Cass Business School
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Managing a Successful Supply Chain Partnership

by

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Thesis

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Lists of Equations, Graphs, Figures and Tables

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Declaration

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Abstract

This thesis presents three studies in Supply Chain Partnership. The first study is to develop a supply chain partnership classification scheme for academic and managerial purposes. The main characteristics of the classification scheme we obtained are that this scheme is 1) specialised for supply chain partnerships, 2) empirically derived, and 3) based on the five determinants of supply chain performance. In addition, the newly developed scheme has provided an important insight into the pattern of the evolution of supply chain partnerships. On the basis of these findings, some requirements for the evolution of supply chain partnerships, which are in the form of components of the partnership development management, were suggested. In the second study, we have identified the major factors of a successful supply chain partnership and estimated models for the three dimensions of supply chain partnership performance. The three performance models provide an important foundation for developing a 'supply chain partnership performance management scheme'. In the final study we have confirmed that suppliers and customers do see things significantly differently, and there is the negative association between these differences and the performance of a supply chain partnership. The third study is exploratory in nature; thus, it has provided some interesting research opportunities for academics.

I. The Nature of The Research

1 Introduction

Over the past two decades, the strategic focus of supply chain management has shifted from an adversarial stance towards a more collaborative mindset (Bowersox, Closs & Stank, 2003). This shift is a result of firms' efforts to 'centralise logistics functions' in the 1960s and 1970s and to 'integrate logistics functions' in the 1980s. As a consequence, the phrase 'supply chain partnership' has become common in today's business language, and has been generating a great deal of interest (Walton, 1996). In the late 1990s and at the beginning of the millennium, when IT and the Internet held great promise, the potential of supply chain partnerships was equally fascinating and companies were expecting huge increases in their competitiveness through supply chain partnerships. Such collaborative strategy was the most used, the most popular, but also the most frequently misunderstood, and the most disappointing supply chain management (SCM) strategy that has come along to date. There are numerous examples of failures and disappointing results of the efforts to implement such a strategy, while success stories are rare. As the promises of supply chain partnership were closely tied to the expectation of e-business, the disappointment with its unfulfilled promises was as great as that felt after the collapse of the dot.com bubble (Sabath & Fontanella, 2002). Despite this disappointing track record, the benefits promised by a well-performing supply chain partnership still deserve attention. For example, the supply chain partnership between Procter & Gamble and Wal-Mart rewarded Procter & Gamble a sales increase to Wal-Mart from $350 million in 1988 to $4 billion in 1999 and a threefold increase in product turnover (Crum & Palmatier, 2004). So, what we can do to reap and actualise these promised benefits of supply chain partnership? Have we learnt anything from our painful experience?

This thesis attempts to suggest a way of answering the above questions by achieving the following three research objectives. The first research objective, which is 'to developing a classification scheme of supply chain partnerships with the five collaboration attributes[1]', can help to answer the above question by providing two important SCM management methods, the 'supply chain partnership classification

[1] Five collaborative attributes are 1) information technology, 2)trust, 3) joint partnership management system, 4) relationship specific asset, and 5) partner asymmetry

method' and 'supply chain partnership growth management'. Then, through the second research objective of 'identifying the factors behind a successful supply chain partnership', we propose a method of managing performance of a partnership effectively and in a systematic manner. The final research objective is 'to identify differences in the viewpoints of the supplier and customer within the same partnership on various SCM related issues and their association with the partnership's performance'. This research objective is more exploratory in nature and introduces the concept of partner asymmetry and its influence to SCM research.

2 Research Objectives

In total, this thesis aims to achieve three main research objectives related to supply chain partnership.

2.1 Development of a Classification Scheme for Supply Chain Partnership

The first research objective of this thesis is to develop a classification scheme of supply chain partnerships with five collaboration performance determinants: 1) IT, 2) trust, 3) joint partnership management system, 4) relationship specific assets, and 5) partner asymmetry[2]. These factors have previously been identified in the academic literature as the main determinants of the performance of a supply chain partnership.

The main reasons for selecting this as the first research objective are as follows. Firstly, there has been abundant use of terms referring to collaborative inter-firm arrangements and classification methods with various different dimensions of partnerships. However, so far, few attempts have been made to classify 'collaborative inter-firm arrangements' with the attributes which influence their performance.

Secondly, the majority of such classification methods cover broader and more diversified forms of collaborative inter-firm arrangements. In terms of supply chain partnership, such efforts mainly remain at the conceptual level, without empirical study. Thus, this lack of a classification study particularly focused on supply chain partnerships and the need for an empirically based classification method necessitates the development of a classification method for supply chain partnership based on the empirical data.

Thirdly, from an academic research point of view, it is important to develop a well-

established classification method. Punj & Stewart (1983) underlined the importance of building a classification method or taxonomy by quoting Wolf's argument that "verification of laws of science may occur only after classification has been completed" and argued that whether the classification occurs explicitly or implicitly, it must occur before significant research is carried out. This applies to research on supply chain partnerships, as 'diversity of collaborative inter-firm arrangements formation' could pose a significant difficulty for conducting research (Garrette & Dussauge 1995). A new and rigorously established classification method based on empirical data, such as the one this research is trying to develop, can be used as a useful tool to overcome the above research obstacle of diversity.

Finally, as Harland *et al.* (2001) have pointed out, the majority of such research on classification methods offers only limited operational assistance for the companies themselves. The new method aims to provide a useful management tool for boundary spanning personnel for various decision-making processes regarding the formation, maintenance and termination of supply chain partnerships.

2.2 Identifying Determinants of the Performance of a Supply Chain Partnership

The second research objective is to identify the major determinants of the performance of a supply chain partnership and estimate the models of the three dimensions of supply chain partnership performance. There have been a number of studies regarding the performance of collaborative inter-firm arrangements. These studies have yielded a number of significant insights, such as the methods of measuring the performance of such arrangements and the performance determinants. From the supply chain management perspective, however, the previous studies are limited in the following ways.

Firstly, the types of inter-firm arrangement covered by these studies are limited. The major forms of collaborative arrangements covered are mainly 'equity related collaborative inter-firm arrangements' such as joint ventures. A few researchers, such as Heide & Stump (1995), Glaister & Buckely (1998), Whipple, Frankle & Daugherty (2002) and Artz (2002), have carried out research regarding the performance issues of 'non-equity inter-firm arrangements'. However, there are few examples of such research where issues related to supply chain partnership were

[2] Please refer to II.4.4.for the detailed information regarding five collaboration performance determinants

exclusively covered.

Secondly, due to the nature of supply chain partnerships and the multiplicity of participants involved, the data collection methods employed by a number of previous empirical studies can potentially expose the results of such studies to the problem of asymmetry of perception among partners. Hamel (1991) pointed out that the performance of a collaborative inter-firm arrangement might be perceived differently by each partner. For example, a supplier might be satisfied by receiving its customer's demand forecast information through the partnership, but on the other hand, the customer might not be very happy, as they feel that they lose bargaining power by releasing this information. If the data related to satisfaction with this partnership are collected from only the suppliers, for instance, the result of such research can present a very skewed picture of the partnership. For this reason, the results of many of the previous studies, where the data were collected solely from one of the multiple partners, are exposed to the bias created by perception asymmetry among partners.

Thirdly, the issues related to the performance of a collaborative inter-firm arrangement have been viewed from two very different perspectives, and little effort has been made to approach the performance issues from an integrated view of these perspectives (Saxton, 1997). Researchers taking the first approach have focused on characteristics such as a) degree of uncertainty, b) relationship specific assets, c) complementary assets of a partner, and d) IT as an explanation for partnership behaviour and performance. On the contrary, other researchers have approached the issue by focusing on the interactive nature of partnership between organisations, examining factors such as trust and partner asymmetry as factors of performance partnerships (e.g. Gulati, 1998). Saxton (1997) pointed out that this lack of an integrated approach could expose the results of such research to the risk of neglecting the importance of relationships and the costs of long-standing relationships that lack infusions of new ideas and capabilities.

This research aims to overcome the above limitations by improving research methodology, limiting the scope of analysis only to supply chain partnerships, and combining two different views of covering the issues related to the performance of collaborative inter-firm arrangement.

2.3 Perception Asymmetry among Partners of Supply Chain Partnership and its Association with its Performance

The third research objective is to identify the existence of the perception asymmetry between customers and suppliers on the various aspects of a supply chain partnership and then assess whether there is a significant negative correlation between the magnitude of this perception asymmetry and the performance of supply chain partnerships. The effects of perception asymmetry on the performance and the status of collaborative inter-firm arrangements are vaguely assumed by academics and practitioners, but few studies have actually demonstrated the existence of such asymmetry, and the impact or association of perception asymmetry on the actual performance of collaborative inter-firm arrangements has not yet been extensively studied. The third research objective is exploratory by nature due to the lack of previous research on this issue.

3 Structure and Summary of Thesis

This thesis is composed of seven chapters. A summary of the contents of each chapter is as follows:

3.1 Chapter I: Introduction

This chapter consists of 1) overall introduction, 2) summary of research objectives and 3) outline of the structure of the thesis.

3.2 Chapter II: Literature Review

Chapter II is devoted to a review of the literature in order to provide a historical perspective of the relevant research area and an in-depth account of independent research endeavours. Also, twelve research hypotheses for research objectives II and III are derived from this literature review. The literature review section consists of reviews of the literature concerning 1) definition of SCM, 2) various terms referring to collaborative inter-firm arrangements, 3) classification methods of collaborative inter-firm arrangement, 4) chronological evolution of supply chain partnership, 5) determinants of collaborative inter-firm arrangement performances, 6) measurement of the performance of collaborative inter-firm arrangements, and 7) perception asymmetry in collaborative inter-firm arrangements.

3.3 Chapter III: Methodology and Research Design

Chapter III consists of 1) data collection section (survey methods), and 2) analytical methods section. In the data collection (survey methods) section, firstly, an industry review of CPG supply chains in general and Korean CPG supply chains in particular is carried out. Questionnaire design, the development of the measures and the administration of the survey are then discussed. The analytical methodology section presents a detailed review of all three major analytical methods used in this study, 1) cluster analysis, 2) multiple regression analysis, and 3) MANOVA.

3.4 Chapter IV: Results I, Classification and Evolution of Supply Chain Partnerships

In this chapter, the results of the cluster analysis to achieve the first research objective are discussed. The results of the cluster analysis provide two important contributions to the existing literature on supply chain management, which are 1) classification of supply chain partnerships into four distinctive patterns by five performance determinants and 2) identification of the pattern of the evolution of partnerships and requirements for evolution. The discussion of these requirements for the evolution of partnerships is targeted to the field of SCM practitioners and is intended to provide them with the managerial implications of partnership growth management.

3.5 Chapter V: Results II, Determinants of Successful Supply Chain Partnerships

In chapter V, the following results are discussed. Firstly, the major determinants of the performance of supply chain partnerships are identified. The results of the analyses suggest that five factors, 1) level of information technology, 2) level of mutual trust, 3) degree of joint partnership management system, 4) existence of the relationship specific assets, and 5) degree of partner asymmetry, each have a positive influence on the performance of a supply chain partnership as individual factors. In addition to this, the three performance models, 1) extent of goal achievement, 2) enhancement of company's competitive positions, and 3) contribution on SCM operational level are estimated, to establish which would be the optimal models for the performance of supply chain partnership. These can be used for the managerial purpose of achieving successful supply chain partnerships and predicting the performance of a supply chain partnership.

3.6 Chapter VI: Results III, Perception Asymmetry among Partners of Supply Chain Partnership and the Association with the Performance

Chapter VI is devoted to a discussion of the results regarding the third research objective. Due to the exploratory nature of this study, managerial implications cannot be offered, but this study adds the following points to the existing literature: firstly, the findings demonstrate that the vaguely assumed perception asymmetry over the performance of partnerships and the status of their supply chain partnerships among supply chain partners does exist, and secondly, this research demonstrates that perception asymmetry related to 1) level of trust, 2) degree of the joint partnership management system and 3) contribution at the SCM operational level are negatively related to the performance of partnerships.

3.7 Chapter VII: Conclusion

The final chapter consists of a summary and discussion of the results, the achievements of the research and the suggestions for future research.

II. Literature Reviews and Research Hypotheses

1 Introduction

The main purpose of a literature review is to provide a historical perspective on the research area and an in-depth account of independent research endeavours (Mentzer & Kenneth, 1995). This literature review was also conducted with the purpose of obtaining an in-depth knowledge of the relatively new academic discipline of 'supply chain management and supply chain partnerships' and identifying gaps in the previous studies.

As the nature of this research is multi-disciplinary, the scope of this literature review covers previous studies from various academic disciplines such as supply chain management, organisational studies, logistics management, marketing and operations science. In addition, this literature review is a 'theoretical literature review' aimed at developing the main research hypotheses of this research.

The structure of the literature review is as follows. Firstly, the concept of supply chain management is reviewed from an evolutionary perspective. This section gives a detailed review of the way in which the concept of SCM and partnerships has evolved from conventional in-house logistics management. Secondly, various past research on three different areas of supply chain partnership is reviewed, 1) the definition and the usage of different terminology referring to supply chain partnerships, 2) classification methods of various supply chain partnerships, and 3) chronological review of evolution of supply chain partnership. Thirdly, studies of measurement and the factors behind a successful supply chain partnership are reviewed. Finally, the literature on perception differences between suppliers and customers on various characteristics of their supply chain partnerships and their association with the performance of supply chain partnership is discussed.

2 Supply Chain Management and Partnerships

In this section, previous studies on 1) definition of SCM, 2) theoretical background of supply chain partnership, and 3) a chronological review of the development of the concept of SCM and partnership are reviewed with the purposes of comprehending 1) the process of the development of the idea of collaborative SCM and supply chain partnerships, and 2) identifying the major economic and business driving forces behind the birth of collaborative SCM.

2.1 Development of the Concept of Supply Chain Management

The concept of logistics management and that of supply chain management are often understood synonymously. The advent of information technology (IT) and other internal/external changes in the business environment have enabled or forced a certain degree of integration of the operations of different business partners. Since then, the definition of supply chain management has been expanding beyond the traditional definition of logistics management. The main focus of this section of the literature review is to discuss how the idea of logistics management has been evolving into the concept of supply chain management.

2.1.1 From Logistics Management to SCM: Definition of SCM

The latest definition of logistics (1998) modified by the Council of Logistics Management is: 'Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements.' It is clearly stated that 'logistics management' is a part of SCM. Throughout the literature search for definitions of SCM, one significant point came to our attention: there were two different views on how to define SCM. The first view on defining SCM is an extension of the definition of traditional logistics management beyond the boundaries of a single enterprise, and mainly focuses on material movement and operational efficiency. On the other hand, the second view on defining SCM is from the wider perspective of integrated business process and strategic management of a broader set of activities and organisations and their links, such as communication (Schary, 1999).

2.1.2 SCM as Management of Logistics Activities beyond the Single Firm Boundary

The first view incorporates the idea of extending the concept of conventional logistics management beyond a single firm boundary. This view reflects the commonly accepted 'operational view' on SCM, that 'operational efficiency' is the key to successful SCM. Bowersox & Closs (1996) explained this tendency as holistic logistics management, that is companies have to search for a new source of cost saving by integrating 'procurement and manufacturing (inbound)' and 'distribution and manufacturing integration (outbound)'.

This view is shared by many early logistics management textbooks as the definition of SCM, and is also widely accepted among industry practitioners and manufacturing operations researchers.

Lambert, Cooper & Pagh (1997) found through their literature search that the term SCM first appeared in 1982. During early 1990s, academics started to separate SCM from logistics management as there was a need for inventory reduction not only within the boundaries of single firm, but also through supply chains (Lambert, Cooper & Pagh, 1997). However, this view restricts the definition of SCM to major logistical processes and takes relatively little consideration of other business processes.

A number of definitions adopt this notion of SCM. Lee & Billington (1995) defined SCM in a similar way, as: 'managing a network of facilities that procure raw materials, transform them into intermediate goods and then final products, and deliver the products to customers through a distribution system.' Swaminathan, Smith & Sadeh (1996) defined SCM as managing 'a network of autonomous or semi-autonomous business entities collectively responsible for procurement, manufacturing, and distribution activities associated with one or more families of related products.' Also, CPFR (Collaborative Planning Forecasting and Replenishment, the Voluntary Inter-industry Commerce Standards Association) defines SCM as: 'The delivery of customer and economic value through the integrated management of the flow of physical goods and associated information, from raw materials sourcing to the delivery of finished products to consumers.' Håkansson (1999) takes a similar operational view in his definition of supply chain management: 'SCM is co-ordinating, scheduling and controlling procurement, production, inventories and deliveries of products and services to customers.'

Element	Traditional	Supply Chain
Inventory Management Approach	Independent efforts	Joint reduction in channel inventories
Total Cost Approach	Minimise firm Cost	Channel-wide cost efficiencies
Time Horizon	Short term	Long term
Amount of Information Sharing and Monitoring	Limited to needs of current transaction	As required for planning and monitoring processes
Joint Planning	Transaction-based	On-going
Compatibility or Corporate Philosophies	Not relevant	Compatible at least for key relationship
Breadth of Supplier Base	Large, to increase competition and spread risk	Small, to increase co-ordination
Channel Leadership	Not needed	Needed for co-ordination
Amount of Sharing of Risks and Rewards	Each on its own	Risks and rewards shared over the long term
Speed of Operations, Information & Inventory Flows	"Warehouse" orientation interrupted by barriers to flow: localised to channel pairs	"DC" orientation interconnecting flows: JIT, Quick Response across the channel.
Information System	Independent	Compatible, key to communication

Table II-1: Traditional and supply chain management approach compared, (Source: http://www.ascet.com/, 2000)

2.1.3 SCM as Business Process Integration beyond Single Firm Boundary

The second view of the definition of supply chain management is much broader than the first. This view encompasses the idea that there should be an effort to integrate other business functions across organisations, along with an integration of logistics functions and strategic management of partnership, in order to achieve supply chain excellence. The idea behind the broader concept of SCM is that in order to survive and prosper, companies will need to operate their supply chains as extended enterprises, with relationships which embrace not only logistics functions but also other business processes, from material extraction to consumption. Greis & Kasarda (1997) named this concept 'extended enterprise' and identified the advent of this emerging concept as the result of the paradigm shift of business management from manufacturing management to consumer satisfaction management. The corporate structure of the 1980s and the early 1990s was designed for mass production and hierarchically controlled organisations where supply chains were either vertically integrated or market relationships. However, the shift of competitive priorities from quality to delivery speed and agility required organisations to seek new capacities by adopting a more advanced format of supply chain or 'extended enterprise'. These more advanced formats of supply chains or extended enterprises refer to: an integrated group of strategically aligned organisations in the supply chain, focused on

specific market opportunities and based on mutual benefits which require a substantial amount of co-operation among partners (Greis & Kasarda, 1997). Similarly, Lambert, Cooper & Pagh (1997) argued that this newly emerging way of looking at SCM from an extended enterprise perspective is the result of two significant changes in the management paradigm: 1) process-oriented business activities that de-emphasise the functional structure between organisations and 2) the departure from the idea that SCM is just logistics management.

One of the main characteristics of the second view is that it places more emphasis on strategic management, and this is the reason why this view is widely accepted among researchers who see SCM from a strategic management and marketing perspective. One good example of a definition taking this view is that of Giunipero & Brand (1996): 'In its broadest context, SCM is a strategic management tool used to enhance overall customer satisfaction that is intended to improve a firm's competitiveness and profitability.' Similarly, Christopher (1997) defined SCM as a strategic tool to manage upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole.

The second characteristic of this view is that it embraces non-logistical business processes as well as major supply chain process such as procurement, manufacturing and distribution. Lambert, Cooper & Pagh (1998) argued that the new ideal vision of SCM should include all business processes in all supply chain members from procurement to consumption.

The definition drawn up by members of the Global Supply Chain Forum illustrates the new trend towards such views clearly: 'Supply chain management is the integration of key business processes from the end user through original suppliers that provide products, services, and information to add value for customers and other stakeholders', (Lambert, Cooper & Pagh, 1998). Ross (1999) similarly defined SCM as: 'A continuously evolving management philosophy that seeks to unify the collective productive competencies and resources of business functions found both within the enterprise and outside in the firm's allied business partners located along intersecting supply channels into a highly competitive, customer-enriching supply system focused on developing innovative solutions and synchronising the flow of marketplace product, services and information to create unique, individualised sources of customer value'.

2.2 Theoretical Background of Supply Chain Partnership

The theoretical background to the idea of supply chain partnership is based on 'co-operative strategy', defined by Child & Faulkner (1998) as: 'The attempt by organisations to realise their objectives through co-operation with other organisations, rather than in competition with them.' According to them, companies which are lacking in competence or resources can significantly benefit from this co-operative strategy. This co-operative strategy can be particularly beneficial for participating companies of a supply chain, where their competence varies from material extraction to retailing.

Child & Faulkner (1998) offered a systematic overview of the main theories, which provides a useful foundation for conducting research on co-operative strategy. They attempted to draw insights into co-operative strategy from four different perspectives: economics, game theory, strategic management theory and organisation theory.

2.2.1 Economic Perspective

Child & Faulkner (1998) put forward four major theories which have been frequently used as theoretical foundations for research on co-operative strategy from the economic perspective. These are 1) market power theory, 2) transaction-cost theory, 3) agency theory and 4) increasing return theory.

