR	Cost and Freight	1-6	7-11	Maritime
CPT	Carriage Paid To	1-6	7-11	Multipurpose
CIF	Cost, Insurance and Freight	1-7	8-11	Maritime
CIP	Carriage and Insurance Paid to	1-7	8-11	Multipurpose
DAF	Delivered At Frontier	1-7	6-11	Multipurpose/Land
DES	Delivered Ex Ship	1-7	8-11	Maritime
DEQ	Delivered Ex Quay (Duty Paid)	1-9	10-11	Maritime
DDU	Delivered Duty Unpaid	1-8, 10-11	9	Multipurpose
DDP	Delivered Duty Paid	1-11		Multipurpose

COSTS AT POINT OF ORIGIN:

1. Packaging and verification (quality control, size, weight, etc.).
2. Collection, loading and stowage (in lorry, wagon, container, etc.) in the factory or warehouse.
3. Internal (national) transport. From factory or warehouse to the terminal, port or airport, containers, groupage, etc.
4. Export office (customs and administrative fees, taxes, obtaining and processing documents, etc.)
5. Terminal costs (port, airport, etc.), unloading and breaking bulk (national transport method), handling in the port, airport, terminal, containers, warehouse, etc., loading and stowage (international transport method) and possible storage waiting for stuffing, connections, etc.

TRANSIT COSTS:

6. International transport (freight)
7. Insurance (transport and merchandise)

COSTS AT DESTINATION:

8. Terminal costs, unloading, breaking bulk, loading, stowage, handling and possible storage during waits for stuffing, etc.
9. Import office (customs and administrative fees, taxes, obtaining and processing documents, etc.)
10. Internal (national) transport from port, airport or terminal to destination (factory or warehouse)
11. Unloading and delivery

APPENDIX B

QUESTIONNAIRE IN KOREAN

설문조사 (2004)

통합적 공급 체인과 경쟁적 우위

안녕하십니까?

저는 해운·국제물류 관련 국책 전문 연구 기관인 한국해양수산개발원 (www.kmi.re.kr)에 근무하고 있는 이상윤 책임연구원입니다.

저는 현재 영국 카디프 대학 (Cardiff Business School; www.cardiff.ac.uk)에서 물류 및 공급 체인 경영 박사 과정을 이수 중에 있습니다. 저의 학위 논문 주제는 통합적인 공급 체인 관리 (Integrated Supply Chain Management)가 전자 산업과 자동차 산업 제조업체들의 물류 성과 (Logistics Operation Performance)와 글로벌 소싱 성과 (Global Sourcing Performance), 그리고 지속적인 경쟁적 우위 (Competitive Advantage)에 어떠한 영향을 무슨 경로를 통해 미치는가를 연구하는 것입니다.

해외 구매 능력과 물류 관리 역량은 기업의 발전과 생존에 주요한 요소가 되어가고 있습니다. 특히, 최근 들어 글로벌 소싱과 통합적 공급 체인 관리는 기업의 제조·물류 비용을 절감하고 고객의 요구를 효과적으로 충족시킴으로써 우수한 성과와 경쟁적 우위를 획득하게 하는 주요한 전략적 기구로서 인식되고 있습니다.

이러한 이유로 귀하에게 실증적 연구를 위한 설문조사를 의뢰하고 자 하오니 부디 수락하여 주시면 감사하겠습니다. 본 설문에는 "옳은 답"과 "틀린 답"이 없습니다. 해당 산업에 종사하고 계신 귀하의 전문가적인 견해에 따라 주관적으로 답변해 주시면 됩니다.

본 설문은 가능한 한 쉽고 편하게 응답하실 수 있도록 대부분 객관식 형태로 디자인되어 있습니다. **선행 실험 결과 모든 설문을 응답하는데 15분 정도가 소요되었습니다.**

본 설문조사는 익명성을 철저히 준수하겠습니다. 귀하께서 제공하신 모든 정보는 기밀로 취급될 것이며 전반적인 산업의 경향을 나타내기 위해 합산된 수치로만 발표될 것입니다. 기업이나 설문응답자의 어떠한 특이 사항도 보고되지 않을 것임을 약속 드립니다. 또한 **본 설문조사의 결과는 오직 학술적 목적으로만 사용할 것이며, 귀하께 제공하여 드릴 것도 약속 드립니다.**

귀하의 응답과 도움은 본 연구의 성패에 가장 절대적인 요소입니다. 여러 가지 업무로 바쁘실 것으로 사료됩니다만 잠시만 시간을 할애하셔서 설문에 응답해 주시면 감사하겠습니다. 완성된 설문은 동봉된 **반송용 봉투**를 이용하여 보내 주시기 바랍니다. 귀하의 도움과 협조에 다시 한번 깊이 감사 드립니다.

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영문설문지가 필요하신 경우에는 위의 연락처로 문의하여 주시기 바랍니다.

제 1 부 설문 응답자 관련 질문

1. 귀하는 본 산업분야에 몇 년간 종사하셨습니까? _______ 년

2. 귀하는 귀사에 입사하신 지 얼마나 되셨습니까? _______ 년

3. 귀하의 사내 직위는 무엇입니까? ______________________

4. 귀 사의 직급구조상 귀하의 직위는 다음 중 어느 것에 해당합니까 (다음 중 한 곳에만 ☑해 주십시오)?
   (사원 = 10, 대표/최고경영자 = 20)

10	11	12	13	14	15	16	17	18	19	20

제 2 부 사업체 관련 질문

만약 귀사가 각기 **고유한 생산라인을 보유하고 있는 독립적인 사업단위 (Business Units)** 또는 사업본부를 운영하고 있다면, **귀하가 속해있는 사업장의 경영활동**과 관련하여 다음의 질문에 답변하여 주시기 바랍니다 (해당하는 보기에 ☑표해 주십시오).

1. 귀사 또는 귀 사업장은 설립된 지 얼마나 되었습니까?

☐ 5 년 미만	☐ 5 년 ~ 10 년	☐ 11 년 ~ 15 년
☐ 16 년 ~ 20 년	☐ 21 년 ~ 25 년	☐ 25 년 초과

2. 귀사 또는 귀 사업장의 총 매출액은 어느 정도 입니까 (2003 년 기준)?

☐ 10 억 원 미만	☐ 10 억 원 ~ 50 억 원	☐ 51 억 원 ~ 100 억 원
☐ 101 억 원 ~ 250 억 원	☐ 251 억 원 ~ 500 억 원	☐ 501 억 원 ~ 1000 억 원
☐ 1001 억 원 ~ 2500 억 원	☐ 2501 억 원 ~ 5000 억 원	☐ 5000 억 원 초과

3. 귀사 또는 귀 사업장의 전일제 고용자수는 어느 정도 입니까?

☐ 100 명 미만	☐ 100 명 ~ 300 명	☐ 301 명 ~ 500 명
☐ 501 명 ~ 1000 명	☐ 1001 명 ~ 2000 명	☐ 2000 명 초과

4. 귀사 또는 귀 사업장의 주요 제품은 무엇입니까?

☐ 가전제품	☐ 유선전화장비	☐ 이동전화기
☐ 컴퓨터	☐ 반도체	☐ 중전기기
☐ 전선	☐ 자동차	☐ 자동차부품
☐ 트레일러	☐ 기타 (명시해 주십시오) ______________	

5. 귀사 또는 귀 사업장은 어떤 형태의 유통·배송 채널 (Distribution Channel)을 이용하고 있습니까?

- ❑ 자사 직접 배송 (Entirely In House)
- ❑ 판매 자회사 (Sales Subsidiary)
- ❑ 지역 파트너와 합작 (Joint Venture)
- ❑ 물류회사 아웃소싱 (Outsourcing)

6. 일반적으로 "해외구매 활동" 즉 "글로벌 소싱 전략 (Global Sourcing Strategy)" 은 "전적인 국내 구매" 로부터 "통합적인 글로벌 구매 전략"에 이르는 진화과정을 따르는 것으로 알려져 있습니다. 귀사의 글로벌 소싱 전략의 단계는 다음 중 무엇입니까?

(a) 전적인 국내 구매 ❑

(b) 필요에 의한 해외 구매 ❑

(c) 구매 전략의 일환으로서의 해외 구매 ❑

(d) 통합적인 글로벌 구매 전략 ❑

☞ 만약 위의 <질문 6>에 대해 "(a) 전적인 국내 구매" 를 답하셨다면 본 설문지의 **제3부**로 가셔서 나머지 질문에 응해주시고, 그렇지 않은 경우에는 아래의 질문에 대해 계속해서 답해주시기 바랍니다.

7. 귀사의 주요 글로벌 소싱 지역은 어느 곳입니까? 모두 표시해 주십시오.

❑ 중국	❑ 일본	❑ 대만	❑ 홍콩
❑ 싱가포르	❑ ASEAN 제국	❑ 북미지역	❑ 남미지역
❑ 서유럽	❑ 동유럽	❑ 카리비안 지역	❑ 중동
❑ 아프리카	❑ 호주	❑ 기타 (명시해주십시오) __________	

8. 귀사 또는 귀 사업단위가 수행하고 있는 글로벌 소싱의 형태는 기업 내 무역 (Intra-firm Trade)과 기업 간 무역 (Inter-firm Trade) 중 어떤 것입니까? 만약 두 가지 모두 해당된다면 교역금액을 기준으로 할 때 대략적 비율은 어느 정도 입니까?

❑ 기업 내 무역 (%)   ❑ 기업 간 무역 (%)

9. 귀사가 글로벌 소싱을 수행함에 있어 주로 이용하는 교역 조건, 즉 "인코텀스 (Incoterms)"는 무엇입니까? 다음 중 귀사가 자주 이용하는 교역조건을 모두 표시해 주십시오. 교역조건에 대한 설명은 첨부된 부록을 참조하시기 바랍니다.

<수입>

❑ EXW	❑ FAS	❑ FOB	❑ FCA	❑ CFR	❑ CIF	❑ CPT
❑ CIP	❑ DAF	❑ DES	❑ DEQ	❑ DDU	❑ DDP	

<수출>

❑ EXW	❑ FAS	❑ FOB	❑ FCA	❑ CFR	❑ CIF	❑ CPT
❑ CIP	❑ DAF	❑ DES	❑ DEQ	❑ DDU	❑ DDP	

제 3 부 공급 체인 통합 역량 관련 질문

귀사 또는 귀 사업단위의 **통합적** 공급 체인 관리 역량과 관련하여 다음의 항목들이 기술하고 있는 사항에 대해 **귀하가 동의하는 정도를** 표해주시기 바랍니다: 1. 강하게 동의하지 않음; 2. 동의하지 않음; 3. 약간 동의하지 않음; 4. 중립; 5. 약간 동의함; 6. 동의함; 7. 강하게 동의함; N. 답변할 수 없음 (해당하는 보기에 ☑표해 주십시오.)

통합적 공급 체인 관리 역량	1 (강한 비동의)	2	3	4	5	6	7 (강한 동의)	N
1. 당사는 기업의 글로벌 운영에 있어 특별히 요구되는 정보 기술 (Information Technology)에 대한 투자를 지속으로 하고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
2. 당사의 정보시스템은 물류 및 공급 체인 관리에 필요한 고유한 요구 사항을 상황에 따라 잘 충족시키고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
3. 당사의 정보 시스템은 전략과 관련된 유용한 정보 (Strategy-related Information)를 제공한다 (예: 세계적 기술 개발, 해외 법규/세제 정보 등).	❑	❑	❑	❑	❑	❑	❑	❑
4. 당사의 정보 시스템은 생산과 관련된 유용한 정보 (Production-related Information)를 제공한다 (예: 국가별 생산비용 정보, 프로세스 통제 정보 등).	❑	❑	❑	❑	❑	❑	❑	❑
5. 당 사의 정보 시스템은 물류와 관련된 유용한 정보 (Logistics-related Information)을 제공한다 (예: 수송 비용 정보, 총 물류 비용 정보 등).	❑	❑	❑	❑	❑	❑	❑	❑
6. 당사의 정보 시스템은 운영 관련 정보를 부서간에 효과적으로 공유할 수 있도록 디자인되어 있다.	❑	❑	❑	❑	❑	❑	❑	❑
7. 당사의 정보 시스템은 운영 관련 정보를 외부의 선정된 공급업자 또는 고객과 효과적으로 공유할 수 있도록 디자인되어 있다.	❑	❑	❑	❑	❑	❑	❑	❑
8. 당 사는 운영 시스템 (구매 시스템, 물류 및 배송 시스템 등)의 디자인을 위한 공식적인 계획 수립 시스템 (Planning Systems)을 사용하고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
9. 당사는 재무 및 물류성과 (Financial and Logistical Performance)의 평가를 위한 공식적인 평가 시스템을 갖추고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
10. 당사의 의사 결정 과정은 총 비용 측정 (Total Cost Measurement)에 기초하고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
11. 당사는 경험으로부터 획득한 지식을 지속적으로 수렴 및 통합하는 계획 수립 과정 (Planning Process)을 적용하고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
12. 당사는 외부 환경요인과 기업의 자원 및 조직의 목표 등을 지속적으로 평가하는 계획 수립 과정 (Planning Process)을 적용하고 있다 (예: SWOT [강점, 약점, 기회, 위기] 분석).	❑	❑	❑	❑	❑	❑	❑	❑
13. 당사는 모든 직무 분야의 부서원이 공동으로 참여하여 전략적 계획(Strategic Plan)을 개발·수립하고 있다.	❑	❑	❑	❑	❑	❑	❑	❑
14. 당사의 물류전략은 다른 분야의 전략적 계획들과 통합적으로 수립되어 있다.	❑	❑	❑	❑	❑	❑	❑	❑
15. 당사는 지난 5 년 동안 핵심 공급업자와의 장기 협약/계약 (일년 이상)을 증가시켜 왔다.	❑	❑	❑	❑	❑	❑	❑	❑

통합적 공급 체인 관리 역량 (계속)	강한 비동의 ←→ 강한 동의
16. 당사는 당사의 핵심 공급업자와 기술적 자원, 연구 개발 비용 등을 공유하고 있다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
17. 당사의 핵심 공급업자들은 당사의 신제품 개발 및 디자인에 참여하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
18. 당사는 공급업자들의 성과를 공식적으로 평가하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
19. 당사는 핵심 공급업자에 대하여 주문량이나 제품 구성 등을 물류 활동이 이미 전행 중에 있어도 유연하게 변경할 수 있다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
20. 당사는 부서간 조화로운 운영을 촉진하기 위해 기능 교차적인(Cross Functional) 정책과 절차를 수립하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
21. 당사는 수립된 운영상·행정상 정책과 절차를 준수하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
22. 당사는 지난 5 년간 보다 통합적인 조직을 갖추기 위하여 공식적인 조직 기구를 축소하여 왔다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
23. 당사는 개인의 경험과 전문성을 발굴하고 그 지식을 조직에 이전·확산 시키기 위한 프로그램을 활발히 사용하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
24. 당사는 고객별로 차별화된 물류서비스 전략을 수립하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
25. 당사는 변화하는 고객의 특별한 서비스 요구를 충족시킬 수 있는 유연한 프로그램을 사용하고 있다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
26. 당사는 고객의 만족도를 공식적으로 측정하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
27. 당사는 고객들과 높은 수준의 대화·교류 (Communication)를 유지하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
28. 당사는 단일 통제 (Single Control) 하에 전체적인 유통 채널 (집하, 수송, 배분)을 통합적으로 운영하고 있다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
29. 당사는 유통 채널의 성과를 총체적으로 측정하고 있다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
30. 당사의 복합 운송 관리 (Multimodal Transportation Management)는 시간, 제품, 수량, 지역 및 배송 순서 등에 있어 유연하다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
31. 당사는 유입수송과 유출수송 (Inbound and Outbound Transportation)을 성공적으로 조화시키고 있다.	1 2 3 4 5 6 7 N ❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑
32. 당사는 지난 5년간 물류서비스 공급업자와의 장기 협약/계약 (일년 이상)을 증가시켜 왔다.	❑ ❑ ❑ ❑ ❑ ❑ ❑ ❑

제 4 부 성과 및 경쟁적 우위 관련 질문

다음의 표에 기술된 성과지표에 대하여 귀사 또는 귀 사업단위가 **주요 경쟁사와 비교할 때 상대적으로** 얼마나 우수한 성과를 기록하고 있는지 표해주시기 바랍니다: 1. 훨씬 열악함; 2. 열악함; 3. 약간 열악함; 4. 차이 없음; 5. 약간 우수함; 6. 우수함, 7. 훨씬 우수함; 답변할 수 없음 (해당하는 보기에 ☑표해 주십시오).