Market Power Theory: Market power theory (MPT) focuses on the ways in which companies improve their competitive advantage by securing their positions in the market. The traditional way of maintaining competitive advantage was described by Porter (1980) as 'offensive coalition', which is, strengthening their positions by confronting competitors. However, as early as the early 1970s, some researchers, such as Hymers (1972), started to demonstrate that co-operation can improve firms' positions by distinguishing between offensive and defensive coalitions. Since then many researchers, such as Lorange, Roos & Simcic (1992), Elfring (1994) and Faulkner (1994), have carried out extensive research on 'complementary alliances' using various methodologies. This new view has developed into the theoretical background of inter-firm alliances.

Child & Faulkner (1998) clarified the insights into co-operative relationships provided by MPT and its drawbacks. According to them, MPT clearly demonstrates

that market power can be retained by a co-operative strategy, and adopting a co-operative strategy can be a cheaper and faster way to obtain or sustain market power than a competitive strategy in some cases. However, MPT fails to account for 'trust' between members of inter-firm alliances.

Transaction-Cost Economics: Many researchers have argued that the main motivation for adopting a co-operative strategy is the level of transaction cost involved. Transaction cost refers to the cost of providing goods or services through the market rather than having them provided from within the firm. According to Coase (1960), transaction cost is incurred as market transactions create the following costs: 'searching and information costs', 'bargaining and decision costs' and 'policing and enforcement costs'. Coase (1938, cited in Child & Faulkner, 1998) also concluded, prior to this, that there are basically two ways to organise economic activity: either within companies (hierarchies) or in the open market. The essence of a company is co-operation, while competition stems from inter-company market relationships. Transaction-cost economics often become an important factor in deciding which form of organisation should be adopted. According to Child & Faulkner (1998), transaction-cost economics are used to emphasis various issues related to co-operative strategy. They summarised the contribution of transaction-cost economics to co-operative strategy as 'providing important insights into the governance form of an alliance'. In addition, 'transaction-cost theory can be used to identify the relevance of the partners' motives, the nature of investment they commit to the alliance, and the specific character of their transaction and to underline efficiency and cost minimising rationales forming alliance.'

Agency Theory: According to Eisenhardt (1989, cited in Child & Faulkner, 1998), agency theory explains how to best organise relationships in which one party (the principal) determines the work which another party (the agent) undertakes. Agency theory states that we need organisations to help monitor and give incentives to agents doing co-ordinated, co-operative work. The main contribution of agency theory is its focus on the importance of common incentives and the monitoring body when firms adopt co-operative strategies.

Increasing-return Theory: Traditionally, many economic theories have been based on the assumption of the law of diminishing return. However, a number of economists such as Arthur (1989) have identified that increasing return does exist,

especially in knowledge-based economies. Similarly, Bettis & Hitts (1995) claimed that increasing return (positive feedback) occurs in an industry with high knowledge contents. Arthur (1989) has argued that 'if technological ecologies are the basic unit for strategy in the knowledge-based world, players compete by building webs, that is; loose alliances of companies organised around a mini-ecology, that amplify positive feedback to the base technology.' Bettis & Hitts (1995) argued that due to this phenomenon of low diminishing returns, the optimum scale may be the entire market and first mover advantages, or an early lead in market share will be magnified into market dominance. In order to achieve such position, technology-based alliance is proven to be an effective strategy.

2.2.2 Game Theory Perspective

There are various definitions of the game theory due to its wide applications. According to Zagare (1984, cited in Child & Faulkner, 1998): 'game theory is about the prediction of outcomes from "games", which are social situations involving two or more players whose interest are interconnected or interdependent.' Child & Faulkner (1998) argued that game theory is about the strategies adopted by the players in a game and the effects these have on the game's outcome. Game theory has had a significant impact on alliance research since the 1980s and provided important insights into co-operative behaviour and strategies. The assumption of this theory is that players are self-interested. However, many researchers have pointed out that the theory itself does not draw a common conclusion, and this inevitably means that competition will follow. The main implication of this theory is that business is not a zero-sum game, but is a game that can be set up so that both players gain benefits from it. Brandenburger & Nalebuff (1995) suggested that it is important for the manager to understand that a game is not given, but that the players are free to change it. By changing the rules, tactics and even the boundaries of the game, a huge number of new possibilities suddenly emerge. Child & Faulkner (1998) argued that the main contribution of the game theory to the analysis of co-operative strategy are in its indication of situations in which this strategy may be rewarding, and also to conditions under which it may be undermined.

2.2.3 Strategic Management Theory Perspective

Strategic management theory offers valuable perspectives on co-operative strategy

by focusing attention on the need for the 'right partner', in order to achieve fit between businesses' respective strategies, so that an alliance between them make a positive contribution to the achievement of each party's objective. These perspectives afforded by the strategic management theory are mainly centred on three issues: the motives behind the formation of an alliance, partner selection criteria and the importance of a 'cultural fit' between partners.

In respect of the first point, many researchers have carried out investigations of the motives behind the formation of strategic alliances. Contractor & Lorange (1988) identified seven reasons for forming inter-firm co-operative arrangements. These are: 1) risk reduction, 2) economies of scale and/or rationalisation, 3) technology exchanges, 4) co-opting or blocking competition, 5) overcoming government or investment barriers, 6) facilitating international expansion, and 7) complementary contributions of partners in value chain. Child & Faulkner (1998) point out that the above rationales have raised the issue of importance of 'openness of the motives of forming collaboration and transparency'. A number of researchers have subsequently argued that a lack of trust could undermine the opportunity to realise the potential benefits of co-operative activities. Secondly, it is not difficult to see the linkage between motives for forming alliances and partner selection criterion. Hitt, Tyler, & Hardee (1995) suggested that after making the decision to engage in an alliance, the selection of an appropriate partner is the next critical decision. The importance of selecting the right partners was stressed by Geringer (1991), who argued that the right choice of partner can yield important competitive benefits, whereas the failure to establish compatible objectives or communicate effectively can lead to insurmountable difficulties. The major selection criterion for choosing partners, which has been mentioned by Geringer (1991), is the strength of the partners' ability to provide or gain access to the 'feature', which is the main purpose of that alliance. Thirdly, the importance of cultural fit was underlined by Bleeke and Ernst (1993) and Faulkler (1995). According to them, with this 'cultural fit', partners can achieve efficient co-operative work and also develop trust as well as positive mutual learning processes.

2.2.4 Organisation Theory

Child & Faulkner (1998) point out that organisational theory provides three important insights into co-operative strategy. The first insight is that organisational

theory embraces a 'resource dependency perspective' and provides a basic explanation for the reasons to seek inter-organisational co-operation, and how partners' investment in alliances has a bearing upon the control they can exercise over the management organisation. The second insight is that organisation theory highlights the issue of how an alliance is appropriately arranged. The third insight relates to the nature of trust within inter-organisational co-operation.

2.3 Chronological Review of Supply Chain Collaboration

The value of reviewing the history of the past thirty years of logistics management or SCM, in terms of assigning historical events or processes to defined periods, is that it can facilitate understanding of events by connecting a series of actions or a particular set of collective activities (Ross, 2000). A comprehensive understanding of SCM requires a thorough understanding of the evolution of logistics management, as we can see the development of SCM characteristics from a simple extension of integrated logistics management to the business philosophy of the whole field of supply chain management.

A number of logistics and SCM management researchers have suggested that the history of the emergence of supply chain partnerships coincides with the evolution of logistics management towards SCM, and that they are closely related. This section firstly reviews the chronological development of supply chain partnerships along with the concept of SCM, and then examines the driving forces and motives of such development in each period in order to illuminate the above issues.

2.3.1 Before the 1980s: The Beginning of Logistics Management

The main characteristics of the period before the 1980s can be summarised by one phrase, 'centralisation of logistics functions'. Between the 1960s and the early1970s, according to Coyle, Baldi & Langley (1996), companies made a significant effort to define their physical distribution or outbound logistics systems, and attempted to systematically manage interrelated business logistics activities for efficient delivery to the end customers.

From an organisational point of view, Ross (2000) pointed out that this strategic change came along with the main changes in management focus and organisation design changes. Those are: optimising operations and customer service and centralising scattered logistics functions into one single organisation. He

characterised this period as 'the birth of modern logistics', since the decentralised, uncoordinated functions converged into a single integrated department. These changes were driven by the new awareness of the benefits of the total logistics system paradigm, such as the concept of 'total logistics cost'. The need to integrate decentralised logistics functions into a single process was intensified by severe economic pressures, intensifying domestic and overseas competition (Karrenbauer, 1985), and increasing pressure from customers regarding variety, price and service (Prida, 1996).

The significance of this period is that 'centralisation of logistics functions' later played an important role in creating a foundation for collaborative supply chain partnerships. Centralisation of logistics functions enabled firms to obtain cost and service trade-off benefits, and this encouraged logistics practitioners to discover the potential saving opportunities by outsourcing their activities. Bowersox, Closs, & Stank (1999) argued that the early form of collaborative supply chain arrangements appeared around 1965 as a 3PLs, along with the idea of expanding logistical competency through outsourcing.

2.3.2 The 1980s: Integration[3] of Logistics Functions towards Supply Chain Partnership

The process of evolution towards SCM and the preparation work for supply chain partnership accelerated around the early 1980s, with the beginning of internal integration. There were significant external/internal changes to the business environment in the 1980s. Externally, two of the most significant changes, which were 'rapid change of economic environments' (high cost of fuel and capital, and increasing global competition) and 'deregulation of transportation', occurred in this period (Coyle, Baldi & Langley, 1996, Bowersox, 1996, Ross, 2000). Internally, the objective of the SCM (more likely to be called logistics management at that time) during this period was shifted to synchronisation of the requirements of the customer

[3] Integration is different to various collaborative inter-firm arrangements. However, the term 'integration' is often used synonymously with terms referring to collaborative inter-firm arrangements such as co-operation or collaboration. Sterling Commerce (2000) suggested that integration refers to 'connecting process or/and applications internally or/and externally'. Keebler & Manrodt (1999) similarly defined integration as: 'uniting, combining, or incorporation of two or more functions within a company or two or more processes between two or more companies into a compatible or unified process in operational sense.' On the other hand, terms referring to collaborative inter-firm arrangements, such as co-operation or collaboration, refer to organisations that actively work together to solve the business problems they share, going beyond bridging the differences airing from their systems and procedures in a strategic sense (Sterling Commerce, 2000). Thus, a true collaborative activity is greatly based on the business process integration of supply chain partners.

with the flow of material from suppliers in order to balance higher customer service, low inventory investment and low unit cost (Stevens, 1989). Traditionally, the method of balancing these factors was focused on the operational and planning levels, but from the 1980s the integration of logistics activities was considered as a new way to balance the trade off between the conflicting goals of balancing the service level and low logistics costs.

The tendency towards the internal integration of logistical activities during this period was a significant initial step towards early supply chain partnership, as it led companies to perceive an opportunity to save cost and increase their competitive advantages by viewing intra-company logistics activities as a 'whole process' from material management to finished goods (Coyle, Baldi & Langley, 1996). According to the four-stage supply chain integration model put forward by Stevens (1989), internal supply chain integration is more likely to be possible after functional integration, and this could eventually lead to external integration embracing customer and supplier. This internal supply chain integration stage involves the integration of all logistics activity of the internal supply chain directly under the control of the company and includes outwards good management. The possibility of a significant increase in the efficiency of cost management brought by internal integration inspired many companies to devise blueprints for external integration, which could bring system-wide benefits across a supply chain.

Ross (2000) explained two main changes in logistics in this period. The first change was that during this period, the field of logistics started to incorporate more business functions, such as warehousing and order processing, and created a strategic logistics contents. Also, this change enabled co-ordinated management of resources to be focused not only on cost management but also on creating strategic competence. The second important change was that the logistics started to play an important role as a core activity in gaining competitive advantages, rather than the traditional supporting role. This change enabled some companies to develop a strategic logistics plan, which could be integrated within the strategic plan of the enterprise. Similarly Coyle, Baldi & Langley (1996) also identified the main progress of logistics management of this period as 'integrated logistics management', and logistics management established itself as an important contributor for the cost saving. According to them, during the 1970s and the 1980s, the recognition of new saving opportunities resulted

in the integration of inbound logistics and outbound logistics, and logistics management started to play an important role.

In summary, the significance of this period in the process of evolution towards SCM was that logistics management started to be recognised as an equally important component in firms' competitive advantage, and this enabled the beginning of the integration of logistics with other company functions, such as manufacturing, marketing and sales. Such internal integration of logistics functions formed a starting point for high-level supply chain partnerships. As a result, various SCM related initiatives, in the form of service-based alliances, R&D, JIT purposes and marketing, started to be considered and implemented as tools to improve competitive advantage around this time.

2.3.3 The 1990s: The Birth of Modern Supply Chain Management

Truly significant changes in the business environment occurred in the 1990s. A more collaborative approach to supply chains and wider efforts to implement supply chain partnerships appeared as a result of firms' strategic responses to the drastic changes in the business environment in the 1990s. For this reason, this was an important period in the history of SCM, and during this period, we started to observe the early form of modern SCM and partnerships.

2.3.3.1 Important Changes in the Business Environment in the 1990s

A number of authors, such as Prahalad & Oosterveld (1999) identified the changes in the business environment and the main driving forces behind them during the 1990s. More specifically, Ross (1999), Simchi-Levis, Kaminsky & Simchi-Levis (1999), Christopher (1998), Coyle, Baldi & Langley (1996), Bowersox & Closs (1996) and others did similar work to identify the new economic environments and the major driving forces behind them from the SCM perspective.

First of all, Coyle, Bardi, & Langley (1996) explained the development of more collaborative SCM with their three-stage supply chain evolution model. According to this three stage model, companies' efforts in approaching SCM issues from collaborative perspectives were the result of companies' responses to the following changes in the business environment: 1) changing nature of the market, 2) changing channel structures and relationships, 3) globalisation of economy and market, 4) government policy and deregulation, and 5) advances of technology.

Secondly, Bowersox & Closs (1996) described this process of migration to a collaborative SCM approach from the conventional logistical management as a 'logistical renaissance' and defined the driving forces for it as: 1) regulatory change, 2) microprocessor commercialisation, 3) information revolution and quality initiatives and, 4) alliance. More recently, Christopher (1998) identified four logistics challenges brought by the new market environment: 1) customer services explosion, 2) time compression, 3) globalisation of industry, and 4) organisational integration.

Finally, Ross (1999) made a similar effort to identify the driving forces and changes in his four-step model of the evolution of supply chains, and concluded that the modern form of SCM, which is a more collaborative approach, is the strategic response to changes in the following aspects: 1) business perspective, 2) customer dynamic, 3) product & service dynamic, 4) information and communication dynamic, and 5) channel dynamic and logistics dynamic. Similarly, Simchi-Levis, Kaminsky & Simchi-Levis (1999) identified the four major driving forces for the evolution of modern SCM as 1) growing global competition, 2) short product lifecycles, 3) customer awareness and 4) advances in communication & transport technology.

All the above authors have underlined the advances in information technology as the single biggest and the most powerful driver and enabler of supply chains.

Other View	**Supply Chain (Logistical) Management View**				
Prahalad & Oosterveld (1999)	**Ross (1999)**	**Simchi-Levis & Kaminsky (1999)**	**Christopher (1998)**	**Coyle, Bardi & Langley (1996)**	**Bowersox & Closs (1996)**
Growth of Global Consumerism	Changing Business Perspective	Growing Global Competition	Customer Services Explosion	Changing Nature of Market	Regulatory Change
Deregulation	Customer Dynamic	Short Product Lifecycle	Time Compression	Changing Channel Structure & Relationship	Micro-processor Commercialisation
Digital Convergence	Product & Service Dynamic	Customer Awareness	Globalisation of Industry	Globalisation of Economy & Market	Information Revolution
Dis-intermediation	Information & Communication Dynamic	Advances In Communication & Transport Technology	Organisational Integration	Government Policy & Deregulation	Quality Initiative
Industrial Boundaries	Channel Dynamic			Advances of Technology	Alliance
	Logistics Dynamic				

Table II-2 : Changes in the business environment of the 1990's and driving forces behind them

2.3.3.2 The Birth of Modern SCM Based on Collaboration

The birth of modern SCM based on closer collaboration and firms' awareness of adopting this approach emerged as either a voluntary or a forced strategic and organisational response to the above changes in the business environment and external driving forces throughout late 1980s and the 1990s.

Many academics support the above idea that a large number of firms coped with the changes in the internal/external environment by changing their business relationships into more collaborative systems such as collaborative SCM. One such example of collaborative SCM was the concept of the 'extended enterprise', which is derived from a firm's ability to quickly exploit not only its internal resources, but also the collective resource of the entire extended network of suppliers, vendors, buyers, and customers. Ross (1999) pointed out that companies in this period actively responded to the above changes by expanding on functions of logistics toward integrated logistics management and out of a single company boundary. The main motivation behind this move is that, in late 1980s to early 1990s, companies started to realise that the real competitive advantage arose not from internal optimisation but from supply chain wide optimisation. Bowersox, Closs & Stank (1999) also argued that this optimisation comes in the form of a partnership by extending the effective control of the enterprise to the selected suppliers and customers, and concluded the effort of system-wide optimisation was a response to the above changes.

Collaborative inter-firm arrangements before the 1990s were mainly based on outsourcing of logistics functions. In the 1990s, firms started to realise the benefits of offsetting cost and benefits between logistics activities and other business functions inside and across the company. Thus, the scope of collaborative inter-firm arrangements within a supply chain expanded over the traditional logistics alliance. The most distinctive collaborative activities in the area of retailers and suppliers, such as quick response, advanced continuous replenishment, and vendor managed inventory received attention (Bowersox, 1998, Simchi-Levis, Kaminsky & Simchi-Levis, 1999).

2.3.3.3 Information Technology: the New Enabler of Collaborative SCM

As has been briefly mentioned above, this new paradigm of supply chain management required significant support from information technology. Simchi-

Levis, Kaminsky & Simchi-Levis (1999), Christopher (1998), Bowersox, Closs & Stank (1999) and Coyle (1996) identified the main enabler of this change as the 'rapid advance of information technology'. In this period, many enterprise solutions, such as ERP, SCM, APO[4] etc., and IT equipment, which facilitate supply chain management activities, became widely available at affordable prices. The past trend of information flow integration was to connect the EDIs[5] of participants within a supply chain via VAN[6]. However, this approach to connecting different participants had the following problems: 1) the scope of communication was limited to those who had a direct connection under certain standards (US Economics and Statistics Administration, 1998) and 2) the huge cost of installation and maintenance of VANs kept many small and medium-sized supply chain participants from process integration. The Internet emerged as an alternative to the VAN and more firms became networked because of its cost effectiveness and flexibility.

3 Classification of Supply Chain Partnerships

The escalating interest in collaborative inter-firm arrangement has led to confusion, without a clear, common understanding as to what everyone means when they say they are involved in, for example, a supply chain collaboration. Also, there have been various studies regarding the classification of collaborative inter-firm arrangements, but few of the classification methods suggested have taken account of determinants of the performance of such arrangements. Also, the majority of them have covered an extensive range of collaborative inter-firm arrangements, and only a few were specialised in supply chain collaborative arrangements. In addition, these studies on the classification of collaborative inter-firm arrangement in supply chains were mainly not empirical but perceptual; thus, they have provided limited assistance to academics and field practitioners.

As an initial step towards achieving the first research objective of this study, where a classification method of supply chain partnerships from the perspective of the performance of partnerships with an emphasis on offering assistance to academic researchers and field practitioners, the uses and the definitions of the range of terms and classification methods applied to collaborative inter-firm arrangements are reviewed below.

[4] ERP: Enterprise Resource Planning, APO: Advanced Planning and Optimisation
[5] EDI: Electronic Data Interchange
[6] VAN: Value Added Network

3.1 Terms Referring to Collaborative Inter-firm Arrangements and Their Use

The comparison of terms referring to collaborative inter-firm arrangements, such as co-operation, co-ordination, coalition, collaboration, partnership, etc. in organisational studies and marketing-related literature provides an overview of how these terms have been used in the literature to refer to collaborative supply chain arrangements in different contexts. In addition, it will help to provide uniformity in the use of these terms, in order to avoid confusion and misuse.

3.1.1 Transactional Relationship

Collaborative inter-firm arrangements among firms can be categorised in ascending levels of integration or inter-dependence between the two extreme pure forms of markets and vertical integration in various ways (Williamson 1975, Powell 1990, Child & Faulkner 1998, Spekman, Kamauff & Myhr 1998, Dyer & Singh 1998, Lambert, Emmelhainz & Gardner 1999, Ross 1999).

The most common form of inter-firm arrangement in supply chain settings is a non-co-operative relationship (Lambert, Emmelhainz & Gardner 1999, Simchi-Levis, Kaminsky & Simchi-Levis 1999). Collaborative inter-firm arrangements at this level have been named in a number of different ways. For example, Child & Faulkner (1998) named this type of collaborative inter-firm arrangement 'transactional' or 'arm's-length' relationships, while Spekman, Kamauff & Myhr (1998) referred to this stage of inter-firm interaction as an 'open market negotiation period'.

The main characteristic of supply chain inter-firm relationships at this stage is a short-term contract-based adversarial relationship with multiple suppliers where price dominates and there is minimal investment, little information sharing, and minimal interaction between respective functional areas with little commitment and trust, (Powell 1990, Ross 1999). Such non-collaborative supply chain relationships are created to fulfil short-term needs rather than to achieve long-term competitive advantages (Simchi-Levis, Kaminsky & Simchi-Levis 1999). Usually, these types of arrangements are the initial starting point of a supply chain partnership.

The low cost of switching partners and the efficient execution of routine tasks are the two main benefits of collaborative inter-firm arrangements in supply chain at this level (Dyer & Singh 1998). Therefore, in order to extend inter-firm arrangements of

this nature to more sophisticated supply chain partnerships, a certain degree of satisfaction from both parties on current transactions and expectation of future transactions are required as pre-conditions. Also, such an expansion towards collaborative partnership requires significant resources, trust and commitment, and a sharing of long-term strategic goals.

3.1.2 Supply Chain Co-operation and Co-ordination

As mentioned above, the changes in the internal/external environment of the 1980s and the early 1990s required firms to simultaneously manage multiple cross-organisational information and material flows in order to source, manufacture, and deliver their products better, faster, and cheaper (Greis & Kasarda, 1997). During this period, the term 'co-operation' was frequently used in numerous articles as a broadly defined general term referring to collaborative inter-firm arrangements in supply chains with a moderate degree of collaborative elements. For example, Stern & Reve (1980) defined this term broadly as a combination of object and collaborator-centred activities based on compatibility of goals, aims or values. Similarly, Anderson & Narus (1990) defined the term 'co-operation' as: 'Similar or complementary co-ordinated actions taken by firms in interdependent relationships to achieve mutual outcomes or singular outcomes with expected reciprocation over time.' From these definitions, it becomes clear that the term 'co-operation' is used to refer to the most extensive type of collaborative inter-firm arrangement in supply chains, varying the degree of integration and inter-dependency.

Subsequently, a number of academics such as Spekman, Kamauff & Myhr (1998) tried to narrow the above definition such that firms exchange some degree of essential information and engage in supplier-customer relationships in the longer-term but in less intense and complicated ways. Similarly, Mentzer, Foggin & Golicic (2000) reported that supply chain practitioners perceive that co-operation requires a shorter perspective with less commitment compared to other terms such as 'collaboration'. Initially, the term was used to describe a wide range of collaborative inter-firm arrangements in supply chains, but later the types of relationship covered by the term 'co-operation' became limited to supply chain arrangements with weaker integration and inter-dependency than other terms such as 'collaboration' or 'co-ordination', but a more tightly tied relationship than an extended form of arm's-length relationship.

As the application of IT becomes more affordable, the degree of information infrastructure and sharing play an important role in defining the nature of collaborative inter-firm arrangement in supply chains. As a consequence, a number of academics have used other terms such as 'co-ordination' to underline a collaborative inter-firm arrangement with strong emphasis on 'information technology and sharing'. For example, Spekman, Kamauff & Myhr (1998) differentiate the term 'co-ordination' with an emphasis on the type of information exchanged, the medium of exchange and the activities involved. Similarly, Lee (2000) implied that 'coordinative activities' are an information-enhanced version of co-operation by arguing that co-ordination is firms' effort to combat demand information distortion by implementing collaborative initiatives such as Collaborative Planning, Forecasting and Replenishment (CPFR) and Vendor Managed Inventories (VMI).

In summary, there is no discrete boundary where co-operation leaves off and co-ordination and collaboration take over. However, one thing is clear: as information technology advances, the term 'co-operation' is regarded as a general term to describe loose collaborative inter-firm arrangements in a supply chain. On the other hand, the term 'co-ordination' implies a stronger linkage of information systems and more focus on information exchange between/among independent supply chain partners. However, it is important to remember that researchers and practitioners tend to use the terms according to their own definitions and preferences.

3.1.3 Supply Chain Collaboration

As the SCM strategic priority has shifted from mass production to delivering customer satisfaction, the need for more collaborative supply chain management, where the scope of activities includes more non-logistics key business processes, is increasing. In addition, the advance of information technology and its applications are making more sophisticated collaborative operations more feasible than ever to supply chain participants. Since then, the most commonly used term in recent publications to describe collaborative inter-firm arrangement appears to be 'collaboration'.

Throughout the literature search, it came to the researcher's attention that depending on the authors of the paper, 'collaboration' can mean very different things.

'Collaboration' is a general and broad term, and is used to refer to different forms of collaborative inter-firm arrangement of independent organisations.

The term 'collaboration' is a commonly used term not only in the field of management study but also in social sciences, education, humanities, business and communication literature. It would be useful to explore briefly how the term 'collaboration' is used in the other fields of academia. The dictionary definition of 'collaboration' is 'to work jointly with others or together especially in an intellectual endeavour and to co-operate with an agency or instrumentality with which one is not immediately connected' (Merriam-Webster Collegiate Online). There are several variations in the ways in which collaboration is defined across academic disciplines, but the most common feature is that collaboration is a group of individuals/organisations bringing together expertise from diverse disciplines to achieve a common goal.

The general perception of this term in a supply chain management context is that 'collaboration' is the 'strongest possible' collaborative inter-firm arrangement in a supply chain setting before joint venture or vertical integration. Collaborative inter-firm arrangements in supply chains at this level can be differentiated by the following two points: firstly, they contain higher levels of collaborative elements such as trust, commitment and information exchange and a shared vision with more sophisticated processes such as joint planning and operation than arrangements described as co-operation and co-ordination (Spekman, Kamauff & Myhr, 1998). Also, integration of resources is an important precondition to this, as supply chain collaboration is a collaborative inter-firm arrangement where two or more firms voluntarily agree to integrate human, financial or technical resources in an effort to create a new, more efficient, effective or relevant business model (Bowersox, Closs, & Stank, 2003). Thus, collaborative inter-firm arrangements in a supply chain at this level can be located at the continuum of two extreme forms, arm's length relationships to vertical integration of organisations, but are closest to the latter without having a serious equity relationship. Secondly, unlike others at co-operation level, some collaborative inter-firm arrangements at this level include a greater variety of non-logistics activities and functions. Thus, in order to capture this characteristic, another dimension can be added for examination along with the degree of existence of collaborative elements. By incorporating this new dimension, a

collaborative inter-firm arrangement in a supply chain at this level can be classified further in two different ways.

3.1.3.1 Type I Supply Chain Collaboration

Type I supply chain collaboration mainly focuses on collaborating on sourcing, manufacturing and distribution-related activities in a supply chain. This relationship is based on the narrow definition of SCM, which is 'applying conventional logistics management beyond a single firm boundary'. This view reflects the commonly accepted operational view on SCM, that is: 'operational effectiveness' is the key to competitive advantage. Consequently, with this definition, the scope of collaborative activities becomes confined to existing conventional logistics and manufacturing operation activities (Lee & Billington, 1995, Bowersox & Closs, 1996, CPFR (VICS), 1998).

Under this definition, supply chain collaboration has the structure of a virtual network, as the fundamental motive of collaborating is 'skill substitution'. A virtual network is a network of independent organisations such as manufacturers, suppliers and customers linked by IT. In a virtual network, each firm provides different functions such as buyer-seller relationships in a supply chain, and the emphasis is placed on 'how one firm can be created with flexible boundaries and ownership aided by IT to work like a single company (Byrne, 1993).

3.1.3.2 Type II Supply Chain Collaboration

Type II supply chain collaboration includes more extended non-logistics activities and functions than the first form. It is based on the extended definition of SCM. This SCM definition is underlined by the idea that there should be a collaborative approach to managing other business processes across SCM participants along with management of the logistics function in order to cope with the changing external environment (Lambert, Cooper & Pagh 1998, Greis & Kasarda 1997, Christopher 1998, Giunipero, Lawrence & Brand 1996, Ross 2000). If this view is taken into consideration, the scope of activities involved in collaborative inter-firm arrangements in supply chain becomes more extensive, as it includes not only logistics functions but also many other business functions. Hence, non-logistics activity-oriented relationships can be included in Type II supply chain collaboration. A number of academics have identified collaborative relationships of this nature. For

example, Ghemawat, Porter & Ralinson (1986) and Ellram (1992) identified collaborative inter-firm arrangements focused on 'marketing/sales/service', and 'technology'. Similarly, Collins & Doorley (1991) identified 'strategic partnership between large companies' on 'R&D.'

Due to the extensive scope of Type II supply chain collaboration including joint R&D[7] and knowledge sharing, the fundamental motive behind the formation of the relationship is not only skill substitution but also 'organisational learning.' Powell & Koput (1996) suggested that organisational learning is a key motive in the formation of alliances with other independent organisations in the hi-tech industry. Nowadays, it is not difficult to observe the growing number of 'learning' partnerships in a supply chain setting between different levels of supply chain partners.

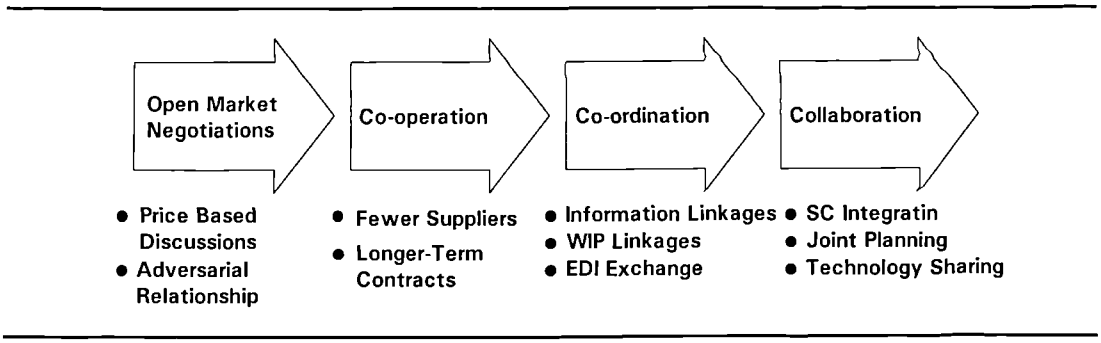

Figure II-1: The key transition from open-market negotiations to collaboration. (Source: Spekman et al. An empirical investigation into supply chain management, Supply Chain Management, vol. 3, 2, 57, 1998)

3.1.4 Supply Chain Networks

In an attempt to optimise supply chains beyond the traditional dyadic relationship, academics and practitioners started to look at collaborative inter-firm arrangements as 'networks', and this term is now frequently used in various academic and practitioners' literatures.

As a first step towards clarifying the term 'supply chain network', the concept of the term 'network' was reviewed. The origin of the term 'network' can be traced back to idea of network approaches. The term 'network', according to Harland (1996), can be broadly defined as a 'specific type of relation linking a defined set of persons, objects or events. The main reason behind the formation of a network is mainly the

[7] R&D collaboration in the context of supply chains happens in the form of new product development, process innovation between different level of supply chain participants and should be distinguished from R&D collaboration between different supply chains.

necessity for resource exchange (Trienekens & Beulens, 2001).

Child & Faulkner (1998) summarised other key reasons behind the formation of networks as follows: 1) to reduce uncertainty, 2) to provide flexibility, 3) to provide capacity, 4) to provide speed, 5) to provide access to resources and skills not owned by the company, and 6) to provide information.

When this concept of the network is used in the context of a supply network, the scope of the definition of this term becomes limited. A supply network is a part of a wider inter-organisation network and consists of companies inter-connected to fulfil their aims of procurement, use and transformation of resources to provide goods or services. The concept of a supply network differs from other, broader industry networks by its main characteristic, which is that it focuses on a set of more manageable companies from the material extraction to the final consumption points (Harland *et al.*, 2001). Harland *et al.* (2001) intended to distinguish supply networks from supply chains by referring to the fact that the term 'supply networks' refers to a more extensive concept, encompassing 'the mess and complexity of networks involving lateral links, reverse loops, and two-way changes, and include a broad, strategic view of resource acquisition, development, management and transformation, while a supply chain concentrates on more simplistic, linear, and unidirectional flows of materials and associated information, taking a less strategic, logistical perspective.'

The use of the term 'supply network' or 'supply chain network' is very much dependent upon the individuals who use this term. As has been mentioned above, the term 'supply network' is often very loosely used interchangeably with the term 'supply chain' to refer to a variety of inter-organisational relationships and arrangements. Also, the term 'network' has often been used in past research as a synonym for non-dyadic supply chain situations such as triadic arrangements, where more than two participants are involved for the purpose of collaborative inter-firm arrangement in a supply chain.

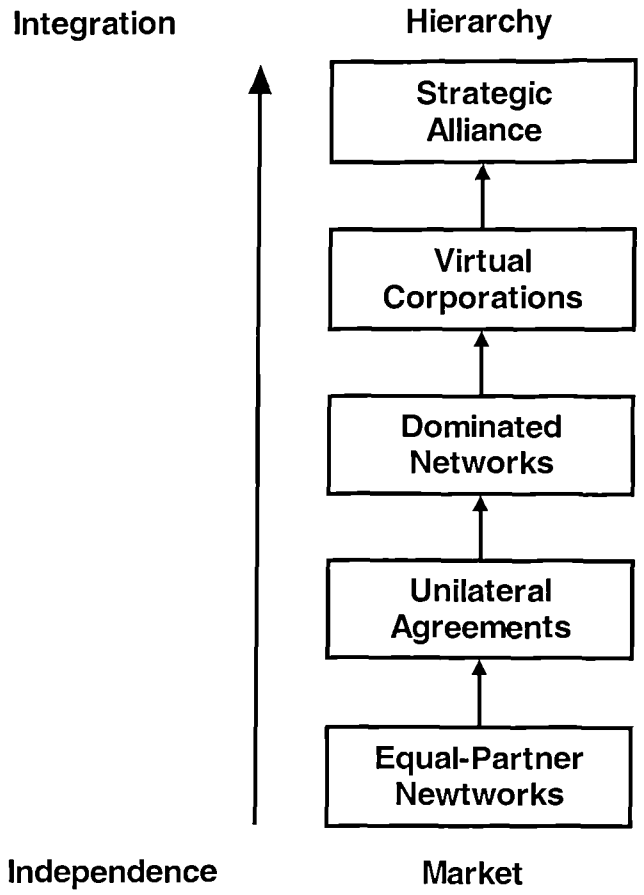

Figure II-2: Different networks in ascending order of level of integration, (Source: Child, J. and Faulkner, D., strategies of co-operation: managing alliances, networks, and joint ventures. Oxford: Oxford University Press, 1998)

However, there is a clear difference between supply networks and other terms, if the major motives for forming such arrangements are taken into consideration. Child & Faulkner (1998) suggested that the term 'network' implies a close but non-exclusive relationship; on the other hand, another frequently used term, 'alliance', loosely implies the creation of an exclusive collaboration, at least over a limited domain. According to Johnson & Mattsson (1991), the major distinction between an alliance and a network is that alliances are formed for reasons related to transaction costs, but networks are formed mainly due to complementary functions or resources possessed by other members of a network. The second major difference between 'network' and other terms is that a network does not necessarily have to be collaborative. Thus, it is not easy to position a network on the dichotomy suggested by Williamson (1975) from the market to vertical integration, as the interdependency of networks varies significantly case by case. For example, an equal-partner network could be a supplier and buyer network based on arm-length relationships. On the other hand, a dominated network, for example, that of Japanese motor manufacturers such as

Toyota, involves a serious level of collaborative structures and activities.

In summary, the term 'network' is used fairly loosely to describe any type of inter-organisational relationship with varying degrees of inter-dependency in an industry or cross-industry. On the other hand, a supply network is more confined to the companies mainly located from material acquisition to final consumption.

3.1.5 Supply Chain Alliances

The term 'alliance' is also frequently used to refer to various collaborative inter-firm arrangements. A number of authors have attempted to define the term 'alliance' and 'strategic alliance'. The term 'alliance' appears to be a generic term, which can be used to refer to the widest possible inter-firm relationship/arrangements. This loose definition of 'alliance' was suggested by a number of academics. Gomes-Casseres' (2001) definition refers to 'alliance' as an organisational structure to govern an incomplete contract between separate firms and in which each firm has limited control. According to this definition, collaborative inter-firm arrangements, which are neither arm's length relationships nor vertical integration/M&A, can be regarded within the broad concept of alliances (Figure II-3).

Figure II-3: The scope inter-firm relationships/ arrangement covered by the term 'alliance', adopted from, (Source: The alliance revolution, Gomes-Casseres, 1996)

Similarly, Parkhe (1991) suggested that the term 'alliance' can be used broadly to refer to a wide range of inter-firm arrangements, by offering the definition that alliances are 'relatively enduring inter-firm co-operative arrangements, involving flows and linkages that utilise resources and/or governance structures from autonomous organisations, for the joint accomplishment of individual goals linked to the corporate missions of each sponsoring firm'. Also, in a similar view Das & Teng (1996) highlighted the term 'alliance' as a broad term used to refer to a variety of co-operative arrangements, including supplier relationships.

As discussed above, the term 'alliance' is used to describe collaborative inter-firm arrangements with varying degree of inter-dependence. On the other hand, the term 'strategic alliance' has more specific and limited use. The fundamental difference between an alliance and a strategic alliance is that a strategic alliance is formed as a

direct strategic response to major strategic needs and opportunities (Child & Faulkner, 1998).

The term 'strategic alliance' is used to describe the strongest and the most advanced form of collaborative inter-firm arrangement (Harland, 1996, and Whipple & Frankel, 2000). For this reason, according to Collins & Doorley (1991), the terms 'strategic alliance' and 'joint venture' are often used interchangeably by academics and managers. However, there is a disagreement between scholars regarding the scope of the term 'strategic alliance'. This term can be used to describe various horizontal and vertical alliances with a strategic nature (Child and Faulkner, 1998). However, Cravens, Shipp, & Cravens (1993) argued that the term 'strategic alliance' is not appropriate to use to refer to vertical supply chain collaborative arrangements, and that it is more appropriate to use this term to describe a horizontal agreement between two or more organisations which co-operate to achieve common strategic objectives (Figure II-4).

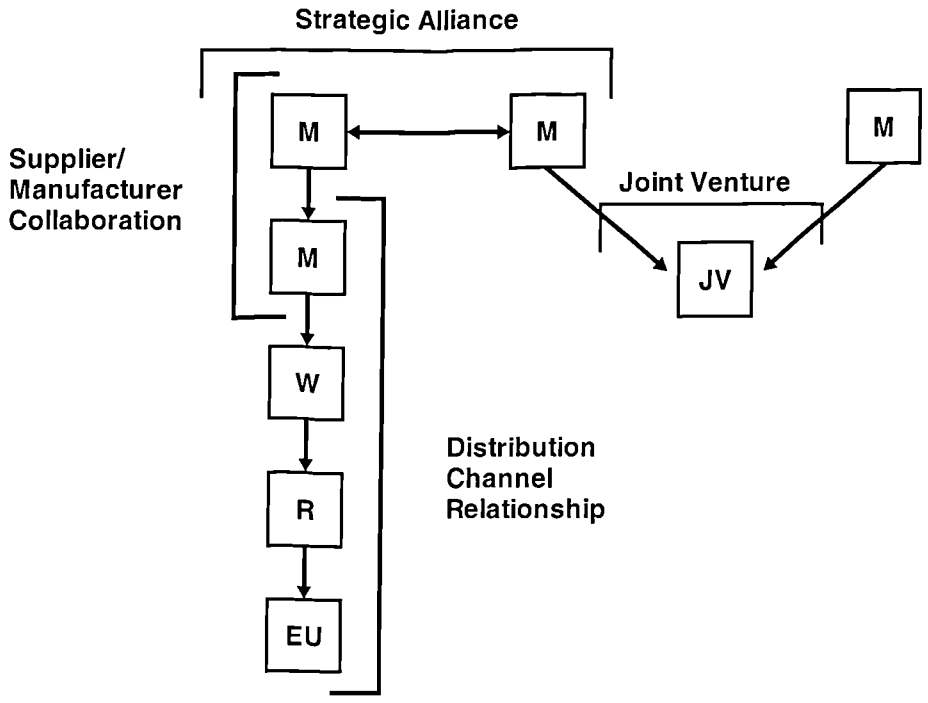

Figure II-4: Illustrative inter-organisational relationships, (Source: Cravens et al., Analysis of co-operative inter-organisational relationships, strategic alliance formulation, and strategic alliance effectiveness, Journal of Strategic Marketing, 1, 55-70, 1993)

On the other hand, the term has been used to refer to collaborative inter-firm arrangements of mainly vertically located firms by a number of SCM/logistics academics. The general definition of a strategic supply chain alliance was given by Cooper & Gardner (1993). According to them, a 'strategic alliance' is a contractual

relationship formed between two independent entities in the logistics channel to achieve specific objectives and benefits, which are 1) logistics advantages, 2) manufacturing advantages, and 3) access to markets. As the setting of collaborative inter-firm arrangements is limited to supply chains, the term 'strategic supply chain alliance' tends to be used to describe a high level of inter-firm arrangements or specific SCM initiatives. Simchi-Levi, Kaminsky & Simchi-Levi (1999), suggested that 'strategic alliance in supply chain is typically multi-faceted, goal-oriented, long-term partnerships between two companies in which both risks and rewards are shared.' This definition suggests that the term refers to high-level collaborative inter-firm arrangements in a supply chain setting. Their definitions are referring to supply chain initiatives/activities rather than relationships, as the types of strategic supply chain alliance mentioned in their work are mainly 3PL, QR, VMI[8] and distribution integration. During the literature review, one thing that came to the researcher's attention is that the term 'alliance' has frequently been used to describe one particular type of supply chain inter-firm arrangement, which is a 3PL[9] arrangement. For example, Moore (1998) used the term 'logistics alliance' to describe an inter-firm co-operative arrangement between a third party and a buying firm with a relatively long time horizon. His definition includes three main aspects of logistics alliance, which are 1) inter-firm relationship with longer time horizon, 2) sharing of information, benefits, and risks, and 3) a degree of collaboration that varies depending on the logistics requirement and the capability of the third party.