☞ **글로벌 소싱 활동을** 수행하고 있는 기업의 경우에는 **질문** 1 에서 **질문** 20 까지 모든 질문에 답해주시기 바랍니다. 그 외의 **응답자**들은 **질문 1** 에서 **질문** 15 까지 답해주시기 바랍니다.

성과 및 경쟁적 우위 지표	1 (훨씬 열악)	2	3	4	5	6	7 (훨씬 우수)	N
1. 경쟁사에 비해 명시 또는 예상된 배송 일자 및 견적 수량을 지속적으로 정확하게 맞춘다.	☐	☐	☐	☐	☐	☐	☐	☐
2. 경쟁사에 비해 물류와 관련한 핵심 고객의 필요와 욕구에 신속하게 대응한다.	☐	☐	☐	☐	☐	☐	☐	☐
3. 경쟁사에 비해 물류와 관련된 고객의 특별한 요구를 유연하게 수용한다.	☐	☐	☐	☐	☐	☐	☐	☐
4. 경쟁사에 비해 고객에게 배송 지연이나 제품 부족(Product Shortages)을 사전에 미리 통지한다.	☐	☐	☐	☐	☐	☐	☐	☐
5. 경쟁사에 비해 Just-In-Time (JIT) 경영을 성공적으로 수행한다.	☐	☐	☐	☐	☐	☐	☐	☐
6. 경쟁사에 비해 상대적으로 저렴한 제조비용으로 제품을 생산한다.	☐	☐	☐	☐	☐	☐	☐	☐
7. 경쟁사에 비해 제조 품질에 대한 고객의 기대를 지속적으로 충족시킨다.	☐	☐	☐	☐	☐	☐	☐	☐
8. 경쟁사에 비해 디자인 품질에 대한 고객의 기대를 지속적으로 충족시킨다.	☐	☐	☐	☐	☐	☐	☐	☐
9. 경쟁사에 비해 제품의 수량, 전환 (Changeover) 및 변형에 있어 유연하다.	☐	☐	☐	☐	☐	☐	☐	☐
10. 경쟁사에 비해 예상치 못했던 사건이나 상황에 잘 대처한다.	☐	☐	☐	☐	☐	☐	☐	☐
11. 경쟁사에 비해 제품과 관련된 생산 혁신 (Product Innovation) 수준이 높다 (즉, 제품에 포함된 일련의 혁신적 아이디어).	☐	☐	☐	☐	☐	☐	☐	☐
12. 경쟁사에 비해 제품과 관련된 공정 혁신 (Process Innovation) 수준이 높다 (즉, 제조 과정에 포함된 일련의 혁신적 아이디어).	☐	☐	☐	☐	☐	☐	☐	☐
13. 경쟁사에 비해 시장점유율 (Market Share) 이 상대적으로 높다 (작년 기준).	☐	☐	☐	☐	☐	☐	☐	☐
14. 경쟁사와 비교할 때 지난 5 년간 매출액 신장률이 상대적으로 높다.	☐	☐	☐	☐	☐	☐	☐	☐
15. 시장 자체의 성장률과 비교할 때 당사의 매출액 신장률이 상대적으로 높다 (본 항목은 주요 경쟁사와의 비교가 아님에 유의하시기 바랍니다.)	☐	☐	☐	☐	☐	☐	☐	☐
만약 귀사가 글로벌 소싱 전략을 수행하고 있다면 아래의 질문에 대해서도 답해주시기 바랍니다.								
16. 글로벌 소싱을 통해 경쟁사에 비해 상대적으로 저렴한 비용으로 생산요소를 취득한다.	☐	☐	☐	☐	☐	☐	☐	☐
17. 글로벌 소싱을 통해 경쟁사에 비해 고급 생산 기술에 성공적으로 접근한다.	☐	☐	☐	☐	☐	☐	☐	☐
18. 글로벌 소싱을 통해 경쟁사에 비해 대상국 시장 (Local Market)에 성공적으로 진출한다.	☐	☐	☐	☐	☐	☐	☐	☐
19. 글로벌 소싱의 결과 경쟁사에 비해 해외 조달 부품을 기다림에 따라 발생하던 지체 시간 (Time Delays)이 감소하였다.	☐	☐	☐	☐	☐	☐	☐	☐
20. 글로벌 소싱을 통해 경쟁사에 비해 국가간 차이로 인해 발생하였던 불리한 입장이나 곤란이 감소하였다 (예: 무역장벽, 문화차이 등).	☐	☐	☐	☐	☐	☐	☐	☐

귀하께서는 본 설문조사의 결과 보고서를 받아 보고 싶으십니까? ❑ 예 ❑ 아니오
만약 그렇다면, 귀하의 명함 또는 전자메일 주소를 완성된 설문지와 함께 동봉하여 주시기 바랍니다.

(A) 명함 동봉 ❑

(B) 전자메일: ________________________

설문응답에 진심으로 감사 드립니다.

완성된 설문은 동봉된 봉투를 이용하여 보내 주시기 바랍니다.

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<부록: 교역조건 (Incoterms) 설명>

인코텀스	명 칭	판매자의 의무	구매자의 의무	적 용
EXW	Ex Works	1	2-11	다목적
FCA	Free Carrier	1-4	5-11	해 운
FAS	Free Alongside Ship	1-3	4-11	다목적
FOB	Free On Board	1-5	5-11	해 운
CFR	Cost and Freight	1-6	7-11	해 운
CPT	Carriage Paid To	1-6	7-11	다목적
CIF	Cost, Insurance and Freight	1-7	8-11	해 운
CIP	Carriage and Insurance Paid to	1-7	8-11	다목적
DAF	Delivered At Frontier	1-7	6-11	다목적/육상
DES	Delivered Ex Ship	1-7	8-11	해 운
DEQ	Delivered Ex Quay (Duty Paid)	1-9	10-11	해 운
DDU	Delivered Duty Unpaid	1-8, 10-11	9	다목적
DDP	Delivered Duty Paid	1-11		다목적

기점 (Origin)에서의 비용
1. 포장 및 증명(수량 통제, 규격, 무게 등)
2. 공장 또는 창고 내에서의 집하, 적하, 보관 (로리, 컨테이너 등)
3. 국내 수송. 공장 또는 창고로부터 터미널, 항만 또는 공항 등
4. 수출 사무소 (관세 및 행정요금, 세금, 취득 및 처리 서류 등)
5. 터미널 비용, 항만, 공항, 터미널, 컨테이너, 창고에서의 핸들링, 적하, 보관 비용

이송비용:
6. 국제 운송 (화물)
7. 보험 (수송 및 상품)

종점 (Destination)에서의 비용:
8. 터미널 비용, 하역, 벌크 브레이킹, 적하, 보관, 핸들링 비용 등
9. 수입 사무소 (관세 및 행정요금, 세금, 취득 및 처리 서류 등)
10. 항만, 공항 및 터미널로부터 종점 (공장 또는 창고)에 이르는 국내 수송
11. 하역 및 인도 (Unloading and Delivery)

APPENDIX C

LETTER OF RECOMMENDATION FROM SUPERVISOR

Cardiff Business School
Ysgol Fusnes Caerdydd
Director *Cyfarwyddwr* Professor *Yr Athro* Roger Mansfield MA PhD

Logistics and Operations Management Section
Adain Logisteg a Rheoli Gweithredu
Director *Cyfarwyddwr* Dr Peter Marlow BSc Econ MSc Econ PhD MILT

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Adeilad Aberconway
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Caerdydd CF10 3EU
Cymru, Y Deyrnas Gyfunol

PBM\PJS 10 June 2004

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

TO WHOM IT MAY CONCERN

Dear Sir or Madam

RE: MR SANG-YOON LEE

I am writing to introduce my PhD student, Mr Sang-Yoon Lee, who is also a researcher at the Korea Maritime Institute. He is currently studying for his PhD at Cardiff University in the United Kingdom and is about to carry out his empirical survey of industries in Korea. For this purpose he has prepared a short multiple choice questionnaire and would be very grateful for your support in completing it on behalf of your company.

I understand that you will receive many requests to participate in surveys but I urge you please to complete this one if you can. Mr Lee's PhD thesis requires a good response rate if he is to complete his studies successfully. I guarantee that he is a full time student in Cardiff and that confidentiality of results is guaranteed.

Thank you for your support.

Yours faithfully

Peter B Marlow

Professor Peter B Marlow
Head, Logistics and Operations Management

APPENDIX D

LETTER OF RECOMMENDATION FROM THE PRESIDENT OF KOREA MARITIME INSTITUTE

KMI
KOREA MARITIME INSTITUTE
1027-4, Bangbae 3-Dong, Seocho-gu, Seoul, 137-851, Korea
TEL: +82-2-2105-2700 FAX: +82-2-2105-2800
http://www.kmi.re.kr

안녕하십니까? 귀사의 발전과 번영을 기원합니다.

해운·국제 물류 국책 전문 연구 기관인 한국해양수산개발원 이상윤 책임연구원을 소개하게 된 것을 기쁘게 생각합니다.

이상윤 책임연구원은 현재 영국 카디프 대학에서 물류·공급 체인 경영 박사과정을 이수 중에 있으며, **제조업체의 통합적 공급 체인 관리가 기업의 경쟁적 우위에 미치는 영향을 주제로 학위 논문을 집필 중에 있습니다.** 이를 위해 전자·자동차 관련 제조업체를 대상으로 실증적 분석을 위한 설문조사를 수행 중에 있습니다.

이를 위해 귀하께 설문 참여를 부탁드립니다. 여러 가지 업무로 바쁘시겠지만 잠시만 시간을 내주셔서 설문에 응하여 주시면 감사하겠습니다. **분석 결과는 응답하신 모든 분께 제공될 것이며 기업의 물류·공급 체인 관리에 있어 의미있는 정보와 아이디어를 얻으실 수 있으리라 믿습니다. 또한 응답하신 분의 개별적 정보는 철저히 기밀로 취급될 것임을 약속드립니다.**

귀하의 응답이 본 연구의 성패에 있어서 가장 중요한 요소입니다. 장래 물류 전문 연구 인력을 육성하신다는 마음으로 설문에 응해주시면 감사하겠습니다. 다시 한번 너른 이해와 협조를 부탁드립니다.

2004년 6월 21일
한국해양수산개발원장

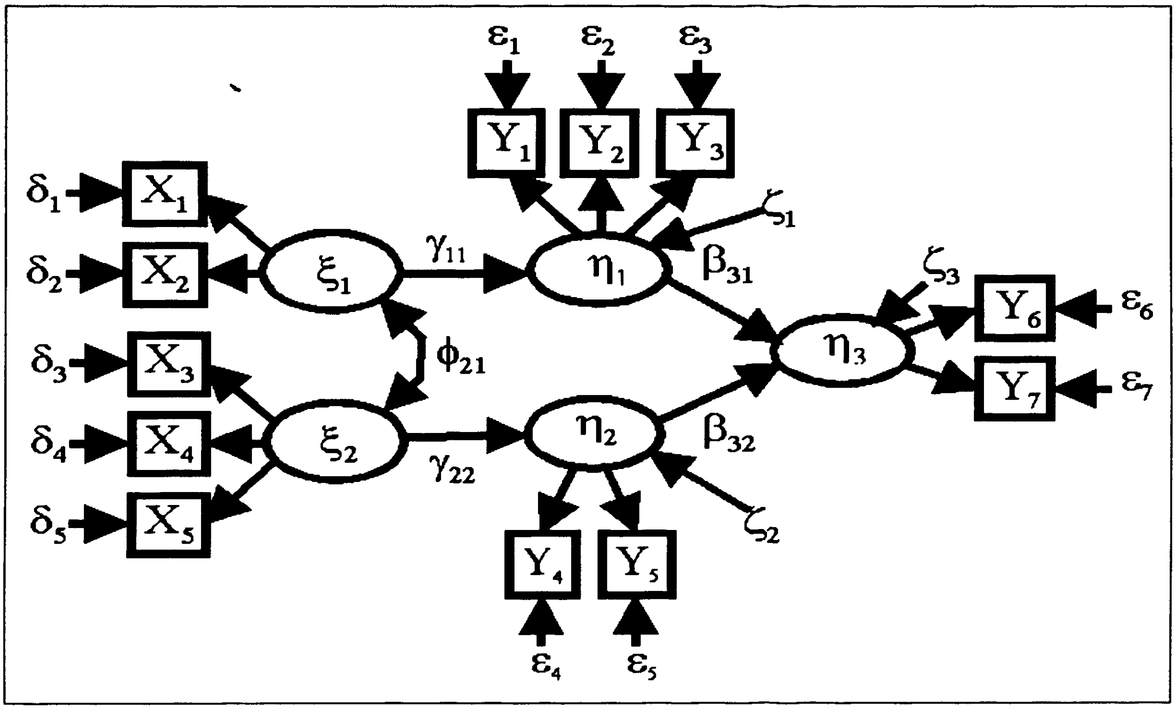
이 정 욱

이 정 욱 드림

APPENDIX E

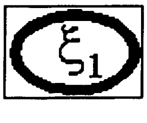
A GRAPHICAL EXAMPLE OF A STRUCTURAL EQUATION MODEL

The following picture and explanations are adapted from "What is Structural Equation Modelling?" provided by a website in order to present a graphical example of a structural equation model.[1]

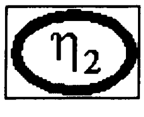


1) Latent Constructs

In structural equation modelling, the key variables of interest are usually "latent constructs". We can observe the behaviour of latent variables only indirectly, and imperfectly, through their effects on manifest variables.



A structural equation model may include two types of latent constructs-- exogenous and endogenous. In the most traditional system, exogenous constructs are indicated by the Greek character "ksi" (*at left*) and endogenous constructs are indicated by the Greek character "eta" (*at right*).



Exogenous constructs are independent variables in all equations in which they appear, while endogenous constructs are dependent variables in at least one equation-although they may be independent variables in other equations in the system. In graphical terms, each endogenous construct is the target of at least one one-headed arrow, while exogenous constructs are only targeted by two-headed arrows.

[1] http://www2.gsu.edu/~mkteer/sem2.html

2) Structural Model

In SEM, the structural model includes the relationships among the latent constructs. In the diagram, one-headed arrows represent regression relationships, while two-headed arrows represent co-relational relations.

$\boxed{\gamma_{22}}$ Parameters representing regression relations between latent constructs are typically labelled with the Greek character "gamma" (*at left*) for the regression of an endogenous construct on an exogenous construct, or with $\boxed{\beta_{32}}$ the Greek character "beta" (*at right*) for the regression of one endogenous construct on another endogenous construct.

$\boxed{\phi_{21}}$ Typically in SEM, exogenous constructs are allowed to covary freely. Parameters labelled with the Greek character "phi" (*at left*) represent these covariances. This covariance comes from common predictors of the exogenous constructs which lie outside the model under consideration.

3) Structural Error

Few SEM researchers expect to perfectly predict their dependent constructs, so model $\boxed{\zeta_{3}}$ typically include a structural error term, labelled with the Greek character "zeta" (*at left*). To achieve consistent parameter estimation, these error terms are assumed to be uncorrelated with the model's exogenous constructs. However, structural error terms may be modelled as being correlated with other structural error terms. Such a specification indicates that the endogenous constructs associated with those error terms share common variation that is not explained by predictor relations in the model.

4) Manifest Variables

$\boxed{X_{1}}$ $\boxed{Y_{6}}$ SEM researchers use manifest variables - that is, actual measures and scores - to ground their latent construct models with real data. Manifest variables associated with exogenous constructs are labelled X, while those associated with endogenous constructs are labelled Y.

5) Measurement Error

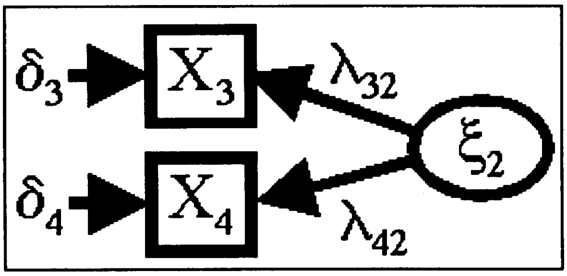
SEM users typically recognize that their measures are imperfect, and they attempt to model this imperfection. Thus, structural equation models include terms representing measurement error. In the context of the factor analytic measurement model, these measurement error terms are uniqueness or unique factors associated with each measure. Measurement error terms associated with X measures are labelled with the Greek character "delta" (*at left*) while terms associated with Y measures are labelled with "epsilon" (*at right*).

$\boxed{\delta_1}$ $\boxed{\varepsilon_3}$

Conceptually, almost every measure has an associated error term. In other words, almost every measure is acknowledged to include some error.