Mentzer (2001) attempted to distinguish between supply chain alliances and other collaborative inter-firm arrangements such as partnerships and alliances by limiting the scope of supply chain alliance to the dyadic level. According to them, partnerships or alliances involve only dyadic relationships between two partners, while on the other hand supply chain type collaborative arrangements often simultaneously involve upstream and downstream partners. However, it is difficult to say that the scope of partnerships or alliances is limited to the dyadic level only.

[8] 3PL: Third Party Logistics, QR: Quick Response, VMI: Vendor Managed Inventory

[9] The definition of 3PL by Bachi and Varum (1996), and Lieb *et al.* (1992) indicates that this type of collaborative inter-firm arrangement in a supply chain replaces either partial or entire logistics functions of supply chains with long-term contractual agreements.

In summary, the term 'alliance' is loosely used to describe varying degrees of inter-firm relationships/arrangements from simple co-operation to fairly complicated joint ventures. On the other hand, a 'strategic alliance' is more focused on fulfilling strategic needs and opportunities and has the highest level of interdependency and integration before vertical integration and M&A. On the other hand, the term 'supply chain strategic alliance' has been used to refer to vertical collaborative inter-firm arrangements that are less strong than the previous term 'strategic alliance' in other types of academic discipline.

3.1.6 Supply Chain Partnership

Another term that is frequently used to describe collaborative inter-firm arrangements is 'partnership'.

The earliest use of this term was in the book by Johnston & Lawrence (1988). They used the term 'value-adding partnership' to refer to a situation in which a set of independent companies work closely together to manage the flow of goods and services along the entire value-added chain. As their definition suggests, this term is mainly used to describe a vertical inter-firm relationship, such as a collaborative inter-firm arrangement, which is intended to achieve the benefits of vertical integration. Ellram (1990) added a new dimension of 'information sharing'. Her definition suggests that 'partnership' refers to a mutual, ongoing relationship involving a commitment over an extended time period, and a sharing of information and the risks and rewards of relationships. Later, Cooper & Gardner (1993) added the additional dimension of shared goals to define the term 'partnership', which is: a relationship that attempts to build interdependence, enhance co-ordination, improve market position focus or to achieve other shared goals and entails sharing benefits and burdens over some agreed time horizon. Similar to the term 'alliance', this term is loosely used to describe inter-organisational relationships with varying degrees of partnership elements (Cooper & Gardner, 1993, Harland, 1996). The major difference between them is that the term 'partnership' is mainly related to non-equity collaboration (Harland, 1996).

A number of academics have argued that the term 'partnership' should be used more restrictedly. Lambert & Emmelhainz (1996) argued that there is a certain degree of confusion over the use of the term 'partnership', and concluded that the term

'partnership' is misused to describe all kind of inter-firm arrangements. Their definition suggests that a relationship can be regarded as a partnership if it requires a certain degree of joint commitment or operations. Their definition of partnership does entail some degree of shared ownership, but it differs from joint ventures, as it does not have an equity relationship. However, their definition of 'arm's length relationship' is rather extensive, and for this reason, their empirical results suggest that only 30% of supply chain relationships fall into the category of partnership. Later, Lambert, Emmelhainz & Gardner (1999) updated their definition of partnership, which is 'a tailor made business relationship based upon mutual trust, openness, shared risk, and shared rewards that yield a competitive advantage, resulting in business performance greater than would be achieved by the firm individually' by adding a new dimension of 'customisation of relationship.'

Despite the fact that some scholars argue that 'partnership should be used to refer to more closely linked collaborative inter-firm arrangements only', the coverage of this term in the literature is the broadest after the term 'alliance'.

3.1.7 Supply Chain Integration

Another term often used in conjunction with the terms 'partnership', 'alliance' and 'collaboration' is 'integration'. According to Sterling Commerce (2000), integration refers to 'connecting process or/and applications internally or/and externally'. Keebler & Manrodf (1999) similarly defined integration as: 'uniting, combining, or incorporation of two or more functions within a company or two or more processes between two or more companies into a compatible or unified process in operational sense. Stank, Keller & Daugherty (2001) added one more elements of uniting functions and applications internally and externally to the definition of Keebler & Manrodf.

On the other hand, other terms such as 'collaboration' refer to organisations that actively work together to solve the business problems they share, going beyond bridging the differences airing from their systems and procedures in a strategic sense (Sterling Commerce, 2000). A similar suggestion was given by Stank, Keller & Daugherty (2001), who argued that collaboration and partnership refer to a process of decision-making among independent parties and involve a certain degree of joint ownership of decisions and collective responsibility for their outcomes.

3.2 Classification Methods of Inter-firm Partnerships

The lack of a standard method for classifying collaborative inter-firm arrangements in supply chains poses a significant problem for both academics and practitioners when they deal with issues related to collaborative inter-firm arrangements. This problem arises for following two reasons.

Firstly, in the early part of the literature review, the problem related to the abundance of terms referring to collaborative inter-firm arrangements was discussed. This disagreement stems from the fact that supply chain management is still a relatively new academic discipline and has its roots in various academic disciplines such as marketing, operations management and the study of organisations. In the same sense, the classification of different types of collaborative inter-firm arrangement in supply chains inevitably becomes a difficult and confusing process.

Secondly, the literature on the classification of collaborative inter-firm arrangements, which would include supply chain partnership, has mainly been produced by the academics from other disciplines such as organisation studies and marketing. They have suggested a number of methods of classification for collaborative inter-firm agreements. However, as Child & Faulkner (1998) pointed out, the classification methods that have emerged from their deliberations have varied widely and few have successfully met the accepted taxonomic principles of mutual exclusivity and parsimony. From the perspective of collaborative arrangements among members of a supply chain, there is only a limited body of research exclusively covering this issue.

The effort to establish a classification of supply chain partnerships is important for the following reasons.

Garrette & Dussauge (1995) argued that the importance of building a taxonomy of collaborative inter-firm arrangements lies in the fact that building a taxonomy is a necessary preliminary stage in modelling the outcomes of such arrangements. They pointed out that the reason behind this is 'diversity of alliance formation'. Diversity, according to their definition, is reflected in the wide range of strategic and organisational factors that have been used to categorise collaborative inter-firm arrangements and is one of the reason behind the difficulty of anticipating their outcomes. This poses a significant problem for research covering performance issues. However, this diversity issue has been often overlooked in SCM research on

partnership issues and insufficient effort has been made to reflect this distinctive nature of supply chain partnership. For this reason, developing a classification method especially for collaborative inter-firm arrangements in supply chains from a performance outcome perspective could provide an important research tool for academics who are engaged in research of this nature.

Secondly, such methods can be used as an important management tool for boundary spanning personnel or decision-makers within a partnership. For a company, which is located in a complex web of suppliers and customers, numerous processes related to various stages of a partnership, from its birth to its death, can be a time- and resource-consuming process. Thus, for boundary spanning personnel, it is important to ensure that scarce resources are allocated to only those collaborative arrangements, which bring or are likely to bring true benefits (Lambert & Emmelhainz 1996). A well-structured method of classification can be a useful reference to help them to make the right decisions on establishing, maintaining, developing and terminating partnerships.

In this research, a number of classification methods suggested by academics from various academic disciplines were reviewed as an initial step towards creating an empirically based classification method.

3.2.1 Classification of Collaborative Inter-firm Arrangements

In the field of alliance study, the issue of classification has been covered by various academics. The foci and complexity of such classification methods vary depending on which dimension the researchers are looking at. The majority of these methods cover a broad range of collaborative inter-firm arrangements, ranging from simple contractual relationships in a supply chain to joint ventures. As a first step towards proposing a classification method for supply chain partnerships, a review of a number of methods covering a broad range of collaborative inter-firm arrangements can provide an important insight for developing a classification method for collaborative inter-firm arrangements in supply chains.

The classic classification method of collaborative inter-firm arrangements is to categorise them in ascending levels of integration and inter-dependency between the extreme forms of pure market and hierarchy suggested by Williamson's well known 'market and hierarchy dichotomy'. The structure of collaborative inter-firm

arrangements is neither pure market nor hierarchical. As Thorelli (1986) suggested, there are many intermediary points between the pure form of market and hierarchical structures of alliance where a collaborative inter-firm arrangement can be located.

One of the most common ways of classification is to examine the functional area of such collaborative arrangements. Porter & Fuller (1986) suggested a method in which various collaborative inter-firm arrangements can be classified by their functional areas of concern: 'operations/logistics', 'marketing/sales/service', 'technology' and 'multiple activities'.

Examination of the locations of firms participating in collaborative arrangement is another common means of classification. Porter & Fuller (1986) attempted to classify various collaborative inter-firm arrangements in a simpler way by checking whether they involved value activity across the borders of value activities or not. According to them, collaborative arrangements, where partners are involved in different activities in the same value chain, are x-coalition, and those where partners are involved in the same activities in the same value chain are y-coalition.

Looking into the structure of ownership and the legal nature of the relationship is another commonly used way of classifying collaborative inter-firm arrangements. Categorising these arrangements into either equity or non-equity collaborations is a commonly used method for research purpose (Kogut & Singh, 1988, Harrigan, 1988, Heide & Stump, 1995, Glaister & Buckely, 1998). Similarly, Ghemawat, Porter, & Ralinson (1986) categorised collaborative inter-firm arrangements by examining the structure of the legal nature: joint venture (shared equity relationship), license, and supply agreement.

A more comprehensive method of classification of collaborative inter-firm arrangements with strategic implications was suggested by Garrette & Dussauge (1995), as an effort to develop a mutually exclusive model of classification. They attempted to classify collaborative inter-firm arrangements into three groups by cluster analysis, which consisted of three dimensions: 1) the structural dimension, 2) the competitive dimension, and 3) the symmetry dimension. Their model suggests that alliances can be put into three different patterns. The first group is named 'quasi-concentration alliances', as members of such alliances contribute similar assets in order to develop, manufacture and market a common product. The second group is termed 'market penetration alliances'. The main characteristic of such alliances is

that they tend to be purely commercial agreements or could involve some manufacturing. Usually, the participants of the second group tend to be dyadic in structure with different competitive positions. They named the third pattern of alliance 'pool configuration'; the most common purpose of forming arrangements of this nature is R&D, but it often entails manufacture of common components and the arrangement often involves multiple partners.

Strategic Context	Source of Leverage: Resource	Source of Leverage: Competencies
Complementarity	I.	II.
Competition	III.	IV.

Figure II-5: Strategic alliances, strategic context and source of leverage, (Source: Pucik, Vladimir, Strategic alliances, organizational learning, and competitive advantage: the HRM agenda, *Human Resource Management,* 27(1), 77-93. 1988)

Pucik (1988) pointed out that the previous methods of classification, such as looking into functional areas, do not reveal much of their competitive contexts. He suggested another way of categorising a collaborative arrangement by examining the source of leverage exercised by the partners. Adding the dimension of the source of leverage exercised by the partners is important, as the method can be used as a strategic tool for decision-making. According to this method, collaborative arrangements can be classified into those leveraging resources and those leveraging competencies. The types of collaborative arrangements that belong to resource focused groups are cross-licensing, technological agreements, joint development programmes, co-production and co-distribution. On the other hand, OEM supply agreements and joint ventures targeting a specific market belong to the competency-focused groups, which fall into categories II and IV (Figure II-5).

Cravens, Piercy & Shipp (1996) created a classification method that made an effort to include new forms of co-operative entities in the networked economy, in which groups of more than two firms often form collaborative inter-firm arrangements (Figure II-6). The first dimension used in this method is the degree of volatility of

environmental change (low vs. high). In a highly volatile environment, firms seek to obtain a certain degree of flexibility and adaptation; on the other hand, in a less volatile environment, firms tend to be more collaborative as low uncertainty enables them to invest more on resources to perform their required functions. The second dimension is the type of inter-organisational relationship (collaborative vs. transactional). Transaction links such as buyer-seller relationships are established when the transaction is the major objective of the firms involved, and uncertainties of environmental changes also encourage such links.

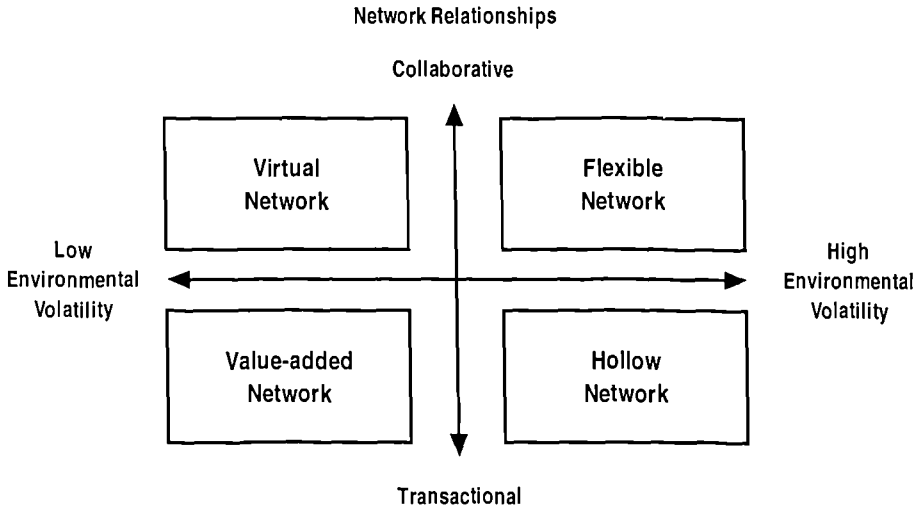

Figure II-6: The classification of network organisations, (Source: Cravens, David W., Nigel F. Piercy and Shannon H. Shipp, New organisational forms for competing in highly dynamic environments: The network paradigm, British Journal of Management, 7(3), 1996)

A more comprehensive model was suggested by Faulkner (1995), which examines three distinctive dimensions of alliances (scope, number of partners and corporate entity), in order to classify alliances in a mutually exclusive way. According to his alliance taxonomy, a total of six forms of alliance can be identified. By looking into the first dimension, scope, alliances can be classified into either complex or focused alliances. A focused alliance refers to a collaborative inter-firm arrangement that is formed to meet a clearly defined set of circumstances in a particular way. On the other hand, the participants of a complex collaborative inter-firm arrangement are willing to co-operate over various activities but wish to retain their separate identities. The second dimension is 'the legal form of the collaborative inter-firm arrangement', where collaborative arrangements are classified into two distinctive forms, collaboration and joint venture. The term 'joint venture' refers to an equity alliance, whereas 'collaboration' refers to an arrangement with little equity

ownership. The third dimension is 'number of partners' where classification is done by examining the number of partners involved in that arrangement (Figure II-7).

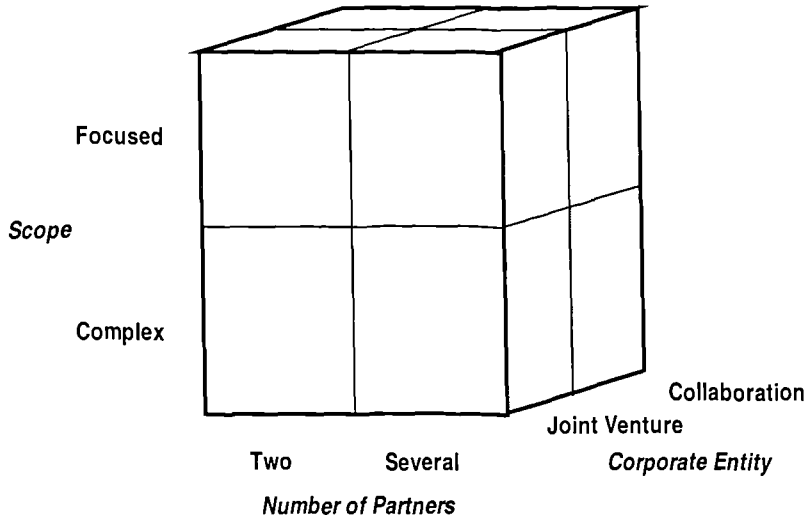

Figure II-7: A taxonomy of alliance forms, (Source: Child, J. & Faulkner, D., Strategies of co-operation: managing alliances, networks, and joint ventures, Oxford: Oxford University Press, 1998).

3.2.2 Classification of Collaborative Inter-firm Arrangements in Supply Chains

In the previous section, a number of classification methods of various collaborative inter-firm arrangements were reviewed. These methods cover not only supply chain partnerships but also a wider range of collaborative inter-firm arrangements such as joint ventures. The major problem with these classification methods is that their coverage is too wide and not specific enough for academics and practitioners in the field of SCM. There have been a number of attempts to classify collaborative inter-firm arrangements occurring in the supply chain setting. These attempts are similar to the approaches used in the above-mentioned classification methods. As a second step towards the proposal of a classification method for supply chain partnerships, the methods used to classify collaborative arrangements in supply chains are reviewed.

One of the common methods of classification is to examine the motives or purpose of forming collaborative supply chain inter-firm arrangements and their functional areas of focus. For example, Ellram (1992) suggested through her empirical research that there are four distinctive patterns, namely: 1) operations/logistics, 2) marketing/sales/service, 3) technology, and 4) multiple motives. This method is similar to that used by Porter & Fuller (1986) to classify wider collaborative inter-firm arrangements.

Another way of classifying collaborative inter-firm arrangements in supply chains is by examining what kinds of a company's supply chain function and up to which level of a supply chain participants are involved for collaborative practices/activities. Ross (2000) classified collaborative inter-firm arrangements in supply chains into three groups according to the scope of participants and collaborative practices. These groups are 'multifunctional partnerships within a company', 'echelon partnerships', and 'multi-echelon partnerships'.

Simchi-Levis, Kaminsky & Simchi-Levis (1999) classified collaborative inter-firm arrangements in supply chains according to the different nature of collaborative activities involved. They identified three major supply chain collaboration activities, namely 'third party logistics (3PL)', 'retailer-supplier partnerships'[10] and 'distribution integration'.

Lambert & Emmelhainz (1996) proposed a method for classifying supply chain partnerships based on empirical data, and the aim of this model was to provide a decision-making tool for the managers of companies who are taking partnerships seriously. This model consisted of two dimensions, namely 'driver' and 'facilitator'. The 'driver' dimension refers to potential benefits such as asset/cost efficiency which are only possible with partnerships. The 'facilitator' dimension refers to corporate environments which allow partnerships to grow and strengthen. According to their classification method, collaborative inter-firm activities/arrangements can be categorised into three types. Type I refers to the situation in which supply chain members recognise each other as partners and, on a limited basis, co-ordinate activities and planning. The partnership usually has a short-term focus and involves only one division or functional area within each organisation. A Type II partnership is more extensive and has a longer time horizon with higher level of integration than Type I. These organisations progress beyond co-ordination of activities to integration of activities involving multiple divisions and functions within the firm. The most advanced form of partnership is Type III, in which supply chain members share a significant level of integration. This type has the longest time horizon and members regard each other's organisations as an extension of their own companies.

[10] Retailer-supplier partnerships refer to various collaborative initiatives, such as 'quick response', 'continuous replenishment', and 'advanced continuous replenishment' and 'vendor managed inventory'.

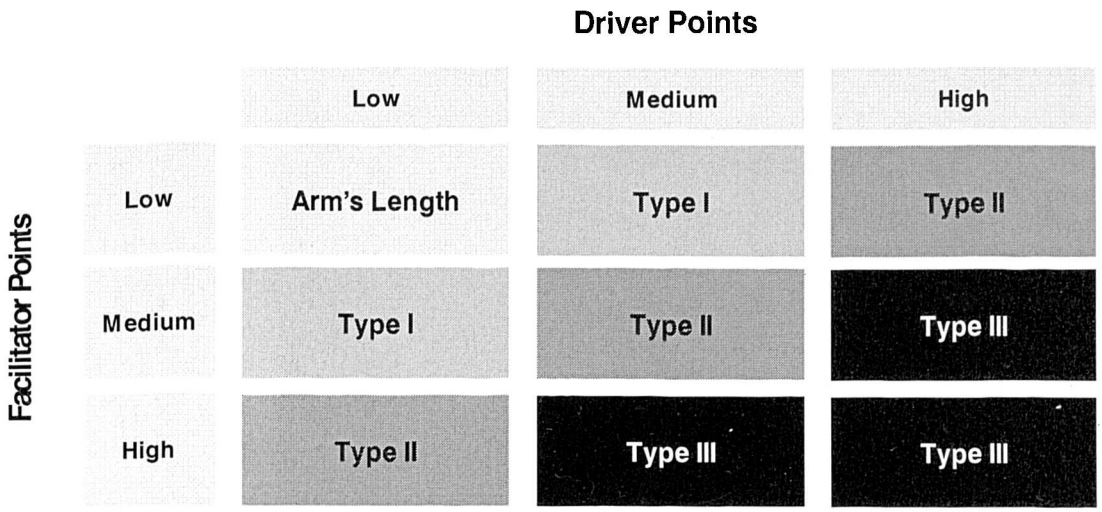

Figure II-8: Propensity to Partner Matrix, (Source: Lambert, Douglas M. and Margaret A. Emmelhainz, So you think you want a partner?, Marketing Management, 5(2), 24-40, 1996)

Another method of classification involves examining the degree of commitment and the existence of organisational infrastructures that bind the partners. Collaborative arrangements in supply chains can vary along a continuum, from 'loose' to 'tight'. Bailey, Clarke-Hill & Robinson (1995) suggested a classification method specifically designed for collaborative arrangements in retail supply chains. According to their method, these arrangements can be classified into eight different levels from 'loose affiliation' to 'controlling interest or full merger with retained identity'.

When the scope of supply chain partnerships is to be extended to a network[11], where often more than two firms are involved, Harland *et al.* (2001) suggested a method of classifying complex supply chain networks (Figure II-9).

[11] The scope of the term 'network' in this study is limited to 'collaborative arrangement' only.

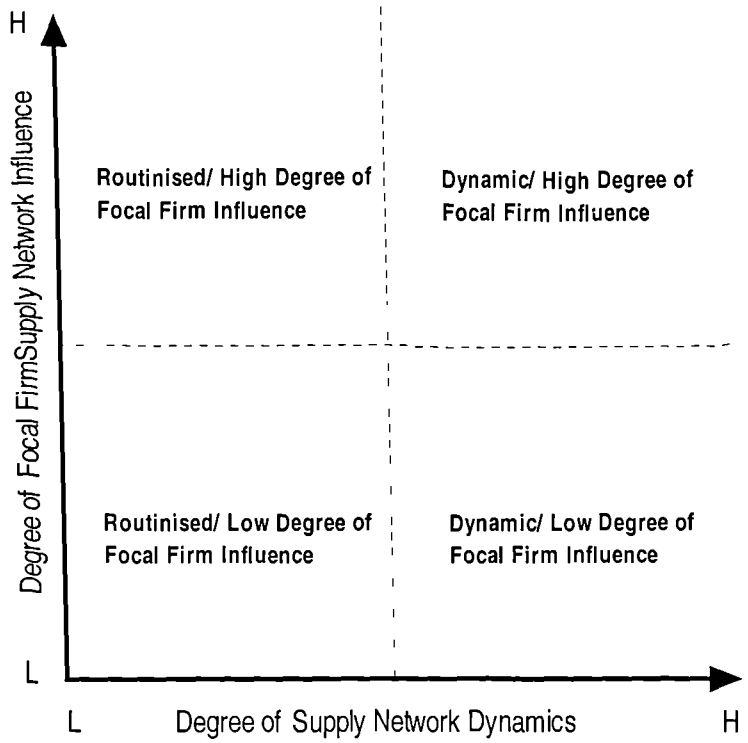

Figure II-9: A classification method of supply chain networks, (Source: Harland, C.M., Lamming, R.C., Zheng, J. and Johnsen, T.E., A taxonomy of supply networks. journal of supply chain management, A Global Review of Purchasing & Supply 37: 21-27, 2000)

4 Performance of Supply Chain Partnership & Hypotheses for Research Objective Two

In the third part of the literature review, trends in past research and issues relating to the performance of collaborative inter-firm arrangements will first be reviewed. Then, the measures used to gauge the performance of collaborative inter-firm arrangement and the factors behind successful partnerships will be discussed. On the basis of the findings, a total of five research hypotheses, regarding the individual influence of the each factor on the performance of a supply chain partnership, are derived.

4.1 Past Research Trends on Performance of Collaborative Inter-firm Arrangement

4.1.1 Brief Summary of Research Tendencies on Collaborative Inter-firm Arrangement Related Issues

Traditionally, firms' competitive advantage is thought to be obtained through a corporate strategy of low cost, production differentiation and competitive scope against competitors (Porter 1985). However, a number of transactions cost theorists have recognised that collaborative inter-firm arrangements can function as a means

to minimise cost and to maximise the efficiency of the firms involved. Child & Faulkner (1998) defined this view as 'co-operative strategy', which is 'the attempt by organisations to realise their objectives through co-operation with other organisations, rather than in competition with them.'

Since then, the following aspects of collaborative inter-firm arrangements have been researched from either dyadic or network-level perspectives (Gulati, 1998).

Firstly, its contribution to the improvement of firm's competitive position has been widely explored (Contractor & Lorange, 1988, Kogut, 1998, Powell, 1990, Hamel, 1991). The outcomes of these research have suggested that collaborative inter-firm arrangements can be used for the various purposes: 1) acquiring resources (Collis & Montgomery, 1995), 2) acquiring capabilities, (Teece & Pisano, 1994), and 3) knowledge (Hamel, 1991).

Secondly, the motivation behind the formation of collaborative inter-firm arrangements has been widely explored. From transaction cost theory, uncertainty and the minimisation of transaction cost have been identified as a key motivation for a collaborative inter-firm arrangement (Coase, 1938, 1960, Child & Faulkner, 1998, Heide & Stump, 1995). In addition, economies of scale (Gomes-Casseres, 1994, Russell & Lawrence, 1998), access to skills and assets in the target market (Kogut, 1988, Gomes-Casseres, 1994), risk reduction of new ventures (Contractor & Lorange, 1988), and internalisation of the partner's core competencies (Hamel, 1991) have been identified as other major motivations.

Thirdly, the selection process, criteria of partners and the consequences of a mismatch have been extensively covered by a number of researchers. Various factors such as the macro-environment, industry structure and unique characteristics of firms are important factors that must be taken into consideration during the selection procedure. Partner asymmetry, such as national or corporate cultural differences, has been an important centre of discussion on the outcome or the performance of collaborative inter-firm activities/arrangements (Hamel, 1991, Shan & Hamilton, 1991, Parkhe, 1993)

Fourthly, the governance mode of collaborative inter-firm arrangements has attracted a significant amount of attention. Buckley & Casson (1988) and Osborn, Baughn & Kovach (1990) suggested that different governance structures of collaborative inter-

firm arrangements have different impacts on the economic output of such arrangements. Furthermore, different types of pitfalls associated with the two distinctive governance modes, equity and non-equity collaboration, have been identified (Kogut & Singh, 1988, Harrigan, 1988, Heide, 1995).

The last and one of the least explored areas of collaborative inter-firm arrangements is that of performance related issues. Gulati (1998) pointed out that performance related issues have received less attention than other areas because of various research obstacles. However, previous research has yielded some significant insights into the performance of collaborative inter-firm arrangements, namely the determinants of the performance and the suitability of measures used.

4.1.2 Limits of Past Research into the Performance of Collaborative Inter-firm Arrangements and its Determinants

Numerous studies have examined issues related to the performance of collaborative inter-firm arrangements. These studies have yielded a number of significant insights, such as indicators to measure the performance of such arrangements and determinants of performance. From the supply chain management perspective, the previous studies are limited in the following ways.

Firstly, the types of collaborative inter-firm arrangement covered are limited. The influx of international joint ventures in the 1980s raised the question of how the performance of joint ventures can be measured (Anderson, 1990). As a consequence, the major forms of arrangements covered by the previous studies were mainly equity related collaborative inter-firm arrangements such as joint ventures. A number of researchers such as Heide & Stump (1995), Glaister & Buckely (1998) Whipple, Frankle & Daugherty (2002) and Artz (2002) carried out research regarding the performance issues of non-equity collaborative inter-firm arrangements using measures previously used to study equity relationships. However, there are few examples of research whose main focus was on measuring the performance of supply chain partnerships. Therefore, some of the measures used for the previous studies may not be appropriate to reflect the performance of supply chain partnerships. The three most widely used objective measures are duration, survival and stability. However, the stability measure cannot be used for this purpose, as there is little equity involvement included in supply chain partnerships. In addition, the majority of subjective performance measures should be rephrased for the purpose of studying

supply chain partnerships.

Secondly, due to the nature of multiplicity of participants of supply chain partnerships, the data collection methods employed by a number of previous empirical studies are often potentially exposed to the problem of perception asymmetry. Hamel (1991) pointed out that the performance of collaborative inter-firm arrangements may be perceived differently by each partner. For this reason, the results of the previous studies, where the data were collected solely from one of the multiple partners, often misrepresent the performance perceived by different partners (Spekman 1997). The methodological limitations of the previous research are discussed in details in the following section.

Finally, the issue of the performance of collaborative inter-firm arrangements has been viewed from two very different perspectives, and little effort (with the exception of studies such as Saxton 1997) has been made to approach these performance issues from an integrated view that takes account of these two perspectives. The first view is that of a group of researchers who have focused on the characteristics of arrangements as an explanation for collaborative inter-firm arrangements' behaviour and performance. This view is based on transaction cost theory and resource dependence theory, and its focus is on how the degree of uncertainty, relationship specific assets, and complementary assets of a partner influence the performance of a collaborative inter-firm arrangement. On the contrary, the other school of thought has approached the theme by focusing on the interactive nature of collaboration between organisations. This research has focused on whether the extent of social embeddedness, as demonstrated by factors such as 1) trust and commitment 2) partner asymmetry, 3) prior-affiliation in a collaborative inter-firm arrangement, is an important factor of performance of that relationship (Gulati 1998). Saxton (1997) pointed out that the first approach ignores the importance of the relationship and the second approach ignores the costs of long-standing relationships that lack infusions of new ideas and capabilities.

4.2 Difficulties of Carrying out Research on Performance Related Issues

Conducting research related to the performance of collaborative inter-firm arrangement is not a simple task. As numerous authors such as Venkatraman & Ramanujam (1986), Anderson (1990), Geringer & Herbert (1991), Gulati (1995) and

Glaister & Buckley (1998) have mentioned, measurement of the performance of collaborative inter-firm arrangement can be controversial and difficult. The following difficulties with carrying out research of this nature have been reported by researchers.

The first main difficulty in carrying out research in this area is that there are few consensus and available measure. Hamel (1991) and Glaister & Buckley (1998) also suggested that it is difficult to choose an appropriate yardstick(s) to be used for measuring the performance of a collaboration; Geringer (1998) suggested that this is related to the fact that the definition of the performance of collaborative inter-firm arrangement remains unclear.

Secondly, the existing measures are not always appropriate to be used in all situations. Geringer & Herbert (1991) also argued that there is no satisfactory way of measuring the performance of a partnership, as efforts to identify variables for the performance are constrained by the compatibility and reliability problems of alternative performance measures. As Glaister & Buckley (1998) pointed out, the problem of compatibility and reliability is caused by the fact that performance would be expected to vary with the nature of the organisation's environment and its recourse capability. This is especially true for the performance of supply chain partnerships situated in a complicated supply chain setting. For example, the performance level of a highly satisfying collaborative supply chain partnership for a group of low-value, slow-moving products may not be appropriate for that of a partnership with high-value, fast-moving products.

Thirdly, Anderson (1990), Hamel (1991) and Glaister & Buckley (1998) expressed another concern: that there is little clear distinction between indicators of performance and determinants of performance, and confusing these two can cause problems when conducting research on the performance of collaborative inter-firm arrangements. For example, a well-established electronic communication system could be viewed as a determinant of the performance of a supply chain collaboration. On the other hand, such communication system might be a result of a highly performing supply chain partnership among the partners.

Fourthly, the fact that collaborative inter-firm arrangements include more than one participant means that the perception of the performance is often asymmetric and increases the complexity of the research design. There needs to be rigorous research

design, especially for the process of data collection, in order to minimise the negative effect of perception asymmetry, and this requirement deters many researchers from approaching this issue (Gulati, 1998, and Geringer & Buckley, 1991).

4.3 Measures for the Performance of Partnerships

The previous studies employed various measures to gauge the performance of collaborative inter-firm arrangements. These measures can be divided into two broad categories, 'objective measures' and 'subjective measures'. Even though some studies employed a single measure for this purpose, the majority of studies used more than one measure in order to reflect the various aspects of the performance of collaborations. Such multiplicity of approaches when measuring performance helps researchers to cover different views on which aspects of performance to measure, and understand how successful these measures indicate the performance to be (Anderson, 1995, Glaister & Buckley, 1998). Also Geringer (1998) pointed out that this multiplicity of approaches adds a great strength to the field of alliance research, as it provides broader and richer insights.

4.3.1 Objective Measures of Performance of Partnership

Object measures are mainly quantitative and comparable, and sometimes less subject to the bias related to data source and collection methods. The following objective measures have been frequently used in previous studies.

- Finance Related Measures

Geringer & Herbert (1991) suggested that the early studies on collaborative inter-firm arrangements employed 'a variety of financial indicators such as profitability, growth and cost position' as proxy measures of the success and the performance of collaborative inter-firm arrangements (for example, Tomlinson (1970) used ROI as an performance indicator).

- Termination and Survival

Previously, the most common approach to measurement of the performance of collaborative inter-firm arrangements was examining the termination of partnerships (Anderson, 1995, Glaister & Buckley, 1998, Gulati, 1998). Many researchers, such as Harrigan (1988), Kogut (1988), Parkhe (1993) and Saxton (1997), used the

survival, termination or duration of partnerships to measure collaboration performance.

- Stability

Franko (1971, cited in Geringer 1989) used the stability of the joint venture (measured by the liquidation or significant changes of ownership of joint ventures) as an indicator of the performance of collaborative inter-firm arrangements. Others, such as Gomers-Casseres (1987), Geringer & Herbert, (1991), Beamish & Inkpen (1995) and Glaister & Buckley (1998) also used stability as a major measure. Geringer & Herbert (1991) and Glaister & Buckley (1998) used a dichotomous variable by checking the changes in the division of joint venture equity from the formation of the joint ventures under investigation.

- Duration

Another frequently used measure is 'duration' (Harrigan 1986, 1988, Geringer & Herbert, 1991, Parkhe 1991 and Glaister & Buckley 1998). In the studies by Geringer & Glaister, the duration was measured by the number of years between the formation and the termination of the partnership or its age at the point of data collection.

However, the above objective measures are subject to some criticism. Gulati (1998) pointed out that using the survival, termination or duration of a partnership as measures exposes the research to the following problems: 1) these measures fail to distinguish between natural and untimely death and 2) these studies consider performance as an either-or condition. Parkhe (1991) also argued that long duration is an imperfect proxy for the success of an alliance, as it can be related to, for example, higher exit barriers. Also, there are problems related to financial indicators, as measures were suggested by several academics. Geringer & Herbert (1991), for example, argued that financial and objective measures embody potential limitations and those are inappropriate for evaluation of partnership performance for the following reasons:

- Obtaining the data for financial and objective measures from private firms or conglomerates is not easy. Often such data is non-existent or it is only consolidated into corporate data.

- Often partners generate financial returns through other mechanisms other than dividends, such as supply contracts.

- Financial and objective measures may fail to adequately reflect the objectives of the collaborative inter-firm arrangement.

Similarly, Anderson (1990) argued that short-term financial indicators are not sufficient, as the collaborative inter-firm arrangements to be measured are often in high-risk settings with long-term performance horizons. Also, Glaister & Buckley (1998) pointed out that financial indicators are not appropriate when collaborative inter-firm arrangements are formed for non-financial purposes. Anderson (1990) similarly argued that financial indicators only measure one dimension of performance, and for this reason, qualitative measures are needed.

4.3.2 Subjective Measures of Performance of Partnership

For the above reasons, some academics such as Ellinger (2000) see the concept of 'successful partnership' as a perception of the personnel who are engaged in such situation. Glaister & Buckley (1998) argued that the inability of financial and objective measures to effectively capture the performance of partnerships has led researchers to perceptual measures of the partners' satisfaction with the partnership performance. According to Geringer & Herbert (1991), early researchers such as Killing (1983) used a single-item perceptual measure of partners' satisfaction with partnership performance. Glaister & Buckley (1998) argued that the main advantage of such subjective measures is that they can provide information about the extent to which the partnership has archived its overall objectives. More recently, Kale, Dyer & Singh (2002) used more extensive measures covering four dimensions of partnership performance, which are 1) the extent to which the collaborative inter-firm arrangement achieved its stated objectives, 2) the extent to which the partnership enhanced the competitive position of the parent company, 3) the extent to which the parent company learnt some critical skills from its partnership partner, and 4) the level of harmony exhibited by the partners.

However, the subjective measures are embedded with potentially serious limitations and can be exposed to biases from data collection methods and sources (Geringer & Herbert, 1991). These researchers argued that such limitations and biases result from

the fact that many research methods have opted for the use of archival or secondary data sources, which may not be appropriate for subjective measures. Another potential limitation is that there may be a lack of consistency between objective and subjective measures of partnerships. However, Dess & Robinson (1984) showed that there is a significantly correlated relationship between these measures for the traditional organisational forms. Furthermore, Glaister & Buckley (1998) have examined the reliability and consistency of the relationship between objective and subjective measures and concluded that significant correlation exists between them in alliance performance.

4.4 Determinant of Performance of Supply Chain Partnership and Hypotheses

Efforts to identify factors that influence the performance of collaborative inter-firm arrangements have been made within many different academic disciplines. In the field of organisational studies, this issue of partnership performance determinants has been actively researched. Significant numbers of empirical studies have been conducted covering determinants of the performance of mainly equity alliances, such as international joint ventures, from the dyadic perspective.

One thing that should be noted is that a large number of these studies have focused on 'equity collaboration', which refers to collaborative inter-firm arrangements with joint ownership and control over the use of assets (Kogut, 1988). In the area of supply chain management and marketing, research efforts have been focusing on supplier-buyer relationships (non-equity collaborations).

As discussed above, well-performing collaborative inter-firm arrangements can be viewed as collaborations which meet the following criteria: 1) long-term duration, 2) survival, 3) high degree of stability of ownership, 4) high level of goal achievement, and 5) high level of perceptual satisfaction of participants' firms. Due to the different ownership structures and the lack of secondary data, the first three of these criteria may not be used to gauge the performance of a supply chain partnership, but the fourth and fifth criteria can be used to identify successful supply chain partnerships. However, despite the fact that there are many different formats of collaborative inter-firm arrangement with many different criteria for high performance, previous research has identified a number of common factors. These common determinants of the performance of collaborative inter-firm arrangements are reviewed below.

4.4.1 Information Technology and Information Sharing

An efficient supply chain partnership requires a significant degree of efficiency and extensiveness of the exchange of vital supply chain information, and willingness of participants to enable this.

Research based on the theory, attempting to define the link between IT and partnership, has been explored in the field of MIS from the transaction cost theory point of view. These studies have yielded the following two insights into the role of IT for partnerships.

The first view is that IT reduces partnership cost, and this enables firms to engage in more collaborative activities (Clemons & Row, 1992, 1993). According to Malone & Rockart (cited in Clemons & Row, 1992), this decrease in the cost of partnership between participants leads to three basic economic effects: 1) increased demand for partnership through IT, 2) substitution of partnership through IT, 3) development of partnership intensive structure. The same authors, however, have suggested that increased levels of partnership can result in either 'more efficient transaction oriented electronic market' or 'more efficient highly integrated, collaborative relationships' (Malone, Yate & Benjamin 1987).

The second view is based on the concept of 'information flow'. The basic concept behind this view is that problems within partnerships are created by uncertainty due to insufficient information or information processing capacity. Thus, according to this view, increasing the timeliness and/or the amount of information between partners can improve or increase collaborative activities (Clemons & Row, 1993). Bakos (1991) argued that improved information systems will result in a decrease in response time and increase the capacity of inter-firm communication, and this will improve the quality of a partnership. Perhaps one of the most vivid illustrations of this aspect of the link between supply chain partnerships and IT is this 'bullwhip effect' or 'demand amplification'. Lee, Padmanabhan & Whang (1997) defined this as the increase in variability as the information travels up into the supply chain. They identified four causes of the bullwhip effect, which are 1) demand forecast update, 2) order batching, 3) price fluctuations, and 4) shortage gaming. A number of authors, such as Simchi-Levis, Kaminsky & Simchi-Levis (1999), Lee, Padmanabhan & Whang (1997), have demonstrated that information sharing can drastically reduce such fluctuation and the inventory level in upper level supply chain. They

emphasised that information is one of the key dimensions of supply chain partnership, since sharing information such as customer demand, inventory status and capacity plans can enable companies to tackle demand amplification and increase the efficiency of co-operative works.

A number of empirical studies in the supply chain setting have explored information technology, especially information sharing, as a key determinant of the performance of a supply chain partnership. Whipple, Frankel & Anselmi (1999) identified through their case study of ECR that the three conditions relating to information (accurate, timely information and appropriate use of the information) improved the effectiveness of a supply chain partnership, and argued that a better IT system can encourage partners to engage more in partnership activities. Similarly, Spekman, Kamauf & Myhr (1998) found that higher degrees of information sharing were significantly associated with successful supply chain partnerships. Simchi-Levis, Kaminsky & Simchi-Levis (1999) argued that a supply chain partnership assisted by information technology can bring the following benefits to the participants: 1) helps reduce variability in the supply chain, 2) helps suppliers make better forecasts, accounting for promotion, 3) enables retailers to better serve their customers by offering tools for locating desired items rapidly, 4) enables retailers to react and adapt to supply problems more rapidly, and 5) enables lead time reduction.