6) Measurement Model

In SEM, each latent construct is usually associated with multiple measures. SEM researchers most commonly link the latent constructs to their measures through a factor analytic measurement model. That is, each latent construct is modelled as a common factor underlying the associated measures. These "loadings" linking constructs to measures are labelled with the Greek character "lambda" (*at left*).



Structural equation models can include two separate lambda matrices, one on the X side and one on the Y side. In SEM applications, the most common measurement model is the congeneric measurement model, where each measure is associated with only one latent construct, and all co variation between measures is a consequence of the relations between measures and constructs.

APPENDIX F

NON RESPONDENTS' BIAS TEST

Non Respondents' Bias Test (Independent Samples T-Test)

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
A1	Equal variances assumed	2.954	.089	1.465	100	.146	2.00714	1.37006	-.71102	4.72530
	Equal variances not assumed			1.519	97.616	.132	2.00714	1.32166	-.61577	4.63005
A2	Equal variances assumed	.888	.348	.325	100	.746	.42143	1.29685	-2.15149	2.99435
	Equal variances not assumed			.331	93.474	.742	.42143	1.27441	-2.10913	2.95199
A4	Equal variances assumed	.560	.456	-.551	100	.583	-.25476	.46256	-1.17246	.66294
	Equal variances not assumed			-.565	95.375	.574	-.25476	.45110	-1.15026	.64073
B1	Equal variances assumed	.227	.635	.089	100	.930	.03095	.34937	-.66218	.72409
	Equal variances not assumed			.088	87.263	.930	.03095	.35062	-.66591	.72781
B2	Equal variances assumed	.296	.588	.660	100	.511	.25714	.38988	-.51637	1.03065
	Equal variances not assumed			.649	83.008	.518	.25714	.39639	-.53126	1.04555
B3	Equal variances assumed	.073	.788	.533	99	.595	.14837	.27821	-.40365	.70040
	Equal variances not assumed			.518	76.776	.606	.14837	.28669	-.42253	.71927
B6	Equal variances assumed	1.020	.315	1.205	99	.231	.24431	.20271	-.15791	.64653
	Equal variances not assumed			1.177	78.793	.243	.24431	.20755	-.16882	.65744
C1	Equal variances assumed	.121	.728	-.123	98	.902	-.04258	.34616	-.72953	.64437
	Equal variances not assumed			-.125	89.907	.901	-.04258	.34177	-.72158	.63642
C2	Equal variances assumed	.151	.698	.532	99	.596	.16911	.31768	-.46123	.79944
	Equal variances not assumed			.521	79.574	.604	.16911	.32445	-.47662	.81483
C3	Equal variances assumed	.016	.901	.715	96	.476	.23294	.32558	-.41332	.87921
	Equal variances not assumed			.714	80.923	.477	.23294	.32626	-.41623	.88211
C4	Equal variances assumed	.051	.821	1.173	96	.244	.39310	.33505	-.27196	1.05816
	Equal variances not assumed			1.153	78.623	.253	.39310	.34103	-.28576	1.07196
C5	Equal variances assumed	.017	.898	1.020	96	.310	.35216	.34520	-.33306	1.03739
	Equal variances not assumed			1.014	84.281	.314	.35216	.34743	-.33872	1.04304
C6	Equal variances assumed	.034	.854	.777	99	.439	.24697	.31771	-.38343	.87738
	Equal variances not assumed			.771	85.878	.443	.24697	.32025	-.38967	.88361
C7	Equal variances assumed	.836	.363	2.234	99	.028	.71792	.32133	.08032	1.35551
	Equal variances not assumed			2.275	93.709	.025	.71792	.31554	.09138	1.34445
C8	Equal variances assumed	.133	.716	.625	100	.533	.20238	.32377	-.43997	.84474
	Equal variances not assumed			.621	86.494	.536	.20238	.32571	-.44506	.84982
C9	Equal variances assumed	.414	.522	1.010	97	.315	.33709	.33371	-.32522	.99941
	Equal variances not assumed			1.024	92.543	.308	.33709	.32913	-.31654	.99073
C10	Equal variances assumed	.175	.676	-.427	98	.670	-.11667	.27307	-.65857	.42523
	Equal variances not assumed			-.431	86.059	.668	-.11667	.27083	-.65506	.42173
C11	Equal variances assumed	.452	.503	.028	100	.978	.00714	.25709	-.50291	.51720
	Equal variances not assumed			.027	82.116	.978	.00714	.26208	-.51421	.52850
C12	Equal variances assumed	.328	.568	-.784	97	.435	-.22288	.28430	-.78714	.34137
	Equal variances not assumed			-.777	81.388	.439	-.22288	.28672	-.79332	.34755
C13	Equal variances assumed	1.610	.207	1.815	100	.073	.51429	.28334	-.04785	1.07642
	Equal variances not assumed			1.760	78.244	.082	.51429	.29219	-.06739	1.09596

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
C14	Equal variances assumed	.155	.694	1.890	100	.062	.51429	.27204	-.02543	1.05401
	Equal variances not assumed			1.918	92.658	.058	.51429	.26814	-.01822	1.04679
C15	Equal variances assumed	.000	.994	-.153	99	.879	-.05122	.33543	-.71679	.61435
	Equal variances not assumed			-.152	84.211	.880	-.05122	.33751	-.72238	.61994
C16	Equal variances assumed	1.088	.300	-.543	98	.588	-.17652	.32489	-.82126	.46822
	Equal variances not assumed			-.534	82.783	.595	-.17652	.33040	-.83371	.48067
C17	Equal variances assumed	.000	.991	.158	100	.875	.05000	.31652	-.57797	.67797
	Equal variances not assumed			.158	87.525	.875	.05000	.31739	-.58080	.68080
C18	Equal variances assumed	5.856	.017	.063	97	.950	.01923	.30421	-.58454	.62300
	Equal variances not assumed			.060	67.316	.952	.01923	.32041	-.62026	.65872
C19	Equal variances assumed	.781	.379	1.155	98	.251	.29103	.25204	-.20914	.79119
	Equal variances not assumed			1.120	76.500	.266	.29103	.25985	-.22644	.80850
C20	Equal variances assumed	.413	.522	.117	99	.907	.03309	.28209	-.52663	.59282
	Equal variances not assumed			.115	81.588	.909	.03309	.28795	-.53977	.60595
C21	Equal variances assumed	.269	.605	-.867	100	.388	-.22619	.26094	-.74390	.29151
	Equal variances not assumed			-.856	84.200	.395	-.22619	.26435	-.75187	.29948
C22	Equal variances assumed	3.715	.057	.813	98	.418	.26044	.32040	-.37539	.89626
	Equal variances not assumed			.784	74.890	.435	.26044	.33198	-.40092	.92179
C23	Equal variances assumed	1.689	.197	.829	98	.409	.23522	.28374	-.32785	.79829
	Equal variances not assumed			.849	92.849	.398	.23522	.27694	-.31475	.78519
C24	Equal variances assumed	.633	.428	-.071	99	.944	-.02098	.29737	-.61102	.56905
	Equal variances not assumed			-.069	83.394	.945	-.02098	.30195	-.62151	.57954
C25	Equal variances assumed	.539	.464	-.035	99	.972	-.01057	.30363	-.61303	.59189
	Equal variances not assumed			-.034	79.785	.973	-.01057	.30989	-.62730	.60616
C26	Equal variances assumed	1.032	.312	.081	100	.935	.02619	.32179	-.61223	.66461
	Equal variances not assumed			.080	81.590	.937	.02619	.32856	-.62746	.67984
C27	Equal variances assumed	.439	.509	.001	99	.999	.00041	.30196	-.59875	.59956
	Equal variances not assumed			.001	78.479	.999	.00041	.30948	-.61566	.61647
C28	Equal variances assumed	.830	.364	.760	99	.449	.23089	.30380	-.37190	.83369
	Equal variances not assumed			.750	81.963	.455	.23089	.30791	-.38165	.84343
C29	Equal variances assumed	5.032	.027	.270	99	.788	.07724	.28648	-.49120	.64567
	Equal variances not assumed			.258	72.170	.797	.07724	.29966	-.52010	.67457
C30	Equal variances assumed	.364	.548	.545	100	.587	.15000	.27498	-.39556	.69556
	Equal variances not assumed			.538	83.837	.592	.15000	.27888	-.40460	.70460
C31	Equal variances assumed	6.443	.013	.398	100	.691	.10952	.27518	-.43642	.65546
	Equal variances not assumed			.375	69.036	.709	.10952	.29189	-.47277	.69182
C32	Equal variances assumed	.877	.351	-.660	98	.511	-.21667	.32852	-.86859	.43526
	Equal variances not assumed			-.639	74.313	.525	-.21667	.33930	-.89269	.45935
D1	Equal variances assumed	4.406	.038	.475	100	.636	.10714	.22544	-.34012	.55440
	Equal variances not assumed			.450	70.552	.654	.10714	.23798	-.36744	.58172
D2	Equal variances assumed	6.373	.013	.560	100	.577	.12381	.22119	-.31503	.56265
	Equal variances not assumed			.523	66.506	.602	.12381	.23656	-.34843	.59605
D3	Equal variances assumed	4.340	.040	.712	100	.478	.15952	.22415	-.28518	.60422
	Equal variances not assumed			.670	68.623	.505	.15952	.23807	-.31547	.63451

		Levene's Test for Equality of Variances		T-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
D4	Equal variances assumed	1.111	.294	.950	100	.344	.23095	.24314	-.25143	.71334
	Equal variances not assumed			.908	73.626	.367	.23095	.25425	-.27569	.73759
D5	Equal variances assumed	1.005	.318	.526	99	.600	.15012	.28514	-.41566	.71590
	Equal variances not assumed			.511	78.680	.610	.15012	.29351	-.43413	.73437
D6	Equal variances assumed	.078	.781	1.104	98	.272	.31938	.28923	-.25459	.89334
	Equal variances not assumed			1.085	82.622	.281	.31938	.29427	-.26595	.90471
D7	Equal variances assumed	1.044	.309	-.084	100	.933	-.01905	.22744	-.47029	.43219
	Equal variances not assumed			-.082	81.003	.935	-.01905	.23263	-.48191	.44382
D8	Equal variances assumed	4.407	.038	-.352	99	.725	-.09524	.27042	-.63181	.44133
	Equal variances not assumed			-.339	75.502	.736	-.09524	.28092	-.65479	.46431
D9	Equal variances assumed	1.995	.161	-.389	100	.698	-.09762	.25068	-.59496	.39973
	Equal variances not assumed			-.374	75.260	.709	-.09762	.26084	-.61720	.42196
D10	Equal variances assumed	2.400	.125	.363	99	.717	.08757	.24095	-.39053	.56567
	Equal variances not assumed			.350	75.896	.727	.08757	.25002	-.41040	.58554
D11	Equal variances assumed	2.886	.092	.806	100	.422	.20476	.25413	-.29942	.70894
	Equal variances not assumed			.774	75.046	.441	.20476	.26459	-.32233	.73185
D12	Equal variances assumed	1.287	.259	1.015	100	.313	.26905	.26504	-.25679	.79489
	Equal variances not assumed			.999	83.365	.320	.26905	.26918	-.26631	.80441
D13	Equal variances assumed	.802	.373	.789	99	.432	.22841	.28947	-.34597	.80279
	Equal variances not assumed			.779	84.200	.438	.22841	.29324	-.35472	.81154
D14	Equal variances assumed	1.857	.176	1.428	99	.156	.38781	.27155	-.15099	.92662
	Equal variances not assumed			1.386	78.215	.170	.38781	.27989	-.16938	.94500
D15	Equal variances assumed	2.374	.127	.065	99	.948	.01816	.27885	-.53513	.57145
	Equal variances not assumed			.063	77.844	.950	.01816	.28772	-.55467	.59099
D16	Equal variances assumed	.024	.876	-.084	86	.933	-.02614	.30944	-.64128	.58900
	Equal variances not assumed			-.084	69.933	.933	-.02614	.30991	-.64426	.59197
D17	Equal variances assumed	.079	.780	-.903	85	.369	-.28413	.31463	-.90970	.34144
	Equal variances not assumed			-.896	68.757	.373	-.28413	.31698	-.91652	.34827
D18	Equal variances assumed	.654	.421	-1.747	86	.084	-.57625	.32979	-1.23186	.07935
	Equal variances not assumed			-1.689	62.529	.096	-.57625	.34124	-1.25827	.10576
D19	Equal variances assumed	.130	.719	-.189	85	.851	-.05327	.28242	-.61480	.50825
	Equal variances not assumed			-.189	70.726	.851	-.05327	.28215	-.61591	.50936
D20	Equal variances assumed	.279	.599	-.647	84	.520	-.19344	.29905	-.78814	.40126
	Equal variances not assumed			-.630	64.172	.531	-.19344	.30729	-.80728	.42041

APPENDIX G

MAHALANOBIS D^2 DISTANCE TEST

Mahalanobis D^2 distance Test (Observations farthest from the centroid)

Observation number	Mahalanobis d-squared	p1	p2
77	114.981	0.000	0.000
41	107.193	0.000	0.000
158	97.469	0.000	0.000
83	93.046	0.000	0.000
178	92.186	0.000	0.000
99	85.455	0.001	0.000
119	84.289	0.001	0.000
125	84.110	0.001	0.000
14	83.570	0.001	0.000
185	82.705	0.001	0.000
84	80.737	0.002	0.000
122	80.520	0.002	0.000
57	80.468	0.002	0.000
187	78.289	0.003	0.000
4	77.894	0.003	0.000
5	77.752	0.003	0.000
87	75.418	0.005	0.000
40	73.834	0.007	0.000
70	73.347	0.008	0.000
188	72.672	0.010	0.000
89	72.175	0.011	0.000
16	72.119	0.011	0.000
156	72.027	0.011	0.000
117	71.601	0.012	0.000
30	71.433	0.012	0.000
103	70.689	0.014	0.000
108	70.543	0.015	0.000
101	69.746	0.017	0.000
172	69.739	0.017	0.000
15	68.955	0.020	0.000
183	68.175	0.023	0.000
98	68.010	0.024	0.000
48	67.823	0.025	0.000
186	67.791	0.025	0.000
121	67.320	0.027	0.000
35	67.319	0.027	0.000
157	67.012	0.029	0.000
36	66.185	0.034	0.000
148	66.150	0.034	0.000
55	65.955	0.035	0.000
92	65.879	0.036	0.000
51	65.461	0.039	0.000
75	65.140	0.041	0.000
112	64.662	0.045	0.000
167	64.627	0.045	0.000
49	64.292	0.048	0.000
144	63.123	0.058	0.000
17	62.932	0.060	0.000
56	61.823	0.072	0.000
27	61.282	0.079	0.000

Observation number	Mahalanobis d-squared	p1	p2
8	60.452	0.090	0.000
38	59.764	0.100	0.000
46	59.475	0.105	0.000
179	59.014	0.112	0.000
184	58.312	0.125	0.000
135	58.258	0.126	0.000
159	58.140	0.128	0.000
73	57.907	0.132	0.000
74	57.566	0.139	0.000
140	57.500	0.140	0.000
145	56.920	0.152	0.000
82	56.797	0.155	0.000
52	55.379	0.188	0.000
195	55.115	0.195	0.000
118	55.033	0.197	0.000
29	54.265	0.217	0.000
6	54.233	0.218	0.000
2	53.806	0.230	0.000
142	53.159	0.249	0.001
181	52.903	0.257	0.001
104	52.021	0.285	0.010
149	51.823	0.291	0.011
53	51.569	0.300	0.015
154	51.264	0.310	0.023
93	51.222	0.312	0.018
194	50.452	0.339	0.077
137	50.233	0.347	0.091
37	50.182	0.348	0.076
114	49.843	0.361	0.114
153	49.461	0.375	0.174
7	49.292	0.382	0.185
152	48.726	0.403	0.338
81	48.677	0.405	0.306
173	48.409	0.416	0.362
141	48.334	0.419	0.339
150	47.388	0.457	0.695
100	47.134	0.467	0.744
80	46.939	0.475	0.769
127	46.841	0.479	0.760
130	46.646	0.487	0.784
191	46.186	0.506	0.880
129	46.031	0.513	0.887
110	45.912	0.518	0.887
58	45.728	0.525	0.900
131	45.578	0.532	0.905
31	45.367	0.540	0.922
189	45.137	0.550	0.939
13	45.121	0.551	0.922
23	44.540	0.575	0.975
22	44.359	0.583	0.979

The p1 column indicates that, assuming normality, the probability of d^2 (for case 77) exceeding a value 114.981 of is <.000. The p2 column, also assuming normality, reveals that the probability is still <.000 that the largest d^2 value for any individual case would exceed 114.981.