Bowersox & Closs (1996) underlined the importance of IT from an integration perspective. According to them, supply chain information systems are the threads that link logistics activities into an integrated process. Later, Bowersox, Closs & Stank (1999) argued that the role of IT as a principal enabler for inter-company integration and partnership, and the Internet, will play a critical role in facilitating 'unprecedented integration across supply chains.' Trevor (1999) expressed a similar view of the role of IT as an enabler of supply chain partnership by stating that supply chain process reengineering and information technology are inextricably linked and in many cases, information technology is a key enabler of the change process towards more collaborative SCM. Schary (1999) also underlined the role of information as a vital link between supply chain partners and argued that information and IT systems play an important role in making supply chain processes possible and increasing supply chain visibility. Eventually these improvements will provide a framework for better partnerships. Anthony (2000) argued that new IT developments

will contribute significantly to solve existing supply chain partnership problems. These include a 'broad spectrum of collaborative initiatives, disparate standards for communication, and various levels of trading partner competencies and business processes', which pose serious difficulties for the implementation of supply chain partnerships.

On the basis of the above literature, the first research hypothesis was derived.

H_3: A supply chain partnership with a higher degree of information technology and information sharing between its partners will achieve better partnership performance.

The information technology here was measured by 1) structure of IT system, 2) willingness to share the information, and 3) variety of information exchanged and the evaluation of this information by the partners[12].

4.4.2 Trust

Trust is an intangible attribute, which is the key to a successful supply chain partnership, but one out of four managers questioned by Fawcett, Magnan, & Williams (2004) pointed out that the real trust is a rare commodity. There are numerous definitions of the term 'trust'. According to Parkhe (1998), several common aspects stand out from the various definitions: 1) trust inherently involves uncertainty about the future, 2) trust implies vulnerability, that is, the risk of losing something of value, the magnitude of this potential loss from untrustworthy behaviour is typically much greater than the anticipated gains from trustworthy behaviour, and 3) trust is placed in another whose behaviour is not under one's control, so that each partner exercises only partial influence over alliance outcomes. Maloni & Benton (2000) defined trust in simpler terms, as a relationship element which is characterised by confidence in the honesty and integrity of partners.

A theoretical explanation of the role of trust is that: high levels of trust between members of partnership are known to reduce uncertainty and opportunism, which are the major risks of getting involved in a situation of collaborative inter-firm arrangement. A number of researchers have reached similar conclusions. Child & Faulkner (1998) argued that a higher level of trust between participants of an inter-organisational partnership helps to reduce the uncertainty of risk involved in the

arrangement and encourages more collaborative activities. Trust can enhance the performance of a collaborative inter-firm arrangement in the following manners: 1) lowing uncertainty surrounding future events and a partner's responses to those future events, 2) minimising risk by lowering the perceived likelihood that opportunities representing significant vulnerability will be exploited by a partner, permitting better sharing and greater specialisation of resources (relationship assets specification), and 3) filling the control gap in managing collaborative inter-firm arrangements, as compared to managing hierarchical organisations (Parkhe 1993, 1998).

Studies specially focused on partnership in supply chain setting by Zaheer, McEvily & Perrone (1998) and Whipple, Frankel & Anselmi (1999) underlined the risk reduction property of trust as reducing the uncertainty and opportunism to produce stronger relationships between participants. For example, in terms of volume uncertainty, which is the most common form of uncertainty in supply chain partnerships (Heide & Stump, 1995), increasing the level of trust can lead to a major improvement in the supply chain partnership's performance by reducing this uncertainty.

A number of other academics have explored the link between performance of partnerships and 'trust' as the structure of reward and risk sharing. Bowersox (1990) and Ellram (1990) argued that trust and commitment allow more effective reward and risk sharing systems for supply chain partnerships.

Trust is known to plays a less significant role in the performance of collaborative inter-firm arrangements when a company possesses relatively complete, accurate and timely information (since such information reduces uncertainty and can be used in planning, structuring and running partnerships); in which vulnerability is low (so the prospects of damaging one's interests are minimal); and in which a relatively high degree of control can be exercised (so that powerlessness over alliance outcomes is minimised) (Parkhe 1998). Also, supplier and customers generally have significantly different levels of trust towards each other (Campbell 1997)

On the basis of the above past research, the second hypothesis was derived.

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[12] For detailed information on how the measures were developed, please refer to Chapter III, section 2.4.

H_4: A supply chain partnership with a higher degree of trust between its partners will achieve better partnership performance.

The degree of trust was measured by 1) the nature of the partnership's relationship governance structure, 2) whether they regard each other as prime partners, and 3) the degree of the balance of power in the partnership[13].

4.4.3 Relationship Specific Assets

Relationship specific assets (transaction-specific investments) refer to assets that are uniquely tailored to a particular business relationship and usually have low value outside of that relationship. These assets can be site, physical, human, dedicated and temporally specific (Williamson 1975). In a supply chain partnership, for example, customers can make investments in equipment and organisational procedures tailored to their partnership and manufacturers can invest in training their staff to use the particular equipment (Heide & Stump 1995). In the current climate, various types of IT investment targeted to information exchange with a certain supply chain partner can be regarded as relationship specific assets.

Relationship specific assets are also known to influence the performance of participants of supply chains. The theoretical background for this is transaction cost economy. Williamson (1975) argued that relation specific assets can create productivity gains in inter-firm collaborations. The link between supply chain partnership performance and relationship specific assets has been covered by various empirical researches. Dyer & Ouchi (1993) suggested in their study of Japanese-style partnerships that interdependency between relationship specific assets could improve certain dimensions of performance, including alliance performance, such as longevity of supplier-customer relationships. Dyer (1996) carried out an extensive study in the US and Japanese automotive industry and concluded that inter-firm human and site asset co-specialisation are positively related to higher inter-firm partnership performance. Handfield (2000) underlined the importance of a specialised team for maintaining relationships and the importance of appropriate investment in the infrastructure of a partnership. The reason behind such improvement is that these relationship specific assets are, by their nature, specialised for the particular partnership; therefore, the outcome of using such assets can be

[13] For detailed information on how the measures were developed, please refer to Chapter III, section 2.4.

highly productive (Jones, Clarke-Hill & Robinson 1988).

However, as recognised in transaction cost theory, increasing relationship specific assets within a production network such as a supply chain involves significant cost (Dyer, 1996). Thus, the positive contribution of partnership specific assets can only be realised when 1) such investments or assets are protected by the existence of safeguards such as expectations for the future in order to prevent such assets from expropriating due to such cost, for example, the cost from opportunism (Heide & Stump, 1995 and Dyer, 1996), and 2) tasks and activities supported by such assets should be characterised by a high level of interdependence. The empirical study of Heide & Stamp (1995) showed that investment by buyers into relationship specific asset without a safeguard could negatively impact the performance of supplier-buyer partnership, as suppliers could behave in opportunistic way. This situation, where the existence of relationship specific assets negatively influences the performance of partnerships, has been named a 'hold-up situation' and its impact can be significant (Williamson, 1975, Heide and Stamp, 1995, Houston & Johnson, 2000, Artz, 1999). The mutuality of such investment is also important. The findings of Artz (1999) showed that investment by only one party can negatively impact partnership performance, but the presence of offsetting investment by other party can increase the partnership performance.

On the basis of the above research, the third hypothesis was derived.

H_5: A supply chain partnership with a higher degree of relationship specific assets between its partners will achieve better partnership performance.

The degree of relationship specific assets was measured by 1) the degree of IT relationship specific assets and 2) the degree of non-IT relationship specific assets[14].

4.4.4 Partner Asymmetry

According to Parkhe (1991), partner asymmetry can fall into two different categories. 'Type I diversity' refers to the difference in reciprocal strengths and complementary resources furnished by partners, which positively influence the outcome of collaborative inter-firm arrangements. Harrigan (1985) argued that collaborative inter-firm arrangements are more likely to succeed when partners possess complementary missions, resource capabilities and managerial capabilities that create

a strategic fit in which the bargaining power of the alliance participants is evenly matched. However, Type II diversity refers to the differences in partner characteristics that often negatively affect the partnership's performance (Parkhe 1991).

Harrigan (1988) concluded through empirical research that these partners' characteristics asymmetries (different cultures, asset sizes and venturing experience levels) and strategic directions (horizontal, vertical, and relatedness linkages with the venture) negatively influence the performance of collaborative inter-firm arrangements.

Many researchers have paid significant amounts of attention to partner asymmetry at the levels of national and societal culture. Previously, researchers such as Hamel (1990) concluded that the difference in national characteristics could negatively influence the performance of international partnerships. However, Park & Ungson (1997) reached a contradictory conclusion, finding that collaborations formed by partners with different national origins tend to last longer. Their findings also suggest that strategic diversity does not affect partnership performance. Non-complementary asymmetry tends to influence the performance of collaborative inter-firm arrangements, and the degree of negative influence becomes greater when such asymmetry exists at the corporate level rather than the national level (Harrigan 1988).

Conceptual Level	Phenomenological Level	Dimension of Diversity	Source of Tension
Meta	Supranational	Societal culture	Difference in perception and interpretation of phenomena, analytical processes
Macro	National	National context	Differences in home, government, policies, national industry structure and institutions
Meso	Top management	Corporate culture	Differences in ideologies and value guiding companies
Meso	Policy Group	Strategic direction	Differences in strategic interests of partners from dynamic external and internal environments
Micro	Functional Management	Management practices and organisation	Differences in management style, organisational structure of parent firms

Table II-3: Inter-firm diversity in alliance, (Source: Parkhe, A., Inter-firm diversity, organizational learnings, and longevity in global strategic alliances Journal of International Business Studies, 22, 579-602, 1991)

[14] For detailed information on how the measures were developed, please refer to section III 2.4.

The possibility of partner asymmetry in supply chain partnerships mainly exists at meso and micro conceptual levels of diversity in strategic direction and management practices and organisation. Saxton (1997) and Bowersox (1999) concluded that strategic similarities or integrity between partners are positively correlated to the partnership performance. Handfield (2000) argued from his case studies on seller-buyer relationships that to avoid 'interface pitfall' in buyer-supplier partnerships, alignment of organisational cultures is important.

The fourth research hypothesis was derived on the basis of the past research reviewed above.

H_6: A supply chain partnership with a lower degree of partner asymmetry between its partners will achieve better partnership performance

In the present study, the degree of partner asymmetry was measured by 1) the difference in the degree of willingness to change comparing between partners, and 2) the difference in the degree of importance placed by partners on the value of keeping commitments[15].

4.4.5 Joint Partnership Management System

'Joint partnership management system' refers to inter-organisational systems or structures, which are known to enhance the performance of collaborative inter-firm arrangement. The importance of well-established joint management structures for the performance of inter-firm partnerships has been underlined by many researchers. Stuart (1997) explained the reason behind this, arguing that joint informal authority of control significantly influences the performance of a supply chain partnership, as the main characteristic of relationships in a supply chain is 'lacking equity ownership'. Similarly, Kogut & Zander (1996) suggested that establishing both tacit and explicit rules for co-ordination is an important factor of successful collaborative inter-firm arrangements. Whipple, Frankel, & Anselmi (1999) explained, from a network theory perspective, that the controlling mechanism can enhance the partnership's performance, as an organisation with hybrid-integrative governance, such as a supply chain with highly collaborative activities, can avoid the typical problems of 'bounded rationality and opportunism' by employing a controlling mechanism. Also, a well structured joint partnership management system can

[15] For detailed information on how the measures were developed, please refer to section III 2.4.

increase the frequency of contact, and this will increase members' future expectation of their partnership, which is known to have a positive effect on partnership performance (Heide & Miner, 1992).

Joint partnership management systems consist of three components, which are: 1) well-defined structure for developing, maintaining and monitoring collaborative inter-firm arrangements, including role specificity 2) joint decision-making system, and 3) risk and benefit sharing system. Each component has a specific impact on the performance of a collaborative inter-firm arrangement in the following ways. Firstly, a well-defined structure for developing, maintaining and monitoring collaborative inter-firm arrangement is known to improve the performance of a supply chain partnership. Bowersox, Closs & Stank (1999) suggested that willingness to create joint structures, framework and metrics positively influences the performance of a supply chain partnership. More specifically, role specificity is an important determinant of successful partnership output. In order to achieve this, partners should develop a clear sense of strategy, mission and the goals of the partnership and jointly identify and clarify each other's roles and responsibilities

Secondly, the presence of a joint decision-making system is frequently mentioned as an important factor behind successful collaborative inter-firm arrangements (Parkhe, 1993, and Saxton, 1997). Saxton (1997) explained how shared decision-making systems can improve the performance of partnerships from two perspectives. Firstly, from the game theory perspective, information asymmetry is reduced when both partners have high participation in and knowledge of strategic decisions and actions. Such a high level of joint system acts as both a signalling and a monitoring mechanism by establishing and building trust and commitment, and thus, positively influences the performance of the partnership. Secondly, from an organisational learning perspective, learning from a partner requires close involvement in an alliance and its decision-making processes (Kogut & Zander, 1992). For these reasons, a high degree of mutual involvement in the decision-making of the partnership will positively affect the performance, as such involvement builds trust and enhances knowledge transfer.

Thirdly, a risk and benefit sharing system is also regarded as an important factor for a successful partnership outcome. Moore (1998) argued that one of the main motivations for companies' desire to become involved in partnerships is the

management of risk. Thus, without the controlling system of sharing risk, the performance of partnerships becomes weaker. Ellinger (2000) holds a similar view, that proper controlling mechanisms, especially rewarding/evaluation systems, can stimulate or foster inter-organisational collaboration by providing incentives to disparate organisations. Bowersox, Closs & Stank (1999) defined a controlling mechanism of this nature as: 'a framework and willingness to apportion fair shares of reward and penalty'.

The fifth research hypothesis was derived on the basis of the past research reviewed above.

H_7: A supply chain partnership with a higher degree of joint partnership management structure between its partners will achieve better partnership performance

The degree of joint partnership management system was measured by 1) the extent of the structure for developing, maintaining and monitoring partnerships, including role specification, 2) the level of mutuality of joint decision-making system, and 3) the degree of risk and benefit sharing system[16].

5 Asymmetries in Partners' Perception of Status of Supply Chain Partnership, its Association with Partnership Performance and Hypotheses for Research Objective Three

We hear numerous complaints from companies in the various levels of supply chain partnership that their counterparts never see things in their partnership as they do. If we accept that there is no such thing as 'objective reality', and that reality is the product of personal perception or cognition, then each individual and his/her action is led by his/her perception rather than by the reality in his/her own manner. On the basis of this proposition, we can easily speculate that companies in a collaborative inter-firm relationship, where the cognitive systems of decision-makers are influenced by different internal and external factors, can perceive the same fact in their partnership/alliance very differently.

To the best of our knowledge, the issue of perception differences among the companies in a collaborative inter-firm arrangement and their associations with the

[16] For detailed information on how the measures were developed, please refer to section III 2.4.

performance of such arrangements has not been covered well in previous research. The issue of perception differences due to cultural differences in collaborative inter-firm arrangements formed among companies from different countries of origin has been covered by academics such as Mohr & Puck (2003), who have suggested that partners in collaborative international inter-firm arrangements do perceive key variables, such as the performance of such arrangements, differently because of cultural difference at various levels.

This perception asymmetry exists in various aspects of supply chain partnerships. The supplier and customer of a supply chain partnership, who are located in different internal/external environments, such as their locations at different levels in the supply chain as a supplier or a customer, could perceive various situations and the status of their supply chain partnerships differently to their counterparts. Rudzki (2004) gave one possible explanation that when viewing the relationships, suppliers tend to regard them from the point of view of market competition and the value of the customer's business. On the other hand, customers tend to see the relationships from the perspective of market complexity and commodity value.

Such perception asymmetry due to the location in the supply chain has been observed in different areas by a number of academics. De Chernatony, Daniels & Johnson (1993) found that suppliers and customers perceive their competitive environments differently due to the different environments they face. Spekman, Salmond & Lambe (1996) identified the presence of asymmetry between the perceptions of suppliers and customers on 1) the level of inter-dependency, 2) partnership related goals, and 3) the strategic direction of the partnership. In terms of perception asymmetry on the characteristics of partnerships, some studies have identified perception differences between partners on the characteristics of their supply chain partnerships.

In Ellram and her colleagues' two studies, namely 1) *Partnering characteristics: a dyadic perspective* and 2) *Partnering pitfalls and success factors*, the perception difference between suppliers and partners was shown to be statistically significant. Firstly, Ellram (1995) found that suppliers and customers in supply chain partnerships showed significant differences in the following areas: 1) the main motivations for entering partnerships, 2) rating of factors' relative importance in establishing and maintaining partnerships, 3) rating of the importance of factors for the success of a partnership, and 4) the factors leading to unsuccessful partnership.

Secondly, Ellram & Hendrick (1995) found that suppliers and customers held significantly different perceptions about the various aspects of supply chain partnerships; these results are summarised in Table II-4.

Partnering Characteristics	Dimension
Perceptions of Futuristic Orientation of Partnership	- Suppliers tend to perceive more that the focus of partnerships is in current transaction - Customers morel likely to think that the suppliers were selected on the basis of their price
Perceptions Win/Win - Risk Sharing Relationship	- Suppliers perceive themselves as more loyal to their partners than customers do to their partners - Suppliers perceive that the risk is shared with their customers less than customers do - Suppliers believe that they are willing to help their partners in difficult situations but customers do not agree with this statement as strongly - Customers believe that they are willing to help their partners in difficult situation but suppliers do not agree with this statement as strongly - Customers have a stronger belief that they and their partners strive for continuous improvement
Information Sharing Understanding	- Suppliers have a weaker perception than customers regarding the sharing of forecast information by customers

Table II-4: The perception asymmetry of partners of supply chain partnership, (Source: Ellram, L.M. and Hendrick, T.E., Partnering characteristics: A dyadic perspective. Journal of Business Logistics 16: 41-24, 1995)

This perception asymmetry can also exist in the partners' perceptions of the performance of partnerships they are engaged in. For example, customers feel that they can get the best price and stability of supply through their partnerships, but their counterparts, suppliers, feel the pressure that the partnerships are governed by their customers' exercising of buyer power. Also, as mentioned above, the perception asymmetry in partnership-related goals frequently exists, and therefore the supplier and the customer may have very different evaluations of any of the dimensions of the performance of a supply chain partnership. Thus, we propose the following two hypotheses.

H_8: There is a significant difference between the perceptions of suppliers and customers on the status of the supply chain partnerships they belong to.

H_9: There is a significant difference between the perceptions of suppliers and customers on the performance measures of the supply chain partnerships they belong to.

The issue of the perception difference among partners of collaborative inter-firm arrangements has been recognised as a serious problem, as it has the potential to negatively influence the performance of inter-firm arrangements. Again, this association has not been extensively covered by academics. A handful of studies

have identified a possible association between the magnitude of perception asymmetry and the performance of partnerships. For example, Spekman, Salmond & Lambe (1996) found that perception asymmetry on the inter-dependency between the supplier and the customer is an important determinant of the performance of a supply chain partnership between them. Perception asymmetry on 1) the status of the supply chain and 2) the performance of the partnerships can potentially cause conflict and misunderstanding among the partners, which can eventually decrease the performance of a supply chain partnership. Thus, we propose that the performance of such partnerships is negatively influenced by perception asymmetry on 1) the status of the supply chain and 2) the performance of the partnership.

H_{10}: The degree of perception asymmetry on the status of the supply chain partnership is negatively correlated with the performance of the supply chain partnership.

H_{11}: The degree of perception asymmetry on the performance of the supply chain partnership is negatively correlated with the performance of supply chain partnership.

6 Conclusion

In the first part of the literature review, previous studies on 1) the definition of SCM, 2) the theoretical background of supply chain partnerships, and 3) the chronological development of the concept of SCM and partnership were reviewed. This review provided us with a sound understanding of 1) the development of the idea of collaborative SCM and supply chain partnerships, and 2) the major economic and business driving forces behind the birth of collaborative SCM.

In the second part of this chapter, various terms referring to collaborative inter-firm arrangements, their uses in the academic literature and the methods of classifying them were reviewed as an initial step towards creating a classification method for supply chain partnerships. Through this literature review, the following achievements were made: 1) clarification of the use of each of these terms, 2) the selection of appropriate terms for referring to collaborative inter-firm arrangements in supply chains for this research, and 3) identifying the weakness of the previous classification methods. Firstly, the use and definition of each term was reviewed and efforts to clarify them were made. On the basis of the findings from the literature review, an

attempt was made to place these terms on Williamson's dichotomy in order to select the most appropriate terms for this thesis (Figure II-10). As can be seen from Figure II-10, it becomes clear that the terms 'co-operation', 'co-ordination' and 'collaboration' are referring to a somewhat limited range of collaborative inter-firm arrangements. On the other hand, the terms 'partnership' and 'alliance' cover almost all collaborative inter-firm arrangements after arm's-length relationships and before vertical integration. The term 'network' is more appropriate in reference to arrangements where more than two parties are involved.

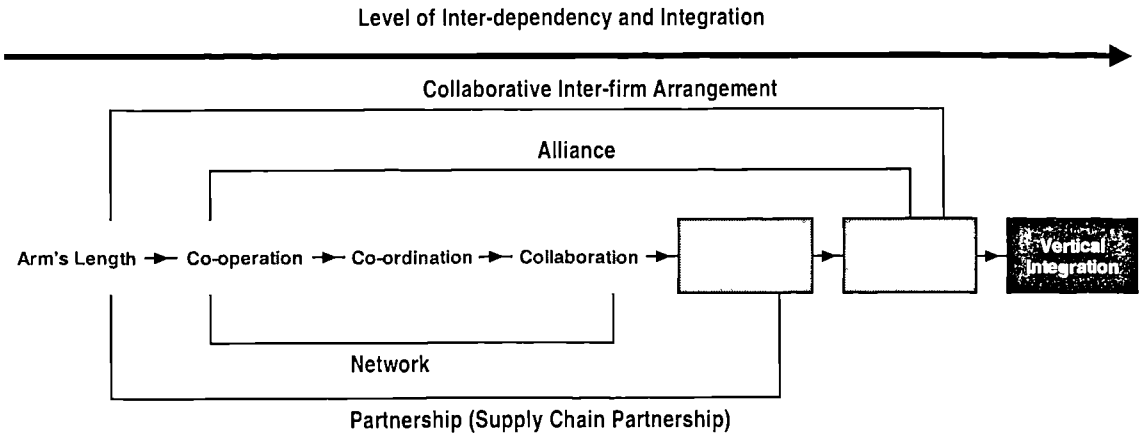


Figure II-10: Different terms referring collaborative inter-firm relationships/arrangement

On the basis of these findings, the decision to use the term 'supply chain partnership' to refer to collaborative inter-firm arrangements in supply chains in this research was made for the following reasons. Firstly, the term 'partnership' covers collaborative inter-firm arrangements with varying degrees of interdependency, and this attribute is suitable to cover the wide range of collaborative inter-firm arrangements in supply chains. Secondly, such arrangements are rarely equity relationships (Harland, 1996); thus, the term 'alliance' is not appropriate, as it encompasses equity collaboration. In addition, the term 'collaborative inter-firm arrangement' was used to refer to any non-SCM specific inter-firm arrangements, as it covers any arrangement from the extended arm-length to joint-venture.

Also, the second part of the literature search has shed light on the following weaknesses of the classification methods from past research: 1) there are few classification methods from performance perspectives, 2) not many of them are focused on collaborative inter-firm arrangements in supply chains. Regarding the research on classification of collaborative inter-firm arrangements in supply chains, these studies were also exposed to a lack of empirical testing, and have failed to

provide significant assistance to SCM academics and practitioners.

In the third part of the literature review, the theoretical backgrounds and empirical studies regarding determinants of the performance of collaborative inter-firm arrangements were reviewed. Also, the difficulties involved in conducting research regarding the performance of collaborative arrangements were reviewed in detail. Then, the strengths and weaknesses of various measures used to gauge the performance of collaborative inter-firm arrangements were also discussed. Through the review of the studies regarding performance, the following points were achieved. Firstly, on the basis of this review, a total of five research hypotheses regarding the individual influences of these determinants on the performance of supply chain partnerships were derived. Secondly, the need for the development of new performance measures, in order to better reflect the performance dimensions of supply chain partnerships, was identified. Thirdly, the review of each performance determinant provided us with the idea of developing measurement items for each construct. Finally, on the basis of the weakness of the previous research reviewed here, ideas for more rigorous research methodology were generated.

In the final part of the literature review, the process of consolidating studies from various academic disciplines was carried out. On the basis of this, four research hypotheses regarding perception asymmetry and its association with partnerships' performance were derived.

III. Methodology and Research Design

1 Introduction

1.1 Qualitative and Quantitative Methods in SCM Research

The majority of the research conducted in the field of supply chain management and logistics has been conducted by using quantitative methods for data analysis (Mentzer & Kahn, 1995). On the other hand, a number of authors such as Ellram (1996) and Stock (1997) pioneered the use of case studies for SCM research. They argued that SCM researchers should consider more use of non-positivist and qualitative research methodology. Recently, an increasing number of authors in the field of SCM research have been adopting qualitative methods for their data analysis.

Qualitative methods refer to an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world (Van Maanen, 1983). As can be seen from this definition, 'qualitative methods' provide opportunities to obtain in-depth insight into an industry or a population. Also, qualitative research helps researchers to identify issues and understand why they are important. Even though qualitative research can be used as part of formal or conclusive research, it is most commonly encountered when conducting exploratory research. After the completion of explanatory research, qualitative research is often followed by a quantitative study and qualitative research techniques are mainly used as part of the primary research process. One good example of adopting qualitative methods in the field of logistics and SCM is the work of Ellram & Edis (1996), which involves an exploratory case study of Kodak to identify factors influencing successful partnering implementation.

In contrast, the primary reason for adopting quantitative methods is to investigate how many units in a population have (or share) a particular characteristic or group of characteristics. It is specifically designed to produce accurate and reliable measurements that permit statistical analysis. Quantitative methods are particularly useful for measuring both attitudes and behaviour and such methods are most commonly encountered as part of formal or conclusive research, but they are also sometimes used when conducting exploratory research. Quantitative research techniques are part of primary research. The aim is to determine the relationship

between an independent variable and another dependent or outcome variable in a population (Kreft & Leeuw, 1997).

Qualitative Research	Quantitative Research
The data is usually gathered using less structured research instruments	The data is usually gathered using more structured research instruments
The results provide much more detail on behaviour, attitudes and motivation	The results provide less detail on behaviour, attitudes and motivation
The results are based on smaller sample sizes and are often not representative of the population	The results are based on larger sample sizes that are representative of the population
The research can usually not be replicated or repeated, giving it low reliability	The research can usually be replicated or repeated, giving it high reliability
The analysis of the results is much more subjective	The analysis of the results is more objective

Table III-1: The comparison of qualitative and quantitative research

However, there is often no clear distinction between the two different methods. Easterby-Smith, Thorpe & Lowe (1991) also pointed out that: "There is no clearer distinction between qualitative and quantitative methods, as often some techniques, such as interviews, can used to gather data in either a quantitative way or qualitative."

1.2 Methods Selected for This Research

One of the most challenging questions for novice researchers in the early stage of their research is probably 'selecting right research methodology'. In an attempt to select the most suitable research methodology, the various methodologies adopted by previous research covering similar topics and exploring the performance of collaborative inter-firm arrangement and its determinants were reviewed, in order to select appropriate research methods for this research. The majority of the research adopted 'survey methods' for data collection, (Harrigan, 1988, Geringer & Herbert 1990, Parkhe, 1990, Dyer, 1996, Stuart, 1997, Groves & Valsamakis, 1998, Moore, 1998, Glaister & Buckley, 1998, Maloni, 2000, Ellinger, 2000). Others, such as Reck & Long (1998), Ellram & Owen (1996), Whipple, Frankel & Anselmi (1999), have adopted 'case study' (qualitative research) methods for data collection, but the nature of these studies was mainly exploratory. In terms of data analysis methods, various analytical methods were adopted. The most commonly adopted analytical methods were simple statistical analysis techniques such as the t-test, correlation analysis and descriptive statistics, (Harrigan, 1988, Geringer & Herbert, Dyer, 1996, Ellram, 1996, Stuart, 1997, Spekman, Kamauff & Myhr 1998). Multiple regression analysis has also been frequently used for data analysis purposes (Harrigan, 1988, Dyer, 1996,

Saxton, 1997, Spekman & Kamauff, 1998, Ellinger, 2000). Also, the ANOVA was adopted by Parkhe (1993), Groves & Valsamakis (1998), etc. Emerging analytical techniques such as Structural Equation Modelling have been employed by Heide & Miner (1992), Moore (1998) and Maloni (2000).

As can be seen from the above discussion, apart from research of an explanatory nature, the majority of the studies with similar research questions adopted quantitative research methodology. A number of researchers suggested that the most important criteria when selecting research methods are all dependent upon the research questions. Ellram (1996) suggested that the selection of research methods should be made after consideration of the researchers' skill and the nature of the research questions. More specifically, Yin (1994) suggested three conditions to consider when choosing an appropriate research strategy (methodology), which consist of 1) the type of research questions posed, 2) the extent of control an investigator has over actual behavioural events, and 3) the degree of focus on contemporary as opposed to historical events.

Strategy	Form of research question	Requires control over behaviour events?	Focuses on contemporary events?
Experiment	How, why	Yes	Yes
Survey	Who, what, where, how many, how much	No	Yes
Archival Analysis	Who, what, where, how many, how much	No	Yes/no
History	How, why	No	No
Case Study	How, why	No	Yes

Table III-2: Relevant situations for research strategies, (Source: R., Yin, Case study research: design and methods (applied social research methods, Vol 5, 1997)

In terms of the present study, the major research questions posed in this thesis are mainly 'what and how much' type questions, and it is not necessary to have control over behaviour or events in this research. Also, these research questions do not investigate historical events, but are concerned with the contemporary events of supply chain partnership. Therefore, following Yin's three conditions of research strategies (methodology), the appropriate methodology for this research appears to be the survey method. Furthermore, the nature of this study is 'empirical study and theory testing' not 'explanatory or theory building'; thus, a quantitative method is more suitable for this research than a qualitative approach.

1.3 Structure of Chapter

In this research, a single survey was conducted on the Korean CPG[17] supply chains in order to collect data. Then, the collected data were analysed to achieve the three main research objectives by three analytical methods of 1) cluster analysis, 2) multiple regression analysis, and 3) MANOVA. This chapter on 'Methodology and Research Design' is to provide detailed information regarding the data collection and analysis of the data used in this research. This chapter consists of two sub-chapters, which are 1) data collection section (survey methods), and 2) analytical methods section. In the data collection (survey methods) section, firstly, an industry review of CPG supply chains in general and the Korean CPG supply chain in particular are carried out. Following this, the questionnaire design, the development of the measures and the administration of survey are discussed. In the analytical methodology section, a detailed review of all three major analytical methods 1) cluster analysis, 2) multiple regression analysis and 3) MANOVA is carried out.

2 Data Collection (Survey Methods)

In total, the data, 74 fully validated pairs of questionnaires, were collected from the Korean CPG supply chain participants by the survey method. In this section, firstly the Korean CPG industry is reviewed, then the population frame of the survey is discussed. Secondly, the structures and characteristics of the questionnaires are discussed in detail, then the process of developing measurements is presented. Finally, the administration of the survey is discussed in detail.

2.1 The Industry Review of the CPG Retail Industry in Korea

The main target of the data collection for this study is the CPG supply chains in Korea. The main reasons behind this is that the CPG retail industry has a complex supply chain structure, due to the various characteristics of the products, such as the low price, large quantity and high seasonality etc. For this reason, the CPG industry itself has been a pioneer for various supply chain partnership initiatives. Supply chain participants in Korea CPG supply chains are no exception. In this review, the characteristics of CPG supply chains and their challenges are firstly reviewed. Then, the current trends and the current market climate of the Korean CPG retail industry

[17] CPG (Consumer packaged goods) refer to consumable goods such as food and beverages, footwear and apparel, tobacco, and cleaning products. In general, CPGs are things that get used up and have to be replaced frequently, in contrast to items that people usually keep for a long time, such as cars and furniture.

are reviewed.

2.1.1 Characteristics of CPG Supply Chains and Challenges

A CPG supply chain has distinctive characteristics mainly because of the nature of commodities carried on it and the distinctive structure of the industry. Therefore, the types of challenge it faces are significantly different to those encountered in other industries.

2.1.1.1 Nature of CPG

The unique characteristics of CPG, which are, 1) 'perishable', 2) 'low-cost', 3) 'low-margin', and 4) 'high-variety', have been reported to create tough challenges to CPG SCM practitioners.

The first characteristic is that many CPG are time-sensitive. Rolstadås (1998) pointed out two major problems related to time-sensitiveness: 1) the quality of CPG, especially food and some type of drinks, is very sensitive to time, humidity, temperature and 2) the unpredictable stability of raw material supplies. In addition, Karolefski & Garry (2002) reported that the demand faced by the CPG industry is more severely exposed to the seasonal fluctuations such as holidays than other industries. All these factors cause a significant strain to the CPG supply chain. Fresh food distribution, in particular, adds a serious constraint and an extra burden to the effort of CPG supply chain optimisation. As a result, this increases uncertainty in terms of procurement, manufacturing and capacity planning in the CPG supply chain.

Secondly, usually CPG are relatively low-value products. According to the Financial Times industry survey on the CPG industry in the UK in 2000, tight margins are to be blamed for the low level of investment into the effort to improve supply chain efficiency by adopting new technology.

Thirdly, more than ever, manufacturers and retailers are presenting an increasing selection and variety of CPG product for consumers. According to Stewart & Martinez (2002), some supermarkets might carry as many as 40,000 individual CPG products. In addition, each product represents a different combination of product characteristics, such as type of packaging, package size, and brand in order to reflect ever-increasing consumer demands on variety of CPG. This all adds more complexity to the planning process for manufacturers and category management for retailers, and

this added complexity can decrease stock turnover and increase spoilage.

2.1.1.2 Challenges for CPG Supply Chains

A number of researchers have reported various challenges for CPG supply chains. Five major challenges facing CPG supply chains are discussed here.

Firstly, the retail out-of-stocks has been frequently referred to as the most common problem. According to a study carried out in 1998 by the National Pork Producers' Council in the US, retailers face an average of 29 percent out-of-stock for pork during peak shopping hours (Stewart & Martinez, 2002). This problem of items being out-of-stock remains the biggest challenge for the CPG supply chain. According to Biggs (2002), this chronic problem stems from the fundamentals of retail, which lie in the difficulty of balancing service level and cost. He pointed out that the sophisticated solutions available have been facilitating the cost control side; however, the effort of controlling the service level has been complicated by the increase of customer demand and ever increasing product ranges.

Secondly, Harris (2002) pointed out that the CPG industry has been exposed to the high rate of failure of new products introduction. Frequent new product failures add extra costs to supply chain partners, and this probably works as a pressure to push the consumer prices up and adds a greater burden to the inventory.

Thirdly, another well reported problem is that the CPG supply chain is vulnerable to 'inefficient promotion' at different levels of the supply chain. At the manufacturer level, food manufacturers often try to push their excess inventory one tier down by offering overstocked products at discounted prices. As Stewart & Martinez (2002) pointed out, such practices of promotion in the CPG manufacturing industry can increase distributor costs for managing larger and fluctuating inventories. As a result, these costs could be pushed to final consumers and further increase price volatility. At the retailer level, promotions by major large discount store retailers can cause a serious problem to their upper-tier partners. One well-known negative consequence is the 'bullwhip effect'[18] or 'demand amplification'.

[18] Lee, H., Padmanabhan., P. & Whang, S. (1997) defined 'the bullwhip effect' as the increase in variability as the information travels up the supply chain and suggested that 'frequent and uncoordinated promotion' of retailers is a main cause of the bullwhip effect.

The fourth challenge is related to the current market situation and changing market structure of the retail business. One of the distinctive trends of CPG supply chain is that down-tier retailers expand their operations by mergers and acquisition. According to Stewart & Martinez (2002), this has been driving significant structural changes across the CPG supply chain. The main motivation behind this can be explained by retailers' expansion strategies in order to achieve better customer service and profits. There is growing consumer pressure on CPG retailers to provide them with physically larger supermarkets to supply more goods and services (Karolefski & Garry, 2002). Other type of expansion, which include convenience-oriented physical expansion, can be very costly, as the larger stores reportedly have high costs for overhead and labour.

Finally, issues related to 'collaborative inter-firm arrangements in supply chain' are attracting significant attention among CPG retailers and manufacturers. Gregerson (2002) reported from the third annual best manufacturing practices survey in the US that 34% of the effort to improve supply chain management is related to establishing closer supplier partnerships. In particular, development of information technology is thought to have been facilitating the process and increasing the feasibility of collaborative initiatives in CPG supply chains (Walton & Princi, 2000). However, a recent report from the industry has concluded that the effort to create supply chain partnerships in the CPG industry is being delayed by the problems stemming from the behaviour of participants: lack of understanding and the need for more trust and commitment (Loudin, 2001). Traditionally, the relationship among CPG supply chain members can be described as 'transactional' or 'hostile' (Stewart & Martinez, 2002).

These behaviour-related obstacles of supply partnership are not new. Firstly, Loudin (2001) took the retailers' point of view to investigate these obstacles to close partnerships. According to his findings, manufacturers are excessively product-focused and lack the IT infrastructure to manage and analyse data. Consequently, retailers tend to increase the pressure on their manufacturers for closer partnerships and try to increase information sharing on consumer marketing activities with manufacturers in order to look into consumer needs and optimise category performance (Loudin, 2001). Manufacturers are not content with their customers regarding their efforts to collaborate. From the manufacturers' point of view, they

believe that retailers are excessively price-centric and traditionally are unwilling to collaborate with them. Manufacturers continue to ask their retail customers for more useful real-time based information to be shared. This lack of understanding of each other's needs and requirements can be a major obstacle for the forging of closer partnerships.

Secondly, the lack of trust is the other main obstruction to supply chain partnerships. Child & Faulkner (1998), Zaheer, McEvily & Perrone (1998) and Whipple, Frankel, & Anselmi (1999) suggested that trust and commitment will reduce the uncertainty and opportunism for partnerships and encourage them to engage in more collaborative activities such as information exchange. Both manufacturers and retailers agree that there should be more partnerships of information sharing, and that significant new investments in new systems and resources are required. However, the above problems obstruct the sharing of the cost of investment into new collaboration infrastructures and raise concerns on the part of retailers that sharing information will lead to a loss of their power over manufactures.

2.1.2 Importance of Retail Industry to Korean Economy

The retail industry in Korea has been a contributor to the growth of the Korean economy. The report by MOICE[19] in 2002 summarised the contribution of the retail industry to the Korean economy as follows.

Firstly, the retail industry in Korea has been one of the main sources of the growth of the national GDP. The percentage of contribution of the Korean retail industry to the GDP increased from 7.9% in 1998 to 9.5% in 2001. In addition, the retail industry has been playing a role in creating a significant amount of new employment. Since the opening of the Korean retail market to foreign companies in 1996, the average GDP contribution of the retail industry has significantly increased, from 9.3% between 1990 - 1995 to 11.2% in 2002 (Korea National Statistical Office, 2002). According to the forecast by MOICE, the GDP contribution is expected to increase to 11.8% by 2007. However, the GDP contribution of the retail industry is still lower than those of developed countries such as the US (15.7%), France (17.7%) and Japan (14%).

[19] The Ministry of Commerce, Industry and Energy, Korea

	Retail		Manufacturing		Agriculture	
	GDP	Employment	GDP	Employment	GDP	Employment
1998	7.9	19.1	30.9	19.5	4.9	12.4
1999	8.5	19.2	30.7	19.8	5.1	11.6
2000	9.2	18.1	31.3	20.1	4.7	10.9
2001	9.5	18.1	30.0	19.7	4.4	10.3

Table III-3: Economic contribution of Korean retail industry, (Source: Bank of Korea, Korea National Statistical Office, 2002)

Secondly, the retail industry plays an important role in terms of creating demand by matching consumers and manufacturers. Furthermore, it stimulates manufacturers to develop newer and more innovative products.

Thirdly, various SCM innovations and initiatives by Korean retailers especially in CPG retailers have contributed significantly to stabilise consumer prices in Korea. For example, the introduction of new retail channels has initiated reconstruction of the Korean retail industry. In particular, two major forms of new retail channel, large discount store and Internet/cable TV shopping channels created a huge impact in terms of dis-intermediation and simplification of the complex traditional retail network in Korea. As a result, the retail industry has contributed to a reduction of the consumer price by 1.79% between 1996 and 1999 (The Bank of Korea, 2000).

2.1.3 Opening-up Korean Retail Market (Regulatory Change)

The regulatory changes in the Korean retail market have played a vital role in shaping this retail market. The opening up of the Korean retail market started in 1981, when foreign investment was allowed in specialised shops whose floor size was less than 331 m^2. Since then, the opening up of the Korean retail market has progressed, as restrictions have been relaxed on 1) number and size of shops, and 2) limits to the amount of foreign investment in the retail industry and retail sectors. The Korean government initially slowed down the process of opening up the Korean retail market, as they believed that such drastic changes could result in an influx of foreign retailers, whose competition could destroy the foundation of local Korean retailers. However, the Korean government decided to implement a full-scale opening-up of the retail market in 1988 by announcing its 'five-step retail market promotion plan', which was the direct result of the Uruguay round (1986) and ever-increasing pressures from the US and EC. The full scale retail market opening-up

plan came into effect in 1996 and the two above-mentioned restrictions on 1) number and size of shops, and 2) limit of amount of foreign investment in retail industry and retail sectors were completely lifted (Kim & Kang, 2004). Since then, the majority of foreign direct investment has been focused on large discount stores, and the world's major retailers, such as Walmart, Carrefour, and Tesco, have started operations in Korea. The liberalisation of the Korean retail market came into effect in 1993. This new regulation relaxed restrictions on shop sizes and effectively allowed Korean local retailers to launch large, western type discount stores.