Observations farthest from the centroid (Mahalanobis distance)
(Global Sourcing Companies)

Observation number	Mahalanobis d-squared	p1	p2
65	111.822	0.000	0.000
151	98.257	0.000	0.000
71	91.161	0.001	0.000
61	91.035	0.001	0.000
75	88.974	0.001	0.000
85	85.136	0.003	0.000
159	85.109	0.003	0.000
48	85.102	0.003	0.000
137	84.691	0.003	0.000
4	84.373	0.003	0.000
72	84.315	0.003	0.000
102	84.247	0.003	0.000
107	83.064	0.004	0.000
87	82.703	0.004	0.000
104	82.224	0.005	0.000
157	81.875	0.005	0.000
76	80.819	0.006	0.000
160	80.358	0.007	0.000
39	79.698	0.008	0.000
33	79.610	0.008	0.000
100	79.171	0.009	0.000
136	78.323	0.011	0.000
92	77.942	0.011	0.000
128	77.923	0.011	0.000
144	76.730	0.014	0.000
5	76.571	0.015	0.000
23	74.815	0.021	0.000
42	74.601	0.022	0.000
14	74.576	0.022	0.000
155	71.634	0.037	0.000
158	71.457	0.038	0.000
79	71.278	0.039	0.000
125	71.074	0.041	0.000
13	70.415	0.045	0.000
29	70.138	0.048	0.000
7	69.127	0.056	0.000
103	67.267	0.076	0.000
40	66.964	0.079	0.000
46	66.771	0.082	0.000
15	66.629	0.083	0.000
95	66.538	0.085	0.000
115	66.119	0.090	0.000
129	64.716	0.111	0.000
156	63.964	0.123	0.000
49	63.677	0.129	0.000
47	63.504	0.132	0.000
89	63.110	0.139	0.000
30	62.852	0.144	0.000
70	62.606	0.149	0.000
124	62.557	0.150	0.000

Observation number	Mahalanobis d-squared	p1	p2
166	62.556	0.150	0.000
120	62.533	0.150	0.000
69	62.501	0.151	0.000
64	61.931	0.163	0.000
24	59.885	0.211	0.000
133	59.573	0.219	0.000
31	59.448	0.223	0.000
43	59.434	0.223	0.000
12	58.775	0.241	0.001
2	58.350	0.253	0.001
152	58.101	0.261	0.002
101	57.982	0.264	0.001
38	57.719	0.272	0.002
80	57.106	0.291	0.006
44	56.780	0.302	0.008
163	56.127	0.323	0.026
110	55.638	0.339	0.050
41	55.139	0.357	0.091
6	54.697	0.373	0.143
122	54.312	0.386	0.196
18	54.257	0.388	0.169
93	53.787	0.406	0.255
25	52.730	0.446	0.591
132	52.625	0.450	0.570
134	52.310	0.462	0.632
117	52.265	0.464	0.589
111	51.649	0.488	0.755
32	51.580	0.490	0.727
146	51.349	0.499	0.753
97	51.191	0.506	0.755
130	51.170	0.507	0.711
62	51.046	0.511	0.701
20	50.812	0.521	0.730
121	49.548	0.571	0.961
118	49.251	0.583	0.972
94	49.032	0.591	0.977
68	49.029	0.591	0.967
139	48.994	0.593	0.957
109	48.568	0.610	0.978
106	47.989	0.632	0.993
86	47.394	0.655	0.998
52	46.604	0.685	1.000
161	46.577	0.686	1.000
96	46.336	0.695	1.000
35	45.672	0.720	1.000
150	45.628	0.721	1.000
153	45.470	0.727	1.000
127	45.042	0.742	1.000
83	45.041	0.742	1.000
50	44.961	0.745	1.000

The p1 column indicates that, assuming normality, the probability of d^2 (for case 65) exceeding a value 111.822 of is <.000. The p2 column, also assuming normality, reveals that the probability is still <.000 that the largest d^2 value for any individual case would exceed 111.822.

APPENDIX H

INPUT DATA FOR MEASUREMENT MODELS (GSE/GSI MODEL)

Covariance Matrix for Measurement Model (GSE Model)

	Info1	Info2	Info3	Info4	Info5	Info6	Info7	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SCM1	SCM2	SCM3	SCM4	SCM5	SCM6	SCM7	SCM8	SCM9	SCM10
Info1	2.790	1.766	1.595	1.528	1.382	1.302	1.290	1.488	1.566	0.962	1.171	1.346	1.111	1.169	1.185	1.204	0.995	1.159	0.695	1.006	0.721	0.767	1.248	1.111
Info2	1.766	2.461	1.768	1.598	1.560	1.502	1.447	1.563	1.552	0.822	1.110	1.226	1.024	1.162	1.023	0.936	0.837	1.084	0.713	0.918	0.664	0.617	1.182	1.001
Info3	1.595	1.768	2.550	1.792	1.527	1.331	1.462	1.393	1.321	0.836	0.933	0.993	1.018	1.070	0.847	0.996	0.850	1.051	0.709	0.868	0.641	0.756	1.158	1.010
Info4	1.528	1.598	1.792	2.509	1.781	1.302	1.495	1.567	1.432	0.779	0.892	0.961	0.912	1.105	0.816	0.951	0.923	0.889	0.650	0.721	0.542	0.705	1.063	0.860
Info5	1.382	1.560	1.527	1.781	2.579	1.666	1.571	1.629	1.367	0.948	1.084	1.109	1.028	1.411	0.930	0.743	0.867	0.892	0.604	0.787	0.632	0.739	1.056	0.888
Info6	1.302	1.502	1.331	1.302	1.666	2.471	1.536	1.700	1.484	0.983	1.183	1.292	1.143	1.244	0.880	0.683	0.614	0.858	0.663	0.833	0.718	0.570	1.127	1.008
Info7	1.290	1.447	1.462	1.495	1.571	1.536	2.426	1.766	1.478	0.661	0.900	0.986	1.013	1.279	0.706	0.711	0.792	0.889	0.575	0.839	0.634	0.686	1.055	0.965
SP1	1.488	1.563	1.393	1.567	1.629	1.700	1.766	2.746	1.991	0.973	1.159	1.314	1.133	1.400	0.858	0.941	0.905	0.879	0.678	1.002	0.723	0.654	1.181	1.063
SP2	1.566	1.552	1.321	1.432	1.367	1.484	1.478	1.991	2.513	0.875	1.048	1.270	1.179	1.329	0.984	0.778	0.763	0.999	0.587	0.929	0.822	0.648	1.136	0.984
SP3	0.962	0.822	0.836	0.779	0.948	0.983	0.661	0.973	0.875	1.969	1.034	0.962	0.792	0.833	0.896	0.767	0.536	0.551	0.722	0.724	0.819	0.537	0.588	0.770
SP4	1.171	1.110	0.933	0.892	1.084	1.183	0.900	1.159	1.048	1.034	1.717	1.332	0.968	0.971	0.986	0.797	0.627	0.714	0.512	0.793	0.679	0.573	0.874	0.823
SP5	1.346	1.226	0.993	0.961	1.109	1.292	0.986	1.314	1.270	0.962	1.332	2.021	1.219	1.025	1.020	0.839	0.717	0.754	0.515	0.990	0.818	0.751	1.122	0.779
SP6	1.111	1.024	1.018	0.912	1.028	1.143	1.013	1.133	1.179	0.792	0.968	1.219	2.044	1.367	1.003	0.920	0.822	0.992	0.658	1.111	0.866	0.599	1.101	0.691
SP7	1.169	1.162	1.070	1.105	1.411	1.244	1.279	1.400	1.329	0.833	0.971	1.025	1.367	1.928	1.030	0.856	0.765	0.884	0.636	1.059	0.743	0.612	1.067	0.981
SCM1	1.185	1.023	0.847	0.816	0.930	0.880	0.706	0.858	0.984	0.896	0.986	1.020	1.003	1.030	2.388	1.238	1.273	1.276	0.588	0.887	0.778	0.858	0.945	0.758
SCM2	1.204	0.936	0.996	0.951	0.743	0.683	0.711	0.941	0.778	0.767	0.797	0.839	0.920	0.856	1.238	2.477	1.585	1.359	0.843	1.026	0.786	0.559	0.970	0.699
SCM3	0.995	0.837	0.850	0.923	0.867	0.614	0.792	0.905	0.763	0.536	0.627	0.717	0.822	0.765	1.273	1.585	2.342	1.395	0.651	0.914	0.685	0.576	0.787	0.503
SCM4	1.159	1.084	1.051	0.889	0.892	0.858	0.889	0.879	0.999	0.551	0.714	0.754	0.992	0.884	1.276	1.359	1.395	2.051	0.803	0.833	0.770	0.601	0.976	0.822
SCM5	0.695	0.713	0.709	0.650	0.604	0.663	0.575	0.678	0.587	0.722	0.512	0.515	0.658	0.636	0.588	0.843	0.651	0.803	1.754	0.789	0.614	0.453	0.555	0.612
SCM6	1.006	0.918	0.868	0.721	0.787	0.833	0.839	1.002	0.929	0.724	0.793	0.990	1.111	1.059	0.887	1.026	0.914	0.833	0.789	1.688	0.997	0.780	0.897	0.741
SCM7	0.721	0.664	0.641	0.542	0.632	0.718	0.634	0.723	0.822	0.819	0.679	0.818	0.866	0.743	0.778	0.786	0.685	0.770	0.614	0.997	1.569	0.802	0.815	0.549
SCM8	0.767	0.617	0.756	0.705	0.739	0.570	0.686	0.654	0.648	0.537	0.573	0.751	0.599	0.612	0.858	0.559	0.576	0.601	0.453	0.780	0.802	2.262	1.195	0.772
SCM9	1.248	1.182	1.158	1.063	1.056	1.127	1.055	1.181	1.136	0.588	0.874	1.122	1.101	1.067	0.945	0.970	0.787	0.976	0.555	0.897	0.815	1.195	2.030	0.915
SCM10	1.111	1.001	1.010	0.860	0.888	1.008	0.965	1.063	0.984	0.770	0.823	0.779	0.691	0.981	0.758	0.699	0.503	0.822	0.612	0.741	0.549	0.772	0.915	1.961
SCM11	1.287	1.203	1.041	1.054	0.906	1.055	1.070	1.161	1.137	0.670	0.894	1.004	0.947	1.102	1.017	1.014	0.882	0.898	0.655	1.045	0.801	0.801	1.133	1.233
SCM12	1.184	0.958	1.008	0.908	0.776	0.833	0.964	1.132	1.127	0.700	0.818	1.031	1.098	0.994	1.211	1.028	1.088	1.254	0.698	1.205	1.011	0.863	1.046	0.921
SCM13	0.770	0.733	0.716	0.610	0.506	0.685	0.668	0.802	0.701	0.540	0.690	0.788	1.008	0.710	1.010	0.940	0.923	0.975	0.739	0.915	0.946	0.693	0.932	0.693
SCM14	0.957	0.973	0.764	0.687	0.712	0.738	0.868	0.883	0.869	0.605	0.772	0.909	0.878	0.942	1.052	0.872	0.646	0.898	0.613	0.967	0.832	0.709	0.848	0.983
SCM15	1.144	1.100	0.929	0.891	0.968	0.883	1.040	1.126	1.111	0.682	0.743	0.809	0.937	1.143	1.028	0.945	0.680	1.075	0.807	0.985	0.755	0.748	0.916	1.236
SCM16	1.145	1.097	0.925	0.844	0.987	0.965	0.998	1.144	1.040	0.676	0.777	0.904	0.900	0.994	1.114	0.972	0.918	0.917	0.600	0.927	0.826	0.794	1.026	1.054
SCM17	0.990	1.155	0.900	0.838	0.895	0.901	0.918	1.224	1.039	0.739	0.913	1.038	1.010	0.970	1.096	0.886	0.804	0.902	0.779	0.972	0.820	0.878	0.957	0.935
SCM18	1.070	1.060	0.933	0.914	0.968	0.897	0.731	0.940	1.041	0.721	0.846	0.838	0.821	0.929	1.298	1.262	1.018	1.187	0.726	0.844	0.881	0.775	1.067	0.998
LP1	0.424	0.464	0.466	0.465	0.314	0.361	0.344	0.394	0.369	0.327	0.500	0.418	0.541	0.484	0.610	0.732	0.511	0.537	0.504	0.584	0.508	0.334	0.547	0.458
LP2	0.350	0.435	0.304	0.342	0.195	0.234	0.273	0.338	0.322	0.212	0.415	0.318	0.385	0.410	0.570	0.574	0.502	0.371	0.323	0.539	0.449	0.321	0.404	0.450
LP3	0.360	0.466	0.320	0.219	0.167	0.285	0.233	0.422	0.295	0.327	0.415	0.356	0.438	0.395	0.589	0.550	0.433	0.318	0.312	0.582	0.525	0.359	0.493	0.482
LP4	0.371	0.453	0.290	0.356	0.215	0.298	0.301	0.455	0.329	0.397	0.437	0.448	0.622	0.381	0.482	0.594	0.459	0.389	0.451	0.600	0.581	0.347	0.465	0.246
LP5	0.743	0.794	0.697	0.768	0.749	0.626	0.624	0.863	0.694	0.447	0.627	0.800	0.713	0.696	0.682	0.780	0.728	0.701	0.560	0.755	0.548	0.505	0.833	0.564
SCA1	0.913	0.661	0.643	0.668	0.757	0.472	0.501	0.733	0.567	0.592	0.526	0.522	0.560	0.638	0.739	0.783	0.635	0.560	0.538	0.611	0.514	0.452	0.737	0.467
SCA2	0.590	0.681	0.521	0.366	0.395	0.339	0.200	0.465	0.439	0.356	0.458	0.484	0.525	0.435	0.671	0.786	0.458	0.576	0.404	0.583	0.567	0.373	0.712	0.390
SCA3	0.666	0.748	0.613	0.543	0.580	0.500	0.427	0.693	0.531	0.510	0.638	0.637	0.667	0.505	0.757	0.785	0.629	0.665	0.510	0.750	0.578	0.528	0.807	0.560
SCA4	0.612	0.638	0.534	0.465	0.383	0.502	0.400	0.558	0.462	0.535	0.628	0.466	0.462	0.405	0.730	0.713	0.634	0.671	0.715	0.671	0.524	0.429	0.613	0.665
SCA5	0.602	0.532	0.255	0.231	0.350	0.319	0.390	0.525	0.419	0.306	0.502	0.510	0.589	0.450	0.593	0.582	0.648	0.518	0.341	0.722	0.684	0.553	0.562	0.385
SCA6	0.878	0.763	0.705	0.661	0.607	0.477	0.555	0.804	0.613	0.469	0.659	0.645	0.612	0.607	0.496	0.743	0.526	0.563	0.525	0.704	0.539	0.565	0.819	0.543
SCA7	0.923	0.796	0.728	0.632	0.575	0.616	0.598	0.894	0.689	0.462	0.710	0.764	0.693	0.701	0.640	0.687	0.425	0.541	0.380	0.680	0.502	0.543	0.936	0.537
CPM1	0.735	0.667	0.354	0.437	0.430	0.377	0.455	0.567	0.573	0.220	0.325	0.321	0.310	0.589	0.468	0.465	0.500	0.511	0.334	0.453	0.333	0.105	0.420	0.383
CPM2	0.812	0.640	0.455	0.505	0.678	0.574	0.615	0.691	0.631	0.479	0.540	0.543	0.514	0.607	0.589	0.685	0.476	0.595	0.220	0.469	0.406	0.081	0.555	0.375
CPM3	0.758	0.611	0.454	0.457	0.642	0.527	0.528	0.620	0.583	0.525	0.566	0.533	0.595	0.667	0.673	0.677	0.609	0.692	0.340	0.556	0.410	-0.045	0.426	0.341

	SCM11	SCM12	SCM13	SCM14	SCM15	SCM16	SCM17	SCM18	LP1	LP2	LP3	LP4	LP5	SCA1	SCA2	SCA3	SCA4	SCA5	SCA6	SCA7	CPM1	CPM2	CPM3
Info1	1.287	1.184	0.770	0.957	1.144	1.145	0.990	1.070	0.424	0.350	0.360	0.371	0.743	0.913	0.590	0.666	0.612	0.602	0.878	0.923	0.735	0.812	0.758
Info2	1.203	0.958	0.733	0.973	1.100	1.097	1.155	1.060	0.464	0.435	0.466	0.453	0.794	0.661	0.681	0.748	0.638	0.532	0.763	0.796	0.667	0.640	0.611
Info3	1.041	1.008	0.716	0.764	0.929	0.925	0.900	0.933	0.466	0.304	0.320	0.290	0.697	0.643	0.521	0.613	0.534	0.255	0.705	0.728	0.354	0.455	0.454
Info4	1.054	0.908	0.610	0.687	0.891	0.844	0.838	0.914	0.465	0.342	0.219	0.356	0.768	0.668	0.366	0.543	0.465	0.231	0.661	0.632	0.437	0.505	0.457
Info5	0.906	0.776	0.506	0.712	0.968	0.987	0.895	0.968	0.314	0.195	0.167	0.215	0.749	0.757	0.395	0.580	0.383	0.350	0.607	0.575	0.430	0.678	0.642
Info6	1.055	0.833	0.685	0.738	0.883	0.965	0.901	0.897	0.361	0.234	0.285	0.298	0.626	0.472	0.339	0.500	0.502	0.319	0.477	0.616	0.377	0.574	0.527
Info7	1.070	0.964	0.668	0.868	1.040	0.998	0.918	0.731	0.344	0.273	0.233	0.301	0.624	0.501	0.200	0.427	0.400	0.390	0.555	0.598	0.455	0.615	0.528
SP1	1.161	1.132	0.802	0.883	1.126	1.144	1.224	0.940	0.394	0.338	0.422	0.455	0.863	0.733	0.465	0.693	0.558	0.525	0.804	0.894	0.567	0.691	0.620
SP2	1.137	1.127	0.701	0.869	1.111	1.040	1.039	1.041	0.369	0.322	0.295	0.329	0.694	0.567	0.439	0.531	0.462	0.419	0.613	0.689	0.573	0.631	0.583
SP3	0.670	0.700	0.540	0.605	0.682	0.676	0.739	0.721	0.327	0.212	0.327	0.397	0.447	0.592	0.356	0.510	0.535	0.306	0.469	0.462	0.220	0.479	0.525
SP4	0.894	0.818	0.690	0.772	0.743	0.777	0.913	0.846	0.500	0.415	0.415	0.437	0.627	0.526	0.458	0.638	0.628	0.502	0.659	0.710	0.325	0.540	0.566
SP5	1.004	1.031	0.788	0.909	0.809	0.904	1.038	0.838	0.418	0.318	0.356	0.448	0.800	0.522	0.484	0.637	0.466	0.510	0.645	0.764	0.321	0.543	0.533
SP6	0.947	1.098	1.008	0.878	0.937	0.900	1.010	0.821	0.541	0.385	0.438	0.622	0.713	0.560	0.525	0.667	0.462	0.589	0.612	0.693	0.310	0.514	0.595
SP7	1.102	0.994	0.710	0.942	1.143	0.994	0.970	0.929	0.484	0.410	0.395	0.381	0.696	0.638	0.435	0.505	0.405	0.450	0.607	0.701	0.589	0.607	0.667
SCM1	1.017	1.211	1.010	1.052	1.028	1.114	1.096	1.298	0.610	0.570	0.589	0.482	0.682	0.739	0.671	0.757	0.730	0.593	0.496	0.640	0.468	0.589	0.673
SCM2	1.014	1.028	0.940	0.872	0.945	0.972	0.886	1.262	0.732	0.574	0.550	0.594	0.780	0.783	0.786	0.785	0.713	0.582	0.743	0.687	0.465	0.685	0.677
SCM3	0.882	1.088	0.923	0.646	0.680	0.918	0.804	1.018	0.511	0.502	0.433	0.459	0.728	0.635	0.458	0.629	0.634	0.648	0.526	0.425	0.500	0.476	0.609
SCM4	0.898	1.254	0.975	0.898	1.075	0.917	0.902	1.187	0.537	0.371	0.318	0.389	0.701	0.560	0.576	0.665	0.671	0.518	0.563	0.541	0.511	0.595	0.692
SCM5	0.655	0.698	0.739	0.613	0.807	0.600	0.779	0.726	0.504	0.323	0.312	0.451	0.560	0.538	0.404	0.510	0.715	0.341	0.525	0.380	0.334	0.220	0.340
SCM6	1.045	1.205	0.915	0.967	0.985	0.927	0.972	0.844	0.584	0.539	0.582	0.600	0.755	0.611	0.583	0.750	0.671	0.722	0.704	0.680	0.453	0.469	0.556
SCM7	0.801	1.011	0.946	0.832	0.755	0.826	0.820	0.881	0.508	0.449	0.525	0.581	0.548	0.514	0.567	0.578	0.524	0.684	0.539	0.502	0.333	0.406	0.410
SCM8	0.801	0.863	0.693	0.709	0.748	0.794	0.878	0.775	0.334	0.321	0.359	0.347	0.505	0.452	0.373	0.528	0.429	0.553	0.565	0.543	0.105	0.081	-0.045
SCM9	1.133	1.046	0.932	0.848	0.916	1.026	0.957	1.067	0.547	0.404	0.493	0.465	0.833	0.737	0.712	0.807	0.613	0.562	0.819	0.936	0.420	0.555	0.426
SCM10	1.233	0.921	0.693	0.983	1.236	1.054	0.935	0.998	0.458	0.450	0.482	0.246	0.564	0.467	0.390	0.560	0.665	0.385	0.543	0.537	0.383	0.375	0.341
SCM11	2.000	1.336	1.077	1.146	1.277	1.149	1.125	0.933	0.506	0.559	0.544	0.474	0.760	0.732	0.553	0.719	0.713	0.608	0.761	0.720	0.447	0.441	0.443
SCM12	1.336	2.423	1.542	1.148	1.146	1.005	1.058	1.035	0.622	0.612	0.664	0.664	0.935	0.598	0.592	0.812	0.832	0.895	0.730	0.807	0.462	0.392	0.703
SCM13	1.077	1.542	1.974	0.978	0.814	0.812	0.940	0.703	0.586	0.522	0.653	0.790	0.846	0.670	0.639	0.795	0.835	0.782	0.630	0.693	0.352	0.382	0.478
SCM14	1.146	1.148	0.978	2.159	1.559	1.203	1.154	1.079	0.600	0.602	0.658	0.505	0.751	0.553	0.688	0.875	0.710	0.585	0.703	0.779	0.403	0.516	0.346
SCM15	1.277	1.146	0.814	1.559	2.066	1.361	1.258	1.126	0.624	0.549	0.501	0.340	0.626	0.607	0.569	0.702	0.703	0.554	0.759	0.670	0.461	0.463	0.379
SCM16	1.149	1.005	0.812	1.203	1.361	1.910	1.372	1.183	0.629	0.557	0.597	0.491	0.610	0.670	0.599	0.708	0.682	0.620	0.709	0.731	0.454	0.503	0.424
SCM17	1.125	1.058	0.940	1.154	1.258	1.372	1.762	1.032	0.600	0.614	0.634	0.555	0.783	0.666	0.678	0.811	0.705	0.652	0.794	0.793	0.368	0.414	0.392
SCM18	0.933	1.035	0.703	1.079	1.126	1.183	1.032	2.245	0.746	0.535	0.507	0.384	0.599	0.633	0.737	0.864	0.777	0.512	0.663	0.659	0.421	0.588	0.514
LP1	0.506	0.622	0.586	0.600	0.624	0.629	0.600	0.746	1.258	0.941	0.849	0.738	0.797	0.523	0.690	0.697	0.782	0.648	0.725	0.706	0.405	0.402	0.504
LP2	0.559	0.612	0.522	0.602	0.549	0.557	0.614	0.535	0.941	1.254	1.132	0.822	0.833	0.582	0.720	0.727	0.835	0.824	0.718	0.790	0.671	0.516	0.546
LP3	0.544	0.664	0.653	0.658	0.501	0.597	0.634	0.507	0.849	1.132	1.403	0.928	0.901	0.644	0.789	0.859	0.920	0.901	0.747	0.885	0.703	0.503	0.506
LP4	0.474	0.664	0.790	0.505	0.340	0.491	0.555	0.384	0.738	0.822	0.928	1.469	1.027	0.656	0.751	0.862	0.868	0.827	0.776	0.767	0.530	0.551	0.613
LP5	0.760	0.935	0.846	0.751	0.626	0.610	0.783	0.599	0.797	0.833	0.901	1.027	1.744	0.964	0.851	0.913	0.938	0.889	1.047	0.977	0.821	0.731	0.780
SCA1	0.732	0.598	0.670	0.553	0.607	0.670	0.666	0.633	0.523	0.582	0.644	0.656	0.964	1.789	0.830	0.788	0.801	0.810	1.016	1.040	0.798	0.927	0.903
SCA2	0.553	0.592	0.639	0.688	0.569	0.599	0.678	0.737	0.690	0.720	0.789	0.751	0.851	0.830	1.304	1.131	0.883	0.838	0.834	0.956	0.703	0.671	0.627
SCA3	0.719	0.812	0.795	0.875	0.702	0.708	0.811	0.864	0.697	0.727	0.859	0.862	0.913	0.788	1.131	1.546	1.093	0.909	0.989	1.075	0.726	0.728	0.724
SCA4	0.713	0.832	0.835	0.710	0.703	0.682	0.705	0.777	0.782	0.835	0.920	0.868	0.938	0.801	0.883	1.093	1.659	0.970	0.928	0.929	0.679	0.680	0.637
SCA5	0.608	0.895	0.782	0.585	0.554	0.620	0.652	0.512	0.648	0.824	0.901	0.827	0.889	0.810	0.838	0.909	0.970	1.446	0.923	0.917	0.868	0.754	0.747
SCA6	0.761	0.730	0.630	0.703	0.759	0.709	0.794	0.663	0.725	0.718	0.747	0.776	1.047	1.016	0.834	0.989	0.928	0.923	1.581	1.333	0.949	0.863	0.766
SCA7	0.720	0.807	0.693	0.779	0.670	0.731	0.793	0.659	0.706	0.790	0.885	0.767	0.977	1.040	0.956	1.075	0.929	0.917	1.333	1.760	1.051	0.887	0.759
CPM1	0.447	0.462	0.352	0.403	0.461	0.454	0.368	0.421	0.405	0.671	0.703	0.530	0.821	0.798	0.703	0.726	0.679	0.868	0.949	1.051	1.893	1.249	1.056
CPM2	0.441	0.392	0.382	0.516	0.463	0.503	0.414	0.588	0.402	0.516	0.503	0.551	0.731	0.927	0.671	0.728	0.680	0.754	0.863	0.887	1.249	1.924	1.379
CPM3	0.443	0.703	0.478	0.346	0.379	0.424	0.392	0.514	0.504	0.546	0.506	0.613	0.780	0.903	0.627	0.724	0.637	0.747	0.766	0.759	1.056	1.379	1.765

Covariance Matrix for Measurement Model (GSI Model)

	Info1	Info2	Info3	Info4	Info5	Info6	Info7	SP1	SP2	SP3	SP4	SP5	SP6	SP7	SCM1	SCM2	SCM3	SCM4	SCM5	SCM6	SCM7	SCM8	SCM9	SCM10	SCM11	SCM12
Info1	2.922	1.876	1.715	1.596	1.508	1.359	1.323	1.542	1.614	1.026	1.234	1.401	1.114	1.260	1.174	1.156	0.952	1.196	0.681	1.083	0.701	0.818	1.281	1.210	1.286	1.117
Info2	1.876	2.509	1.855	1.738	1.715	1.583	1.490	1.634	1.528	0.899	1.131	1.213	0.958	1.185	1.000	0.959	0.809	1.038	0.761	0.931	0.631	0.643	1.144	1.073	1.202	0.924
Info3	1.715	1.855	2.553	1.815	1.539	1.353	1.423	1.412	1.392	0.859	0.930	1.040	0.989	1.109	0.925	0.969	0.851	1.007	0.734	0.899	0.597	0.676	1.128	1.035	1.116	1.018
Info4	1.596	1.738	1.815	2.458	1.772	1.284	1.418	1.516	1.468	0.785	0.880	0.915	0.923	1.106	0.797	0.976	0.890	0.907	0.690	0.782	0.499	0.629	1.026	0.884	1.052	0.816
Info5	1.508	1.715	1.539	1.772	2.538	1.736	1.560	1.764	1.586	0.944	1.145	1.228	1.123	1.474	1.014	0.857	0.898	0.899	0.691	0.913	0.710	0.654	1.096	0.935	1.004	0.779
Info6	1.359	1.583	1.353	1.284	1.736	2.558	1.528	1.685	1.518	1.023	1.185	1.308	1.183	1.310	0.985	0.672	0.649	0.845	0.687	0.843	0.707	0.577	1.142	1.024	1.073	0.754
Info7	1.323	1.490	1.423	1.418	1.560	1.528	2.269	1.709	1.511	0.709	0.862	0.957	0.978	1.268	0.723	0.725	0.804	0.789	0.585	0.841	0.515	0.618	0.947	0.994	1.074	0.846
SP1	1.542	1.634	1.412	1.516	1.764	1.685	1.709	2.687	1.962	1.046	1.124	1.256	1.125	1.485	0.938	0.900	0.916	0.879	0.691	0.996	0.632	0.630	1.138	1.067	1.168	1.072
SP2	1.614	1.528	1.392	1.468	1.586	1.518	1.511	1.962	2.495	0.970	1.023	1.164	1.125	1.405	0.985	0.726	0.741	1.001	0.623	0.920	0.757	0.743	1.092	0.999	1.067	1.048
SP3	1.026	0.899	0.859	0.785	0.944	1.023	0.709	1.046	0.970	1.958	1.116	0.998	0.896	0.851	0.985	0.755	0.657	0.635	0.656	0.781	0.915	0.604	0.733	0.716	0.636	0.743
SP4	1.234	1.131	0.930	0.880	1.145	1.185	0.862	1.124	1.023	1.116	1.748	1.349	0.962	0.993	1.079	0.846	0.718	0.725	0.602	0.808	0.676	0.552	0.862	0.814	0.860	0.717
SP5	1.401	1.213	1.040	0.915	1.228	1.308	0.957	1.256	1.164	0.998	1.349	1.982	1.172	1.025	1.056	0.817	0.729	0.775	0.522	0.932	0.728	0.834	1.133	0.758	0.936	0.913
SP6	1.114	0.958	0.989	0.923	1.123	1.183	0.978	1.125	1.125	0.896	0.962	1.172	2.033	1.435	1.068	0.915	0.800	0.953	0.661	1.074	0.825	0.555	1.038	0.702	0.950	1.001
SP7	1.260	1.185	1.109	1.106	1.474	1.310	1.268	1.485	1.405	0.851	0.993	1.025	1.435	1.988	1.112	0.933	0.856	0.939	0.662	1.082	0.726	0.640	1.105	0.981	1.085	0.978
SCM1	1.174	1.000	0.925	0.797	1.014	0.985	0.723	0.938	0.985	0.985	1.079	1.056	1.068	1.112	2.425	1.368	1.263	1.347	0.657	0.988	0.874	0.949	0.997	0.857	0.977	1.256
SCM2	1.156	0.959	0.969	0.976	0.857	0.672	0.725	0.900	0.726	0.755	0.846	0.817	0.915	0.933	1.368	2.418	1.661	1.409	0.779	1.027	0.726	0.615	1.019	0.684	1.073	1.100
SCM3	0.952	0.809	0.851	0.890	0.898	0.649	0.804	0.916	0.741	0.657	0.718	0.729	0.800	0.856	1.263	1.661	2.308	1.418	0.698	0.961	0.712	0.587	0.773	0.643	0.981	1.118
SCM4	1.196	1.038	1.007	0.907	0.899	0.845	0.789	0.879	1.001	0.635	0.725	0.775	0.953	0.939	1.347	1.409	1.418	2.066	0.863	0.865	0.788	0.627	0.935	0.890	0.972	1.319
SCM5	0.681	0.761	0.734	0.690	0.691	0.687	0.585	0.691	0.623	0.656	0.602	0.522	0.661	0.662	0.657	0.779	0.698	0.863	1.666	0.778	0.673	0.535	0.598	0.578	0.664	0.732
SCM6	1.083	0.931	0.899	0.782	0.913	0.843	0.841	0.996	0.920	0.781	0.808	0.932	1.074	1.082	0.988	1.027	0.961	0.865	0.778	1.673	0.982	0.857	0.935	0.729	1.093	1.237
SCM7	0.701	0.631	0.597	0.499	0.710	0.707	0.515	0.632	0.757	0.915	0.676	0.728	0.825	0.726	0.874	0.726	0.712	0.788	0.673	0.982	1.573	0.899	0.800	0.524	0.801	1.001
SCM8	0.818	0.643	0.676	0.629	0.654	0.577	0.618	0.630	0.743	0.604	0.552	0.834	0.555	0.640	0.949	0.615	0.587	0.627	0.535	0.857	0.899	2.236	1.180	0.811	0.866	0.876
SCM9	1.281	1.144	1.128	1.026	1.096	1.142	0.947	1.138	1.092	0.733	0.862	1.133	1.038	1.105	0.997	1.019	0.773	0.935	0.598	0.935	0.800	1.180	2.026	0.959	1.162	0.986
SCM10	1.210	1.073	1.035	0.884	0.935	1.024	0.994	1.067	0.999	0.716	0.814	0.758	0.702	0.981	0.857	0.684	0.643	0.890	0.578	0.729	0.524	0.811	0.959	1.971	1.233	0.943
SCM11	1.286	1.202	1.116	1.052	1.004	1.073	1.074	1.168	1.067	0.636	0.860	0.936	0.950	1.085	0.977	1.073	0.981	0.972	0.664	1.093	0.801	0.866	1.162	1.233	1.961	1.280
SCM12	1.117	0.924	1.018	0.816	0.779	0.754	0.846	1.072	1.048	0.743	0.717	0.913	1.001	0.978	1.256	1.100	1.118	1.319	0.732	1.237	1.001	0.876	0.986	0.943	1.280	2.412
SCM13	0.748	0.739	0.725	0.587	0.539	0.665	0.577	0.741	0.672	0.600	0.666	0.709	0.987	0.761	1.158	0.993	0.997	1.080	0.785	0.920	0.952	0.626	0.914	0.743	1.097	1.549
SCM14	0.950	0.892	0.699	0.719	0.762	0.808	0.784	0.936	0.806	0.621	0.751	0.812	0.758	0.908	1.045	0.849	0.621	0.839	0.659	0.904	0.739	0.762	0.825	1.003	1.150	1.103
SCM15	1.159	1.104	0.863	0.880	0.990	0.922	0.993	1.166	1.126	0.569	0.742	0.770	0.948	1.162	1.009	0.884	0.712	1.078	0.719	0.989	0.727	0.792	0.927	1.178	1.286	1.186
SCM16	1.165	1.104	0.885	0.822	1.067	1.069	0.959	1.165	1.042	0.724	0.819	0.880	0.831	1.034	1.128	0.945	0.818	0.896	0.569	0.894	0.796	0.774	1.025	1.114	1.185	0.974
SCM17	0.987	1.157	0.875	0.833	0.948	0.956	0.890	1.235	1.006	0.757	0.930	0.989	0.939	1.004	1.143	0.889	0.728	0.907	0.814	0.956	0.778	0.888	0.951	0.979	1.171	1.015
SCM18	1.087	0.982	0.848	0.799	0.987	0.931	0.588	0.827	0.911	0.736	0.838	0.721	0.698	0.893	1.322	1.277	0.976	1.144	0.742	0.809	0.827	0.784	1.014	1.034	0.920	0.983
LP1	0.368	0.489	0.441	0.475	0.374	0.337	0.257	0.298	0.309	0.283	0.454	0.369	0.520	0.508	0.689	0.688	0.537	0.545	0.475	0.562	0.463	0.336	0.576	0.422	0.478	0.554
LP2	0.349	0.514	0.359	0.351	0.233	0.257	0.247	0.317	0.299	0.216	0.408	0.291	0.415	0.400	0.640	0.654	0.533	0.406	0.412	0.566	0.426	0.400	0.495	0.471	0.540	0.523
LP3	0.344	0.492	0.367	0.239	0.173	0.265	0.227	0.385	0.243	0.279	0.352	0.292	0.427	0.335	0.686	0.582	0.495	0.372	0.387	0.565	0.498	0.403	0.569	0.473	0.502	0.628
LP4	0.363	0.460	0.294	0.384	0.255	0.247	0.288	0.365	0.247	0.395	0.397	0.366	0.584	0.390	0.566	0.641	0.502	0.418	0.509	0.577	0.557	0.353	0.490	0.229	0.476	0.630
LP5	0.717	0.835	0.768	0.751	0.796	0.638	0.609	0.840	0.641	0.438	0.590	0.765	0.710	0.701	0.639	0.872	0.712	0.760	0.636	0.771	0.539	0.491	0.879	0.563	0.706	0.866
SCA1	0.929	0.770	0.736	0.606	0.752	0.478	0.461	0.688	0.594	0.574	0.503	0.540	0.643	0.694	0.738	0.868	0.653	0.620	0.556	0.711	0.595	0.408	0.813	0.485	0.700	0.540
SCA2	0.635	0.673	0.551	0.395	0.445	0.351	0.152	0.410	0.378	0.374	0.443	0.477	0.522	0.453	0.723	0.835	0.452	0.571	0.483	0.617	0.585	0.404	0.772	0.450	0.598	0.632
SCA3	0.728	0.753	0.650	0.599	0.613	0.520	0.405	0.680	0.493	0.550	0.630	0.659	0.652	0.514	0.837	0.868	0.679	0.643	0.607	0.803	0.607	0.545	0.852	0.611	0.789	0.845
SCA4	*0.602*	*0.711*	*0.544*	*0.462*	*0.419*	*0.474*	*0.291*	*0.469*	*0.417*	*0.460*	*0.587*	*0.400*	*0.428*	*0.409*	*0.779*	*0.754*	*0.727*	*0.676*	*0.704*	*0.668*	*0.501*	*0.453*	*0.689*	*0.629*	*0.694*	*0.763*
SCA5	0.558	0.550	0.257	0.154	0.341	0.271	0.299	0.443	0.352	0.322	0.429	0.461	0.557	0.404	0.612	0.612	0.662	0.529	0.420	0.733	0.672	0.556	0.564	0.380	0.556	0.814
SCA6	0.925	0.844	0.687	0.642	0.599	0.459	0.482	0.762	0.624	0.468	0.647	0.709	0.624	0.629	0.514	0.798	0.541	0.544	0.562	0.765	0.564	0.527	0.833	0.552	0.827	0.726
SCA7	0.997	0.839	0.749	0.589	0.552	0.620	0.518	0.842	0.660	0.534	0.665	0.783	0.673	0.719	0.667	0.822	0.390	0.531	0.487	0.723	0.501	0.474	0.934	0.575	0.764	0.757
CPM1	0.791	0.784	0.433	0.413	0.427	0.376	0.463	0.576	0.591	0.186	0.300	0.345	0.351	0.570	0.436	0.525	0.523	0.546	0.402	0.483	0.356	0.113	0.480	0.353	0.409	0.440
CPM2	0.912	0.832	0.550	0.557	0.780	0.648	0.623	0.743	0.737	0.503	0.574	0.600	0.609	0.691	0.607	0.747	0.561	0.655	0.289	0.481	0.420	0.071	0.682	0.403	0.486	0.384
CPM3	0.812	0.729	0.534	0.492	0.766	0.519	0.547	0.632	0.601	0.526	0.540	0.539	0.643	0.737	0.702	0.820	0.742	0.758	0.378	0.587	0.448	-0.033	0.520	0.316	0.389	0.649
GSP1	1.196	0.956	0.803	0.750	0.914	0.844	0.772	0.920	0.787	0.648	0.762	0.804	0.759	0.907	0.895	0.831	0.758	0.691	0.571	0.772	0.493	0.341	0.720	0.709	0.781	0.839
GSP2	1.281	0.937	0.908	0.924	0.974	0.808	0.786	1.000	0.860	0.516	0.769	0.932	0.807	0.891	0.912	0.927	0.888	0.835	0.570	0.839	0.475	0.426	0.925	0.751	0.920	0.955
GSP3	1.187	0.897	0.969	0.852	0.967	0.782	0.856	0.846	0.951	0.555	0.697	0.804	0.788	0.940	0.933	0.884	0.848	0.929	0.616	0.759	0.543	0.473	0.881	0.924	0.941	0.982
GSP4	0.942	0.799	0.875	0.787	0.880	0.844	0.795	0.844	0.864	0.480	0.607	0.761	0.792	0.887	0.732	0.741	0.494	0.639	0.627	0.745	0.383	0.410	0.895	0.785	0.792	0.677
GSP5	0.978	0.789	0.978	0.817	0.816	0.783	0.728	0.736	0.881	0.466	0.584	0.722	0.759	0.797	0.793	0.774	0.625	0.801	0.575	0.671	0.381	0.429	0.739	0.705	0.667	0.644

	SCM13	SCM14	SCM15	SCM16	SCM17	SCM18	LP1	LP2	LP3	LP4	LP5	SCA1	SCA2	SCA3	SCA4	SCA5	SCA6	SCA7	CPM1	CPM2	CPM3	GSP1	GSP2	GSP3	GSP4	GSP5
Info1	0.748	0.950	1.159	1.165	0.987	1.087	0.368	0.349	0.344	0.363	0.717	0.929	0.635	0.728	0.602	0.558	0.925	0.997	0.791	0.912	0.812	1.196	1.281	1.187	0.942	0.978
Info2	0.739	0.892	1.104	1.104	1.157	0.982	0.489	0.514	0.492	0.460	0.835	0.770	0.673	0.753	0.711	0.550	0.844	0.839	0.784	0.832	0.729	0.956	0.937	0.897	0.799	0.789
Info3	0.725	0.699	0.863	0.885	0.875	0.848	0.441	0.359	0.367	0.294	0.768	0.736	0.551	0.650	0.544	0.257	0.687	0.749	0.433	0.550	0.534	0.803	0.908	0.969	0.875	0.978
Info4	0.587	0.719	0.880	0.822	0.833	0.799	0.475	0.351	0.239	0.384	0.751	0.606	0.395	0.599	0.462	0.154	0.642	0.589	0.413	0.557	0.492	0.750	0.924	0.852	0.787	0.817
Info5	0.539	0.762	0.990	1.067	0.948	0.987	0.374	0.233	0.173	0.255	0.796	0.752	0.445	0.613	0.419	0.341	0.599	0.552	0.427	0.780	0.766	0.914	0.974	0.967	0.880	0.816
Info6	0.665	0.808	0.922	1.069	0.956	0.931	0.337	0.257	0.265	0.247	0.638	0.478	0.351	0.520	0.474	0.271	0.459	0.620	0.376	0.648	0.519	0.844	0.808	0.782	0.844	0.783
Info7	0.577	0.784	0.993	0.959	0.890	0.588	0.257	0.247	0.227	0.288	0.609	0.461	0.152	0.405	0.291	0.299	0.482	0.518	0.463	0.623	0.547	0.772	0.786	0.856	0.795	0.728
SP1	0.741	0.936	1.166	1.165	1.235	0.827	0.298	0.317	0.385	0.365	0.840	0.688	0.410	0.680	0.469	0.443	0.762	0.842	0.576	0.743	0.632	0.920	1.000	0.846	0.844	0.736
SP2	0.672	0.806	1.126	1.042	1.006	0.911	0.309	0.299	0.243	0.247	0.641	0.594	0.378	0.493	0.417	0.352	0.624	0.660	0.591	0.737	0.601	0.787	0.860	0.951	0.864	0.881
SP3	0.600	0.621	0.569	0.724	0.757	0.736	0.283	0.216	0.279	0.395	0.438	0.574	0.374	0.550	0.460	0.322	0.468	0.534	0.186	0.503	0.526	0.648	0.516	0.555	0.480	0.466
SP4	0.666	0.751	0.742	0.819	0.930	0.838	0.454	0.408	0.352	0.397	0.590	0.503	0.443	0.630	0.587	0.429	0.647	0.665	0.300	0.574	0.540	0.762	0.769	0.697	0.607	0.584
SP5	0.709	0.812	0.770	0.880	0.989	0.721	0.369	0.291	0.292	0.366	0.765	0.540	0.477	0.659	0.400	0.461	0.709	0.783	0.345	0.600	0.539	0.804	0.932	0.804	0.761	0.722
SP6	0.987	0.758	0.948	0.831	0.939	0.698	0.520	0.415	0.427	0.584	0.710	0.643	0.522	0.652	0.428	0.557	0.624	0.673	0.351	0.609	0.643	0.759	0.807	0.788	0.792	0.759
SP7	0.761	0.908	1.162	1.034	1.004	0.893	0.508	0.400	0.335	0.390	0.701	0.694	0.453	0.514	0.409	0.404	0.629	0.719	0.570	0.691	0.737	0.907	0.891	0.940	0.887	0.797
SCM1	1.158	1.045	1.009	1.128	1.143	1.322	0.689	0.640	0.686	0.566	0.639	0.738	0.723	0.837	0.779	0.612	0.514	0.667	0.436	0.607	0.702	0.895	0.912	0.933	0.732	0.793
SCM2	0.993	0.849	0.884	0.945	0.889	1.277	0.688	0.654	0.582	0.641	0.872	0.868	0.835	0.868	0.754	0.612	0.798	0.822	0.525	0.747	0.820	0.831	0.927	0.884	0.741	0.774
SCM3	0.997	0.621	0.712	0.818	0.728	0.976	0.537	0.533	0.495	0.502	0.712	0.653	0.452	0.679	0.727	0.662	0.541	0.390	0.523	0.561	0.742	0.758	0.888	0.848	0.494	0.625
SCM4	1.080	0.839	1.078	0.896	0.907	1.144	0.545	0.406	0.372	0.418	0.760	0.620	0.571	0.643	0.676	0.529	0.544	0.531	0.546	0.655	0.758	0.691	0.835	0.929	0.639	0.801
SCM5	0.785	0.659	0.719	0.569	0.814	0.742	0.475	0.412	0.387	0.509	0.636	0.556	0.483	0.607	0.704	0.420	0.562	0.487	0.402	0.289	0.378	0.571	0.570	0.616	0.627	0.575
SCM6	0.920	0.904	0.989	0.894	0.956	0.809	0.562	0.566	0.565	0.577	0.771	0.711	0.617	0.803	0.668	0.733	0.765	0.723	0.483	0.481	0.587	0.772	0.839	0.759	0.745	0.671
SCM7	0.952	0.739	0.727	0.796	0.778	0.827	0.463	0.426	0.498	0.557	0.539	0.595	0.585	0.607	0.501	0.672	0.564	0.501	0.356	0.420	0.448	0.493	0.475	0.543	0.383	0.381
SCM8	0.626	0.762	0.792	0.774	0.888	0.784	0.336	0.400	0.403	0.353	0.491	0.408	0.404	0.545	0.453	0.556	0.527	0.474	0.113	0.071	-0.033	0.341	0.426	0.473	0.410	0.429
SCM9	0.914	0.825	0.927	1.025	0.951	1.014	0.576	0.495	0.569	0.490	0.879	0.813	0.772	0.852	0.689	0.564	0.833	0.934	0.480	0.682	0.520	0.720	0.925	0.881	0.895	0.739
SCM10	0.743	1.003	1.178	1.114	0.979	1.034	0.422	0.471	0.473	0.229	0.563	0.485	0.450	0.611	0.629	0.380	0.552	0.575	0.353	0.403	0.316	0.709	0.751	0.924	0.785	0.705
SCM11	1.097	1.150	1.286	1.185	1.171	0.920	0.478	0.540	0.502	0.476	0.706	0.700	0.598	0.789	0.694	0.556	0.827	0.764	0.409	0.486	0.389	0.781	0.920	0.941	0.792	0.667
SCM12	1.549	1.103	1.186	0.974	1.015	0.983	0.554	0.523	0.628	0.630	0.866	0.540	0.632	0.845	0.763	0.814	0.726	0.757	0.440	0.384	0.649	0.839	0.955	0.982	0.677	0.644
SCM13	2.002	0.984	0.894	0.784	0.943	0.714	0.559	0.548	0.674	0.789	0.871	0.675	0.701	0.866	0.824	0.779	0.693	0.722	0.466	0.424	0.511	0.742	0.764	0.828	0.555	0.555
SCM14	0.984	2.023	1.499	1.118	1.118	0.959	0.565	0.612	0.645	0.519	0.750	0.645	0.722	0.904	0.651	0.551	0.760	0.808	0.430	0.490	0.366	0.710	0.859	0.809	0.663	0.645
SCM15	0.894	1.499	1.945	1.341	1.268	1.039	0.559	0.573	0.543	0.381	0.605	0.614	0.626	0.757	0.611	0.586	0.741	0.699	0.433	0.430	0.398	0.711	0.864	0.860	0.811	0.711
SCM16	0.784	1.118	1.341	1.913	1.344	1.148	0.591	0.567	0.631	0.494	0.562	0.704	0.623	0.759	0.650	0.613	0.741	0.743	0.493	0.561	0.502	0.930	0.810	0.844	0.758	0.707
SCM17	0.943	1.118	1.268	1.344	1.749	0.943	0.543	0.615	0.630	0.500	0.720	0.690	0.673	0.842	0.678	0.623	0.790	0.762	0.374	0.475	0.407	0.797	0.811	0.823	0.804	0.749
SCM18	0.714	0.959	1.039	1.148	0.943	2.062	0.726	0.545	0.480	0.326	0.508	0.566	0.662	0.746	0.707	0.425	0.539	0.529	0.318	0.540	0.474	0.633	0.744	0.744	0.731	0.730
LP1	0.559	0.565	0.559	0.591	0.543	0.726	1.255	0.963	0.860	0.741	0.792	0.480	0.709	0.709	0.684	0.599	0.703	0.701	0.371	0.357	0.468	0.590	0.608	0.585	0.502	0.540
LP2	0.548	0.612	0.573	0.567	0.615	0.545	0.963	1.268	1.144	0.851	0.791	0.551	0.735	0.745	0.810	0.744	0.730	0.774	0.586	0.462	0.470	0.580	0.582	0.605	0.477	0.507
LP3	0.674	0.645	0.543	0.631	0.630	0.480	0.860	1.144	1.372	0.916	0.881	0.621	0.780	0.826	0.897	0.833	0.754	0.876	0.635	0.456	0.445	0.593	0.536	0.544	0.487	0.445
LP4	0.789	0.519	0.381	0.494	0.500	0.326	0.741	0.851	0.916	1.511	1.058	0.678	0.740	0.847	0.826	0.806	0.798	0.755	0.542	0.562	0.573	0.559	0.493	0.475	0.289	0.307
LP5	0.871	0.750	0.605	0.562	0.720	0.508	0.792	0.791	0.881	1.058	1.792	0.930	0.878	0.930	0.897	0.826	1.059	0.932	0.764	0.731	0.742	0.725	0.868	0.751	0.695	0.677
SCA1	0.675	0.645	0.614	0.704	0.690	0.566	0.480	0.551	0.621	0.678	0.930	1.745	0.853	0.764	0.702	0.755	0.993	1.021	0.729	0.914	0.872	0.740	0.810	0.743	0.600	0.594
SCA2	0.701	0.722	0.626	0.623	0.673	0.662	0.709	0.735	0.780	0.740	0.878	0.853	1.322	1.111	0.885	0.841	0.836	0.955	0.698	0.690	0.635	0.626	0.700	0.655	0.453	0.478
SCA3	0.866	0.904	0.757	0.759	0.842	0.746	0.709	0.745	0.826	0.847	0.930	0.764	1.111	1.515	1.066	0.877	0.967	1.038	0.669	0.690	0.686	0.713	0.819	0.805	0.543	0.534
SCA4	0.824	0.651	0.611	0.650	0.678	0.707	0.684	0.810	0.897	0.826	0.897	0.702	0.885	1.066	1.509	0.922	0.884	0.891	0.607	0.550	0.456	0.685	0.578	0.673	0.483	0.459
SCA5	0.779	0.551	0.586	0.613	0.623	0.425	0.599	0.744	0.833	0.806	0.826	0.755	0.841	0.877	0.922	1.428	0.918	0.859	0.810	0.714	0.693	0.700	0.691	0.638	0.397	0.359
SCA6	0.693	0.760	0.741	0.741	0.790	0.539	0.703	0.730	0.754	0.798	1.059	0.993	0.836	0.967	0.884	0.918	1.563	1.316	0.906	0.828	0.722	0.889	0.982	0.902	0.752	0.761
SCA7	0.722	0.808	0.699	0.743	0.762	0.529	0.701	0.774	0.876	0.755	0.932	1.021	0.955	1.038	0.891	0.859	1.316	1.756	1.022	0.887	0.730	0.936	1.033	0.948	0.743	0.717
CPM1	0.466	0.430	0.433	0.493	0.374	0.318	0.371	0.586	0.635	0.542	0.764	0.729	0.698	0.669	0.607	0.810	0.906	1.022	1.873	1.237	1.025	0.754	0.736	0.878	0.402	0.405
CPM2	0.424	0.490	0.430	0.561	0.475	0.540	0.357	0.462	0.456	0.562	0.731	0.914	0.690	0.690	0.550	0.714	0.828	0.887	1.237	1.890	1.384	0.849	0.835	0.893	0.601	0.685
CPM3	0.511	0.366	0.398	0.502	0.407	0.474	0.468	0.470	0.445	0.573	0.742	0.872	0.635	0.686	0.456	0.693	0.722	0.730	1.025	1.384	1.719	0.850	0.917	0.963	0.600	0.682
GSP1	0.742	0.710	0.711	0.930	0.797	0.633	0.590	0.580	0.593	0.559	0.725	0.740	0.626	0.713	0.685	0.700	0.889	0.936	0.754	0.849	0.850	1.904	1.462	1.418	1.080	1.074
GSP2	0.764	0.859	0.864	0.810	0.811	0.744	0.608	0.582	0.536	0.493	0.868	0.810	0.700	0.819	0.578	0.691	0.982	1.033	0.736	0.835	0.917	1.462	1.871	1.538	1.195	1.207
GSP3	0.828	0.809	0.860	0.844	0.823	0.744	0.585	0.605	0.544	0.475	0.751	0.743	0.655	0.805	0.673	0.638	0.902	0.948	0.878	0.893	0.963	1.418	1.538	1.979	1.096	1.224
GSP4	0.555	0.663	0.811	0.758	0.804	0.731	0.502	0.477	0.487	0.289	0.695	0.600	0.453	0.543	0.483	0.397	0.752	0.743	0.402	0.601	0.600	1.080	1.195	1.096	1.655	1.357
GSP5	0.555	0.645	0.711	0.707	0.749	0.730	0.540	0.507	0.445	0.307	0.677	0.594	0.478	0.534	0.459	0.359	0.761	0.717	0.405	0.685	0.682	1.074	1.207	1.224	1.357	1.575

APPENDIX I

INPUT DATA FOR STRUCTURAL MODELS (GSE/GSI MODEL)

Covariance Matrix for Structural Model (GSE Model)

	IT	IC	IS	SPF	SPP	SPS	SCM1	SCM2	SCM3	SCM4	SCM5	SCM6	SCM7	SCM8	SCM9	SCM10	SCM11
IT	2.196	1.572	1.385	1.542	1.213	1.117	1.104	1.070	0.916	1.122	0.704	0.962	0.693	0.692	1.215	1.056	1.245
IC	1.572	1.982	1.471	1.451	0.995	1.090	0.864	0.896	0.879	0.944	0.654	0.792	0.605	0.733	1.092	0.920	1.000
IS	1.385	1.471	1.992	1.607	1.090	1.170	0.793	0.697	0.703	0.874	0.619	0.836	0.676	0.628	1.091	0.987	1.062
SPF	1.542	1.451	1.607	2.310	1.198	1.260	0.921	0.860	0.834	0.939	0.633	0.966	0.773	0.651	1.159	1.023	1.149
SPP	1.213	0.995	1.090	1.198	1.601	1.046	1.003	0.818	0.672	0.734	0.514	0.892	0.748	0.662	0.998	0.801	0.949
SPS	1.117	1.090	1.170	1.260	1.046	1.676	1.017	0.888	0.793	0.938	0.647	1.085	0.804	0.606	1.084	0.836	1.025
SCM1	1.104	0.864	0.793	0.921	1.003	1.017	2.388	1.238	1.273	1.276	0.588	0.887	0.778	0.858	0.945	0.758	1.017
SCM2	1.070	0.896	0.697	0.860	0.818	0.888	1.238	2.477	1.585	1.359	0.843	1.026	0.786	0.559	0.970	0.699	1.014
SCM3	0.916	0.879	0.703	0.834	0.672	0.793	1.273	1.585	2.342	1.395	0.651	0.914	0.685	0.576	0.787	0.503	0.882
SCM4	1.122	0.944	0.874	0.939	0.734	0.938	1.276	1.359	1.395	2.051	0.803	0.833	0.770	0.601	0.976	0.822	0.898
SCM5	0.704	0.654	0.619	0.633	0.514	0.647	0.588	0.843	0.651	0.803	1.754	0.789	0.614	0.453	0.555	0.612	0.655
SCM6	0.962	0.792	0.836	0.966	0.892	1.085	0.887	1.026	0.914	0.833	0.789	1.688	0.997	0.780	0.897	0.741	1.045
SCM7	0.693	0.605	0.676	0.773	0.748	0.804	0.778	0.786	0.685	0.770	0.614	0.997	1.569	0.802	0.815	0.549	0.801
SCM8	0.692	0.733	0.628	0.651	0.662	0.606	0.858	0.559	0.576	0.601	0.453	0.780	0.802	2.262	1.195	0.772	0.801
SCM9	1.215	1.092	1.091	1.159	0.998	1.084	0.945	0.970	0.787	0.976	0.555	0.897	0.815	1.195	2.030	0.915	1.133
SCM10	1.056	0.920	0.987	1.023	0.801	0.836	0.758	0.699	0.503	0.822	0.612	0.741	0.549	0.772	0.915	1.961	1.233
SCM11	1.245	1.000	1.062	1.149	0.949	1.025	1.017	1.014	0.882	0.898	0.655	1.045	0.801	0.801	1.133	1.233	2.000
SCM12	1.071	0.898	0.899	1.129	0.925	1.046	1.211	1.028	1.088	1.254	0.698	1.205	1.011	0.863	1.046	0.921	1.336
SCM13	0.751	0.611	0.676	0.752	0.739	0.859	1.010	0.940	0.923	0.975	0.739	0.915	0.946	0.693	0.932	0.693	1.077
SCM14	0.965	0.721	0.803	0.876	0.840	0.910	1.052	0.872	0.646	0.898	0.613	0.967	0.832	0.709	0.848	0.983	1.146
SCM15	1.122	0.929	0.962	1.118	0.776	1.040	1.028	0.945	0.680	1.075	0.807	0.985	0.755	0.748	0.916	1.236	1.277
SCM16	1.121	0.918	0.981	1.092	0.841	0.947	1.114	0.972	0.918	0.917	0.600	0.927	0.826	0.794	1.026	1.054	1.149
SCM17	1.072	0.878	0.909	1.132	0.975	0.990	1.096	0.886	0.804	0.902	0.779	0.972	0.820	0.878	0.957	0.935	1.125
SCM18	1.065	0.938	0.814	0.991	0.842	0.875	1.298	1.262	1.018	1.187	0.726	0.844	0.881	0.775	1.067	0.998	0.933
RELIA	0.444	0.415	0.352	0.382	0.459	0.512	0.610	0.732	0.511	0.537	0.504	0.584	0.508	0.334	0.547	0.458	0.506
RESP	0.415	0.268	0.267	0.356	0.391	0.420	0.596	0.575	0.475	0.340	0.325	0.573	0.492	0.353	0.467	0.477	0.563
PRNO	0.412	0.287	0.299	0.392	0.443	0.501	0.482	0.594	0.459	0.389	0.451	0.600	0.581	0.347	0.465	0.246	0.474
QUAL	0.671	0.503	0.366	0.532	0.554	0.533	0.713	0.785	0.544	0.620	0.457	0.667	0.573	0.450	0.760	0.475	0.636
FLEX	0.596	0.370	0.403	0.491	0.527	0.477	0.662	0.648	0.641	0.595	0.528	0.696	0.604	0.491	0.588	0.525	0.661
INNO	0.840	0.651	0.561	0.750	0.695	0.653	0.568	0.715	0.475	0.552	0.452	0.692	0.521	0.554	0.878	0.540	0.741
MS	0.701	0.407	0.416	0.570	0.323	0.449	0.468	0.465	0.500	0.511	0.334	0.453	0.333	0.105	0.420	0.383	0.447
SGRC	0.726	0.546	0.594	0.661	0.541	0.561	0.589	0.685	0.476	0.595	0.220	0.469	0.406	0.081	0.555	0.375	0.441
SGRM	0.685	0.518	0.527	0.601	0.550	0.631	0.673	0.677	0.609	0.692	0.340	0.556	0.410	-0.045	0.426	0.341	0.443

	SCM12	SCM13	SCM14	SCM15	SCM16	SCM17	SCM18	RELIA	RESP	PRNO	QUAL	FLEX	INNO	MS	SGRC	SGRM
IT	1.071	0.751	0.965	1.122	1.121	1.072	1.065	0.444	0.415	0.412	0.671	0.596	0.840	0.701	0.726	0.685
IC	0.898	0.611	0.721	0.929	0.918	0.878	0.938	0.415	0.268	0.287	0.503	0.370	0.651	0.407	0.546	0.518
IS	0.899	0.676	0.803	0.962	0.981	0.909	0.814	0.352	0.267	0.299	0.366	0.403	0.561	0.416	0.594	0.527
SPF	1.129	0.752	0.876	1.118	1.092	1.132	0.991	0.382	0.356	0.392	0.532	0.491	0.750	0.570	0.661	0.601
SPP	0.925	0.739	0.840	0.776	0.841	0.975	0.842	0.459	0.391	0.443	0.554	0.527	0.695	0.323	0.541	0.550
SPS	1.046	0.859	0.910	1.040	0.947	0.990	0.875	0.512	0.420	0.501	0.533	0.477	0.653	0.449	0.561	0.631
SCM1	1.211	1.010	1.052	1.028	1.114	1.096	1.298	0.610	0.596	0.482	0.713	0.662	0.568	0.468	0.589	0.673
SCM2	1.028	0.940	0.872	0.945	0.972	0.886	1.262	0.732	0.575	0.594	0.785	0.648	0.715	0.465	0.685	0.677
SCM3	1.088	0.923	0.646	0.680	0.918	0.804	1.018	0.511	0.475	0.459	0.544	0.641	0.475	0.500	0.476	0.609
SCM4	1.254	0.975	0.898	1.075	0.917	0.902	1.187	0.537	0.340	0.389	0.620	0.595	0.552	0.511	0.595	0.692
SCM5	0.698	0.739	0.613	0.807	0.600	0.779	0.726	0.504	0.325	0.451	0.457	0.528	0.452	0.334	0.220	0.340
SCM6	1.205	0.915	0.967	0.985	0.927	0.972	0.844	0.584	0.573	0.600	0.667	0.696	0.692	0.453	0.469	0.556
SCM7	1.011	0.946	0.832	0.755	0.826	0.820	0.881	0.508	0.492	0.581	0.573	0.604	0.521	0.333	0.406	0.410
SCM8	0.863	0.693	0.709	0.748	0.794	0.878	0.775	0.334	0.353	0.347	0.450	0.491	0.554	0.105	0.081	-0.045
SCM9	1.046	0.932	0.848	0.916	1.026	0.957	1.067	0.547	0.467	0.465	0.760	0.588	0.878	0.420	0.555	0.426
SCM10	0.921	0.693	0.983	1.236	1.054	0.935	0.998	0.458	0.477	0.246	0.475	0.525	0.540	0.383	0.375	0.341
SCM11	1.336	1.077	1.146	1.277	1.149	1.125	0.933	0.506	0.563	0.474	0.636	0.661	0.741	0.447	0.441	0.443
SCM12	2.423	1.542	1.148	1.146	1.005	1.058	1.035	0.622	0.629	0.664	0.702	0.864	0.768	0.462	0.392	0.703
SCM13	1.542	1.974	0.978	0.814	0.812	0.940	0.703	0.586	0.591	0.790	0.717	0.808	0.661	0.352	0.382	0.478
SCM14	1.148	0.978	2.159	1.559	1.203	1.154	1.079	0.600	0.641	0.505	0.781	0.648	0.741	0.403	0.516	0.346
SCM15	1.146	0.814	1.559	2.066	1.361	1.258	1.126	0.624	0.529	0.340	0.636	0.628	0.714	0.461	0.463	0.379
SCM16	1.005	0.812	1.203	1.361	1.910	1.372	1.183	0.629	0.589	0.491	0.653	0.651	0.720	0.454	0.503	0.424
SCM17	1.058	0.940	1.154	1.258	1.372	1.762	1.032	0.600	0.636	0.555	0.744	0.678	0.794	0.368	0.414	0.392
SCM18	1.035	0.703	1.079	1.126	1.183	1.032	2.245	0.746	0.535	0.384	0.800	0.645	0.661	0.421	0.588	0.514
RELIA	0.622	0.586	0.600	0.624	0.629	0.600	0.746	1.258	0.898	0.738	0.693	0.715	0.716	0.405	0.402	0.504
RESP	0.629	0.591	0.641	0.529	0.589	0.636	0.535	0.898	1.246	0.880	0.776	0.869	0.789	0.685	0.508	0.518
PRNO	0.664	0.790	0.505	0.340	0.491	0.555	0.384	0.738	0.880	1.469	0.806	0.847	0.772	0.530	0.551	0.613
QUAL	0.702	0.717	0.781	0.636	0.653	0.744	0.800	0.693	0.776	0.806	1.278	0.931	0.964	0.715	0.700	0.675
FLEX	0.864	0.808	0.648	0.628	0.651	0.678	0.645	0.715	0.869	0.847	0.931	1.261	0.924	0.774	0.717	0.692
INNO	0.768	0.661	0.741	0.714	0.720	0.794	0.661	0.716	0.789	0.772	0.964	0.924	1.502	1.000	0.875	0.762
MS	0.462	0.352	0.403	0.461	0.454	0.368	0.421	0.405	0.685	0.530	0.715	0.774	1.000	1.893	1.249	1.056
SGRC	0.392	0.382	0.516	0.463	0.503	0.414	0.588	0.402	0.508	0.551	0.700	0.717	0.875	1.249	1.924	1.379
SGRM	0.703	0.478	0.346	0.379	0.424	0.392	0.514	0.504	0.518	0.613	0.675	0.692	0.762	1.056	1.379	1.765

Covariance Matrix for Structural Model (GSI Model)

	IT	IC	IS	SPF	SPP	SPS	SCM1	SCM2	SCM3	SCM4	SCM5	SCM6	SCM7	SCM8	SCM9	SCM10	SCM11	SCM12	SCM13
IT	2.296	1.688	1.439	1.580	1.150	1.129	1.087	1.058	0.881	1.117	0.721	1.007	0.666	0.731	1.212	1.141	1.244	1.020	0.744
IC	1.688	1.978	1.462	1.523	0.969	1.120	0.912	0.934	0.879	0.938	0.705	0.865	0.602	0.653	1.083	0.952	1.057	0.871	0.617
IS	1.439	1.462	1.971	1.606	1.007	1.185	0.854	0.699	0.726	0.817	0.636	0.842	0.611	0.598	1.045	1.009	1.074	0.800	0.621
SPF	1.580	1.523	1.606	2.277	1.097	1.285	0.962	0.813	0.829	0.940	0.657	0.958	0.695	0.687	1.115	1.033	1.117	1.060	0.706
SPP	1.150	0.969	1.007	1.097	1.401	0.983	1.040	0.806	0.701	0.712	0.593	0.840	0.773	0.663	0.909	0.763	0.810	0.791	0.658
SPS	1.129	1.120	1.185	1.285	0.983	1.723	1.090	0.924	0.828	0.946	0.661	1.078	0.776	0.597	1.072	0.841	1.018	0.990	0.874
SCM1	1.087	0.912	0.854	0.962	1.040	1.090	2.425	1.368	1.263	1.347	0.657	0.988	0.874	0.949	0.997	0.857	0.977	1.256	1.158
SCM2	1.058	0.934	0.699	0.813	0.806	0.924	1.368	2.418	1.661	1.409	0.779	1.027	0.726	0.615	1.019	0.684	1.073	1.100	0.993
SCM3	0.881	0.879	0.726	0.829	0.701	0.828	1.263	1.661	2.308	1.418	0.698	0.961	0.712	0.587	0.773	0.643	0.981	1.118	0.997
SCM4	1.117	0.938	0.817	0.940	0.712	0.946	1.347	1.409	1.418	2.066	0.863	0.865	0.788	0.627	0.935	0.890	0.972	1.319	1.080
SCM5	0.721	0.705	0.636	0.657	0.593	0.661	0.657	0.779	0.698	0.863	1.666	0.778	0.673	0.535	0.598	0.578	0.664	0.732	0.785
SCM6	1.007	0.865	0.842	0.958	0.840	1.078	0.988	1.027	0.961	0.865	0.778	1.673	0.982	0.857	0.935	0.729	1.093	1.237	0.920
SCM7	0.666	0.602	0.611	0.695	0.773	0.776	0.874	0.726	0.712	0.788	0.673	0.982	1.573	0.899	0.800	0.524	0.801	1.001	0.952
SCM8	0.731	0.653	0.598	0.687	0.663	0.597	0.949	0.615	0.587	0.627	0.535	0.857	0.899	2.236	1.180	0.811	0.866	0.876	0.626
SCM9	1.212	1.083	1.045	1.115	0.909	1.072	0.997	1.019	0.773	0.935	0.598	0.935	0.800	1.180	2.026	0.959	1.162	0.986	0.914
SCM10	1.141	0.952	1.009	1.033	0.763	0.841	0.857	0.684	0.643	0.890	0.578	0.729	0.524	0.811	0.959	1.971	1.233	0.943	0.743
SCM11	1.244	1.057	1.074	1.117	0.810	1.018	0.977	1.073	0.981	0.972	0.664	1.093	0.801	0.866	1.162	1.233	1.961	1.280	1.097
SCM12	1.020	0.871	0.800	1.060	0.791	0.990	1.256	1.100	1.118	1.319	0.732	1.237	1.001	0.876	0.986	0.943	1.280	2.412	1.549
SCM13	0.744	0.617	0.621	0.706	0.658	0.874	1.158	0.993	0.997	1.080	0.785	0.920	0.952	0.626	0.914	0.743	1.097	1.549	2.002
SCM14	0.921	0.726	0.796	0.871	0.728	0.833	1.045	0.849	0.621	0.839	0.659	0.904	0.739	0.762	0.825	1.003	1.150	1.103	0.984
SCM15	1.131	0.911	0.957	1.146	0.694	1.055	1.009	0.884	0.712	1.078	0.719	0.989	0.727	0.792	0.927	1.178	1.286	1.186	0.894
SCM16	1.135	0.924	1.014	1.104	0.808	0.933	1.128	0.945	0.818	0.896	0.569	0.894	0.796	0.774	1.025	1.114	1.185	0.974	0.784
SCM17	1.072	0.885	0.923	1.120	0.892	0.972	1.143	0.889	0.728	0.907	0.814	0.956	0.778	0.888	0.951	0.979	1.171	1.015	0.943
SCM18	1.035	0.878	0.759	0.869	0.765	0.795	1.322	1.277	0.976	1.144	0.742	0.809	0.827	0.784	1.014	1.034	0.920	0.983	0.714
RELIA	0.429	0.430	0.297	0.303	0.369	0.514	0.689	0.688	0.537	0.545	0.475	0.562	0.463	0.336	0.576	0.422	0.478	0.554	0.559
RESP	0.425	0.287	0.249	0.311	0.307	0.394	0.663	0.618	0.514	0.389	0.399	0.566	0.462	0.401	0.532	0.472	0.521	0.576	0.611
PRNO	0.594	0.541	0.446	0.523	0.492	0.596	0.603	0.756	0.607	0.589	0.572	0.674	0.548	0.422	0.685	0.396	0.591	0.748	0.830
QUAL	0.697	0.542	0.357	0.490	0.522	0.535	0.780	0.851	0.566	0.607	0.545	0.710	0.596	0.474	0.812	0.530	0.693	0.739	0.783
FLEX	0.605	0.363	0.334	0.420	0.443	0.450	0.696	0.683	0.694	0.602	0.562	0.700	0.587	0.504	0.627	0.505	0.625	0.789	0.801
INNO	0.901	0.636	0.520	0.722	0.634	0.661	0.591	0.810	0.465	0.537	0.525	0.744	0.533	0.501	0.884	0.563	0.795	0.741	0.707
MS	0.788	0.424	0.419	0.583	0.277	0.460	0.436	0.525	0.523	0.546	0.402	0.483	0.356	0.113	0.480	0.353	0.409	0.440	0.466
SGRC	0.872	0.629	0.636	0.740	0.559	0.650	0.607	0.747	0.561	0.655	0.289	0.481	0.420	0.071	0.682	0.403	0.486	0.384	0.424
SGRM	0.770	0.597	0.533	0.616	0.535	0.690	0.702	0.820	0.742	0.758	0.378	0.587	0.448	-0.033	0.520	0.316	0.389	0.649	0.511
LFC	1.076	0.822	0.808	0.853	0.738	0.833	0.895	0.831	0.758	0.691	0.571	0.772	0.493	0.341	0.720	0.709	0.781	0.839	0.742
APT	1.109	0.935	0.797	0.930	0.739	0.849	0.912	0.927	0.888	0.835	0.570	0.839	0.475	0.426	0.925	0.751	0.920	0.955	0.764
PLM	1.042	0.929	0.819	0.899	0.686	0.864	0.933	0.884	0.848	0.929	0.616	0.759	0.543	0.473	0.881	0.924	0.941	0.982	0.828
RTD	0.870	0.847	0.820	0.854	0.616	0.840	0.732	0.741	0.494	0.639	0.627	0.745	0.383	0.410	0.895	0.785	0.792	0.677	0.555
RLD	0.883	0.870	0.755	0.808	0.591	0.778	0.793	0.774	0.625	0.801	0.575	0.671	0.381	0.429	0.739	0.705	0.667	0.644	0.555

	SCM14	SCM15	SCM16	SCM17	SCM18	RELIA	RESP	PRNO	QUAL	FLEX	INNO	MS	SGRC	SGRM	LFC	APT	PLM	RTD	RLD
IT	0.921	1.131	1.135	1.072	1.035	0.429	0.425	0.594	0.697	0.605	0.901	0.788	0.872	0.770	1.076	1.109	1.042	0.870	0.883
IC	0.726	0.911	0.924	0.885	0.878	0.430	0.287	0.541	0.542	0.363	0.636	0.424	0.629	0.597	0.822	0.935	0.929	0.847	0.870
IS	0.796	0.957	1.014	0.923	0.759	0.297	0.249	0.446	0.357	0.334	0.520	0.419	0.636	0.533	0.808	0.797	0.819	0.820	0.755
SPF	0.871	1.146	1.104	1.120	0.869	0.303	0.311	0.523	0.490	0.420	0.722	0.583	0.740	0.616	0.853	0.930	0.899	0.854	0.808
SPP	0.728	0.694	0.808	0.892	0.765	0.369	0.307	0.492	0.522	0.443	0.634	0.277	0.559	0.535	0.738	0.739	0.686	0.616	0.591
SPS	0.833	1.055	0.933	0.972	0.795	0.514	0.394	0.596	0.535	0.450	0.661	0.460	0.650	0.690	0.833	0.849	0.864	0.840	0.778
SCM1	1.045	1.009	1.128	1.143	1.322	0.689	0.663	0.603	0.780	0.696	0.591	0.436	0.607	0.702	0.895	0.912	0.933	0.732	0.793
SCM2	0.849	0.884	0.945	0.889	1.277	0.688	0.618	0.756	0.851	0.683	0.810	0.525	0.747	0.820	0.831	0.927	0.884	0.741	0.774
SCM3	0.621	0.712	0.818	0.728	0.976	0.537	0.514	0.607	0.566	0.694	0.465	0.523	0.561	0.742	0.758	0.888	0.848	0.494	0.625
SCM4	0.839	1.078	0.896	0.907	1.144	0.545	0.389	0.589	0.607	0.602	0.537	0.546	0.655	0.758	0.691	0.835	0.929	0.639	0.801
SCM5	0.659	0.719	0.569	0.814	0.742	0.475	0.399	0.572	0.545	0.562	0.525	0.402	0.289	0.378	0.571	0.570	0.616	0.627	0.575
SCM6	0.904	0.989	0.894	0.956	0.809	0.562	0.566	0.674	0.710	0.700	0.744	0.483	0.481	0.587	0.772	0.839	0.759	0.745	0.671
SCM7	0.739	0.727	0.796	0.778	0.827	0.463	0.462	0.548	0.596	0.587	0.533	0.356	0.420	0.448	0.493	0.475	0.543	0.383	0.381
SCM8	0.762	0.792	0.774	0.888	0.784	0.336	0.401	0.422	0.474	0.504	0.501	0.113	0.071	-0.033	0.341	0.426	0.473	0.410	0.429
SCM9	0.825	0.927	1.025	0.951	1.014	0.576	0.532	0.685	0.812	0.627	0.884	0.480	0.682	0.520	0.720	0.925	0.881	0.895	0.739
SCM10	1.003	1.178	1.114	0.979	1.034	0.422	0.472	0.396	0.530	0.505	0.563	0.353	0.403	0.316	0.709	0.751	0.924	0.785	0.705
SCM11	1.150	1.286	1.185	1.171	0.920	0.478	0.521	0.591	0.693	0.625	0.795	0.409	0.486	0.389	0.781	0.920	0.941	0.792	0.667
SCM12	1.103	1.186	0.974	1.015	0.983	0.554	0.576	0.748	0.739	0.789	0.741	0.440	0.384	0.649	0.839	0.955	0.982	0.677	0.644
SCM13	0.984	0.894	0.784	0.943	0.714	0.559	0.611	0.830	0.783	0.801	0.707	0.466	0.424	0.511	0.742	0.764	0.828	0.555	0.555
SCM14	2.023	1.499	1.118	1.118	0.959	0.565	0.629	0.635	0.813	0.601	0.784	0.430	0.490	0.366	0.710	0.859	0.809	0.663	0.645
SCM15	1.499	1.945	1.341	1.268	1.039	0.559	0.558	0.493	0.692	0.599	0.720	0.433	0.430	0.398	0.711	0.864	0.860	0.811	0.711
SCM16	1.118	1.341	1.913	1.344	1.148	0.591	0.599	0.528	0.691	0.631	0.742	0.493	0.561	0.502	0.930	0.810	0.844	0.758	0.707
SCM17	1.118	1.268	1.344	1.749	0.943	0.543	0.623	0.610	0.757	0.651	0.776	0.374	0.475	0.407	0.797	0.811	0.823	0.804	0.749
SCM18	0.959	1.039	1.148	0.943	2.062	0.726	0.513	0.417	0.704	0.566	0.534	0.318	0.540	0.474	0.633	0.744	0.744	0.731	0.730
RELIA	0.565	0.559	0.591	0.543	0.726	1.255	0.912	0.767	0.709	0.642	0.702	0.371	0.357	0.468	0.590	0.608	0.585	0.502	0.540
RESP	0.629	0.558	0.599	0.623	0.513	0.912	1.232	0.860	0.771	0.821	0.784	0.611	0.459	0.457	0.587	0.559	0.575	0.482	0.476
PRNO	0.635	0.493	0.528	0.610	0.417	0.767	0.860	1.355	0.849	0.839	0.886	0.653	0.647	0.657	0.642	0.680	0.613	0.492	0.492
QUAL	0.813	0.692	0.691	0.757	0.704	0.709	0.771	0.849	1.265	0.917	0.949	0.684	0.690	0.661	0.670	0.759	0.730	0.498	0.506
FLEX	0.601	0.599	0.631	0.651	0.566	0.642	0.821	0.839	0.917	1.195	0.888	0.708	0.632	0.574	0.692	0.634	0.656	0.440	0.409
INNO	0.784	0.720	0.742	0.776	0.534	0.702	0.784	0.886	0.949	0.888	1.488	0.964	0.857	0.726	0.912	1.008	0.925	0.747	0.739
MS	0.430	0.433	0.493	0.374	0.318	0.371	0.611	0.653	0.684	0.708	0.964	1.873	1.237	1.025	0.754	0.736	0.878	0.402	0.405
SGRC	0.490	0.430	0.561	0.475	0.540	0.357	0.459	0.647	0.690	0.632	0.857	1.237	1.890	1.384	0.849	0.835	0.893	0.601	0.685
SGRM	0.366	0.398	0.502	0.407	0.474	0.468	0.457	0.657	0.661	0.574	0.726	1.025	1.384	1.719	0.850	0.917	0.963	0.600	0.682
LFC	0.710	0.711	0.930	0.797	0.633	0.590	0.587	0.642	0.670	0.692	0.912	0.754	0.849	0.850	1.904	1.462	1.418	1.080	1.074
APT	0.859	0.864	0.810	0.811	0.744	0.608	0.559	0.680	0.759	0.634	1.008	0.736	0.835	0.917	1.462	1.871	1.538	1.195	1.207
PLM	0.809	0.860	0.844	0.823	0.744	0.585	0.575	0.613	0.730	0.656	0.925	0.878	0.893	0.963	1.418	1.538	1.979	1.096	1.224
RTD	0.663	0.811	0.758	0.804	0.731	0.502	0.482	0.492	0.498	0.440	0.747	0.402	0.601	0.600	1.080	1.195	1.096	1.655	1.357
RLD	0.645	0.711	0.707	0.749	0.730	0.540	0.476	0.492	0.506	0.409	0.739	0.405	0.685	0.682	1.074	1.207	1.224	1.357	1.575