2.1.4 Current Trends in the CPG Retail Industry in Korea

Three major changes to the CPG retail business environment in Korea can be summarised as follows: 1) the advent of large discount stores, 2) the introduction of alternative CPG distribution channels, and 3) the growth of consumerism. These business environmental changes have been shaping the trend and the climate of the Korean CPG retail industry.

2.1.4.1 Advent of Large Discount Stores in Korea

The birth of the large discount store was triggered by 1) the opening up of the Korean retail industry and 2) the deregulation of the market. The opening up of the Korean retail market took place in 1996. This introduced an advanced retail mode, large discount stores, to the Korean market along with the deregulation of the CPG retail sector (2001, 2002, MOICE). Before 1996, there were only 19 discount stores operating in Korea, all run by local operators. However, the introduction of the advanced form of large discount store initiated the megarisation of the CPG retailer and slowed down the growth rate of other forms of CPG retails such as supermarkets and department stores. The number of large discount store has increased more than ten fold since the opening up of the market in 2002. According to the forecast by KCA (Korea Chainstores' Association), the number of large discount store in Korea is expected to rise to 378 by the end of 2005.

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
No of Stores	1	4	19	34	62	85	115	162	190	230

Table III-4: The growth of number of large discount stores in Korea, (Source: Ban, J., Supermarkets and supercentres, current trend and prospective, 2003)

2.1.4.2 Growth of Alternative CPG Retail Channels

The rapid diffusion of broadband Internet and cable/satellite TV since the middle of the 1990s has been providing Korean end-customers with more choice of where to buy, such as Internet shops or via TV shopping channels. Korea has a well-developed infrastructure for alternative CPG retail channels, especially for online shopping. Currently, more than 10 million people have access to high-speed broadband Internet services and 7.28 million people are shopping online. In addition, 45.3% of the entire female population, who are the major decision makers in terms of CPG purchases in Korea, are using the Internet and the number of female Internet users is expected to continue to increase (Lee, 2002). Regarding cable and satellite TV, despite their late introduction, more than 64% of Korean people have access to one of these services, and five major shopping channels (LG home shopping, CJ39, Hyundai, Harim and Eyevision) are available (2002, Korea National Statistical Office).

		2000	2001	2002
Internet Shopping	Turnover ($ million)	1,122	2,150	4,285
	%	5%	7%	12%
	Growth Rate	121.6%	91.6%	99.3%
TV Home Shopping	Turnover ($ million)	934	1,531	3,582
	%	4%	5%	9%
	Growth Rate	79.1%	63.9%	133.9%
Department Store	Turnover ($ million)	12,583	13,750	15,416
	%	54%	47%	40%
	Growth Rate	13.5%	9.3%	12.1%
Discount Store	Turnover ($ million)	8,833	11,750	14,917
	%	38%	40%	39%
	Growth Rate	39.5%	33%	27%
Total	Turnover ($ million)	23,473	29,181	38,201
	Growth Rate	NA	24%	31%

Table III-5: Comparison of internet shopping and TV home shopping to other forms of distribution channel, (Source: Korea national statistical office, forecasted from Hana research institute, Figures, 000,000 USD)

2.1.4.3 Growing Consumerism in Korea

Another change in the Korean CPG distribution market is growing consumerism (MOICE, 2002). The main driving force behind this change is easy accessibility to information from the Internet. As mentioned above, accessibility to the high-speed broadband Internet service in Korea is one of the best and cheapest in the world. As a

result, Korean consumers are able to express more diversified and sophisticated needs for new and better products and services. Using price comparison websites to get the best prices and terms is also a common online consumer activity. Participating in online communities to obtain product/service related information from fellow consumers' reviews is another major online consumer activity. Recently, there have been a number of cases of boycotts of certain manufactures and retailers in Korea, organised by consumers from Internet communities on. From the industry's perspective, the Internet is an important channel for obtaining information regarding their service level, customer satisfaction and new product development.

2.1.5 Structure of CPG Retail Industry in Korea

There are four major sectors within the Korean retail market: 1) large discount stores, 2) supermarkets, 3) department stores, and 4) convenience stores (Ban, 2003). The proportion of the total number of shops in these four major sectors accounted for 1.27% of the total number of retailers in Korea in 2000. However, they account for 22.88% of the total revenue generated by the retail sector.

Type of Retailers	Companies		Turnover ($ million)	
	Number	%	Amount	%
Total	693,701	100%	127,519	100%
Retail Sales in Non-Specialised Large Stores	132,612	19.12%	67,367	52.83%
Department Stores	110	0.02%	12,535	9.83%
Large Discount Stores	163	0.02%	8,863	6.95%
Supermarkets	5,285	0.76%	6,736	5.28%
Convenience Stores	3,271	0.47%	1,043	0.82%
Retail Sales of Foods, Beverages and Tobacco in Specialised Stores	123,242	17.77%	38,146	29.91%
Retail Sales of Pharmaceuticals and Medical Equipment, Cosmetics and Toilet Articles	134,534	19.39%	8,955	7.02%
Retail Sales of Textiles, Clothing, Footwear and Leather Goods	41,788	6.02%	3,940	3.09%
Retail Sales of Electrical Household Appliances, Furniture and Household Appliances	143,537	20.69%	13,115	10.28%
Retail Sales of Electric Goods, Kitchenware and Other Household Appliances	57,633	8.31%	12,226	9.59%
Retail Sales in Other Specialised Stores	166,631	24.02%	18,250	14.31%
Retail Sales of Used Goods in Stores	4,041	0.58%	188	0.15%
Retail Sales not in Stores	1,925	1.86%	3,477	2.73%

Table III-6: Retail industry in Korea in 2000, (Source: Korea national statistical office, 2001)

The three major forms of CPG products distribution are 1) large discount stores, 2)

supermarkets, and 3) the Internet and TV home shopping. Some large department stores have their own supermarket-type CPG retail spaces. However, this kind of CPG retail activity is not their main retail activity.

2.1.5.1 Large Discount Stores

Since the advanced form of discount store was introduced in Korea, this sector has been the front-runner of the CPG retail industry in terms of localising and implementing various SCM initiatives in Korea. In addition, it has contributed significantly to increasing the stability of prices for the consumer by 1) dis-intermedation of the complex traditional CPG supply chain, 2) price wars, and 3) SCM process innovations. MOICE estimates that the large discount store sector annually contributes to a reduction of consumer prices by an average of 0.45%.

Type of Retailers	1999		2000		2001		2002	
	Number	Turnover ($ million)	Number	Turnover ($ million)	Number	Turnover ($ million)	Number	Turnover ($ million)
Total	699,739	112,964	693,701	127,519	690,000	132,874	690,000	139,518
Department Stores	103	11,111	110	12,578	85	13,727	84	14,969
Large Discount Stores	116	6,309	164	8,864	193	11,657	235	14,652
Supermarkets	4,510	3,613	5,285	6,736	5,500	7,016	5,600	7,366
Convenience Stores	2,339	848	3,271	1,043	3,895	1,522	5,714	1,833
Total of four Majors Forms	7,068	21,881	8,830	29,221	9,673	33,922	11,633	38,820

Table III-7: Structural change of Korean retail industry since 1999, (Source: Korea national statistical office, 2003)

The large discount store sector is one of the fastest growing sector in the Korean CPG retail industry. As can be seen in Table III-8 below, the large discount store sector has been showing remarkable growth, not only in turnover but also in the number of new stores open. According to the KCA, the large discount store sector will catch up with the department store sector in annual revenue terms by 2003.

	Turnover (000,000 USD)					
		%	2001	%	2002	%
All Stores	8,864	100.00%	11,658	100.00%	14,652	100.00%
E-Mart	1,966	22.18%	2,858	24.52%	4,667	31.85%
Lotte Mart	843	9.51%	1,062	9.11%	1,917	13.08%
Carrefour	866	9.77%	958	8.21%	1,667	11.38%
Samsung Tesco	469	5.29%	1,047	8.98%	2,000	13.65%
Walmart	336	3.79%	474	4.07%	833	5.69%
	Number of Stores					
	2000	%	2001	%	2002	%
All Stores	164	100.00%	193	100.00%	235	100.00%
E-Mart	27	16.46%	41	21.24%	49	20.85%
Lotte Mart	17	10.37%	24	12.44%	32	13.62%
Carrefour	20	12.20%	22	11.40%	25	10.64%
Samsung Tesco	7	4.27%	14	7.25%	21	8.94%
Walmart	6	3.66%	9	4.66%	15	6.38%

Table III-8: The top 5 large discount stores and their annual turnover and number of stores in Korea, (Source: The report on Korean supermarkets and supercentres, Ban, J., 2003)

Currently, the large discount store market is dominated by the five major players. They account for 75.8% of all revenue from this sector. The current market leader is the local brand E-Mart. One unique phenomenon is that the strong multinational foreign major retailers such as Wal-Mart and Carrefour have not been able to perform well in Korea. Their failure to localise the store structure and service provided is to be blamed for their low performance (Forbes Korea 2003:7). However, Samsung Tesco has been doing reasonably well, as they started their operations in Korea in the form of a joint venture with the local large discount store 'Samsung Homeplus', which already had a strong presence in the market, and successfully localised their store structure and services on the basis of the knowledge of their local partner.

2.1.5.2 Supermarkets

According to the latest figures available, there were 5,285 supermarkets in Korea in 2002 with a total turnover of 67 billion USD, (Ban, 2003). The structure of the Korean supermarket sector is a two-tier system. The first tier represents a chain of supermarkets mainly located in large cities and run by large distribution companies. The second tier consists of small and medium sized family-run supermarkets. The

number of supermarkets belonging to the first tier supermarket chains (top 10 supermarket chains) is 228, and they account for 4.3% of the total number of supermarkets in Korea. However, their annual turnover is more than 12 billion USD, and this accounts for 26.9% of the total turnover of the Korean supermarket sector.

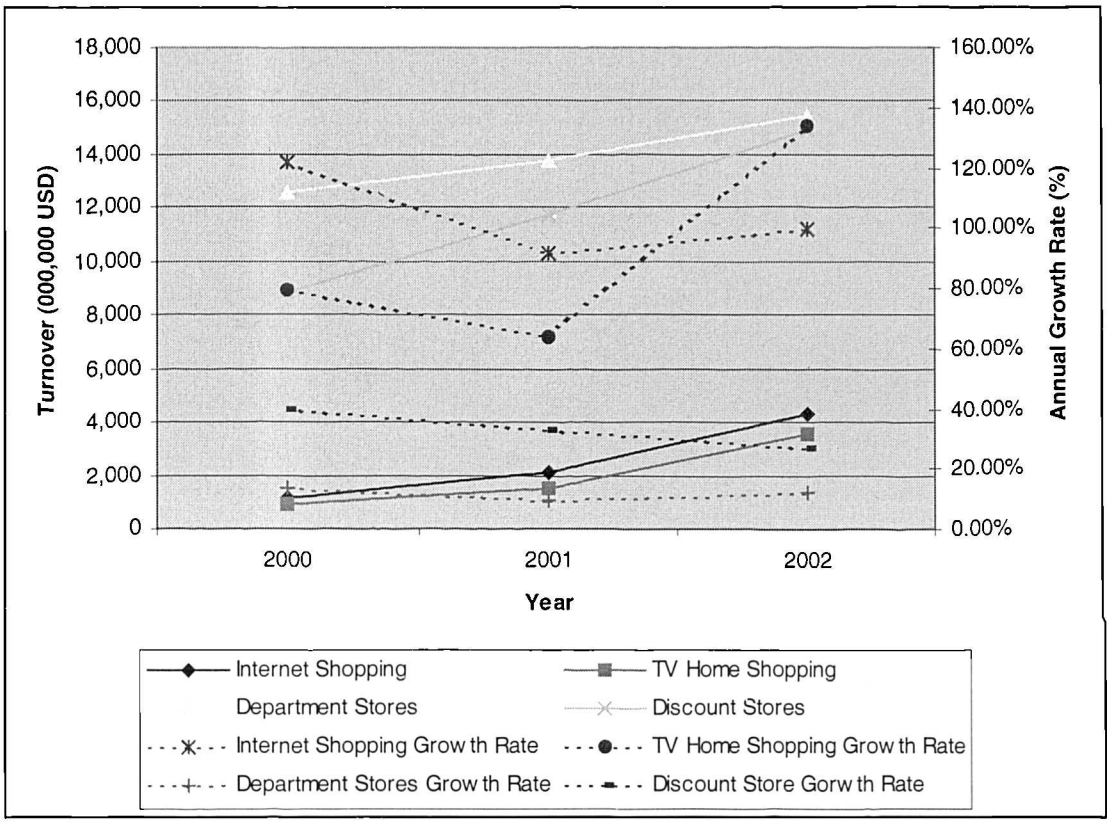
Supermarket Chains	Number of Shops	Turnover (Estimated)	%
LG Mart	66	558	8.3
Top Mart	32	404	6.0
Hanhwa	28	346	5.1
Haitai Stores	39	190	2.8
Suhyup	22	100	1.5
Top 5	187	1,598	23.7
Kolon Mart	8	67	1.0
CS Mart	7	42	0.6
Lottelemon	9	42	0.6
Bigsale Mart	11	33	0.5
Hanra Mart	6	31	0.5
Top 10	228	1,813	26.9
Rest of them	5,057	4,923	73.1
Total	5,285	6,736	100

Table III-9: Major players of Korean supermarket sector, $million, (Source: The report on Korean supermarkets and supercentres, Ban, J., 2003)

The supermarket sector has been the biggest victim of the introduction of large discount stores in Korea. As the pressure on the supermarket sector from large discount stores and department stores increases, the growth of the supermarket sector in terms of annual turnover and the rate of expansion has been slowing down drastically. In fact, the biggest threat comes from the rapid expansion of the large discount store sector. In order to survive this new competition, the first-tier supermarket chains have been adopting a new format of retail 'super super market (SSM)'. SSM refers to a supermarket with a size of between 1, 322 m^2 - 1,983 m^2, 6000 SKU[20] and parking spaces for more than 150 cars (Ban, 2003). However, the second tier supermarkets are expected to phase out in the future, due to the intense competition from the larger supermarkets.

2.1.5.3 Alternative Retail Channels (Internet and TV Home Shopping)

[20] Stock keeping unit



Graph III-1 : Comparison of Internet shopping and TV home shopping to other forms of distribution channel, (Source: Korea national statistical office, Figures, 000,000 USD)

The Internet and TV home shopping sectors are becoming popular channels for the distribution of CPG in Korea. In comparison with the discount and department store sectors, the amount of transaction made on these alternative channels is not very significant. However, the growth rates for the Internet shopping and TV home shopping sectors have been significantly higher than any other CPG retail sector (the three year average growth rates between 2000 and 2002 for Internet and TV home shopping were 104.1% and 92.3%). Therefore, these two channels hold huge potential as major distribution channels of CPG in the future. Approximately 26.6% of the total transactions made on the Internet in 2002 were related to CPG (Ban, 2003). The annual growth rate for CPG product sales is the highest of other products sold online, at 200.5%.[21] According to the figures for February 2002, there are 2,276 online shops and five major shopping channels are in operation. The total revenue from these two sectors is 7.8 billion dollar worth of products sold on the Internet and through TV home shopping, and 26.6% of the products are CPG (2002, Korea National Statistical Office).

[21] The data for TV homeshopping are not available.

The growth rates for these channels are expected to slow down to 40.8% (Internet Shopping) and 31.3% (TV Home shopping) in 2003. The main factors behind this slowdown are 1) the slowdown of the Korean economy in 2003 and 2) the reduction of investment from the major Internet shopping companies such as Samsung and Hyundai. Regarding Internet shopping in particular, after years of rapid growth, a period of cooling down and market restructuring is expected. Following this, steady and sustainable growth is expected in this sector. In terms of the home shopping sector, three new shopping channels (Hyundai, Harim and Eyevision) have been opened and this will intensify the competition.

Lee (2002) suggested that the following issues should be tackled in order to sustain the high level of growth for the alternative CPG retail sector in Korea. Firstly, the improvement of online security by implementing *trustmark* and secure payment system is required. The implementation of *trustmark* is expected to ease the major security barrier associated with online and TV home shopping, which will reassure and encourage consumers to shop more on these alternative channels. Secondly, a better payment system is required to reduce the cost related to the current payment system. Thirdly, an effort to reduce the logistics cost in collaboration with other sectors of CPG retail is required.

Having outlined the characteristics and problems of CPG supply chain overall and presented an industry review of Korean CPG supply chains, I will now discuss the data collection and analytical methodology employed in this study.

2.2 Sampling Frame

The initial step in any sampling process is the selection of an appropriate target population and the identification of population parameters. The determination of the target population always depends upon the particular objectives of the study. In addition, the target population must be well-defined if implementation of the measurement process at the field level is to be successful.

In this study, the target population is the CPG supply chain in Korea. The main reasons behind this decision are, firstly, that CPG supply chains are typically exposed to the problems caused by heavy promotion of downstream customers such as supermarkets and inaccurate demand forecasting, and secondly, the CPG supply chain is among the first industries to implement various supply chain partnership

initiatives.

As Tull & Hawkins (1993) suggested, a sampling frame is intended to represent the members of the population, and the ideal sampling frame is a complete listing of all members of the population. However, Flynn *et al.* (1990) argued that depending on the research question, a survey can be administrated to a certain group which is homogeneous with respect to at least one characteristics rather than sampling at random from the entire population. This research is intending to achieve 1) classification of supply chain partnerships, 2) identification of factors behind successful supply chain partnerships, and 3) clarification of the link between perception asymmetry and the performance of partnerships. However, sampling the entire population of Korean CPG supply chain at random would decrease the likelihood of selecting enough supplier-customer relationships at the stage of partnerships. Therefore, a sampling frame was constructed by providing a rule defining membership; in this case, 'annual turnover of customer' was used. The rationale behind this membership is that supply chain partnerships are more likely to exist in business relationships between retailers and their major suppliers, due to the size of transaction that can justify the resource allocation.

In total, fifty-four companies (thirty-four large discount store chains, ten supermarket chains, five Internet shopping outlets and five TV home shopping channels) in the category of CPG retailers were selected from various sources such as publications from the Korea National Statistical Office, the Ministry of Trade, Energy and Industry and the Korea Chainstore Association. In terms of discount stores, all companies which are currently operating one or more discount store(s) in Korea were included in the population frame, with the assumption that discount stores tend to have more active partnerships with their suppliers. The number of the headquarters of large discount store contacted for the survey was thirty-four, which is the number of the total population of discount stores in Korea. In total, ten supermarket chains were contacted. As mentioned above, the majority of Korean supermarkets are small and medium sized family-run supermarkets, where little supply chain partnership exists, so the rule of defining membership based on an annual turnover of at least 25 million was applied. As a result, in total ten supermarket chains with annual turnover of more than 25 million UDS were selected from the directory of supermarket chains published by the Korean Chainstore Association. In terms of alternative retail

channels, similar logic was applied. As a result, five home shopping channels, (the population size of home shopping channels is five), and the top five Internet CPG retail companies by annual turnover were selected from the data provided by the Korean National Statistical Office and the Ministry of Trade, Energy and Industry.

2.3 Questionnaire Design

The research instrument of this research is a self-administered postal questionnaire with closed questions. Various researchers have used this type of instrument, as it is relatively cost-effective and enables data collection from a large sample with wide geographic coverage. It has been reported that such instruments have a number of problems, such as low response rates, undetectable ambiguities and non-response bias.

2.3.1 Main Characteristics of Questionnaires

The questionnaires used in this study were intended to obtain information regarding measures for supply chain partnership performance and its determinants (Appendix 4).

The main characteristics of this survey are as follows: firstly, it was a targeted survey of personnel involved in partnership management, such as merchandisers and procurement managers from retailers and sales persons and account managers from the supplier side, as the literature has identified them as key informants about supply chain partnership performance issues.

Secondly, a major concern that arises when a study of collaborative inter-firm arrangement is conducted is 'perception asymmetry' between partners. This occurs in partnership research due to the multiplicity of participants of such inter-firm arrangements. For example, the performance of a supply chain partnership and the status and situation of that partnership could be perceived very different by the participants at different levels of the supply chain. In the case of information exchange, for instance, a supplier might be satisfied by receiving its customer's demand forecast information. On the other hand, the customer might not be very happy, as they feel that they are losing bargaining power by releasing information. In such situation, if the performance data regarding the information exchange aspect of the partnership is only collected from one side, the outcomes of that kind of research could be potentially different depending on which side the data was collected from.

Unfortunately, a large number of previous studies in this field are potentially exposed to this problem and often misrepresent the performance of a partnership, as their data are collected only from one side of the alliance or partnership (Hamel 1990). In order to minimise the possible bias from performance asymmetry, and for cross-validation purposes, a set of questionnaires were asked to both the supplier and the retailer in order to minimise the perception asymmetry on 1) the five major determinants of a supply chain partnership and 2) the performance of a supply chain partnership. In total, twenty-eight out of a total of thirty-three (customers) and thirty-six (suppliers) questions were posed to both sides, and these questions were either identical questions or a set of questions measuring the same aspects but re-phrased for different participants at different levels of the supply chain. Thus, a set of completed questionnaires from both the supplier and customer of a partnership becomes a valid pair for analysis.

2.3.2 Structure of Questionnaire

A pair of questionnaires is consisted of 'Type A (for CPG suppliers)' and 'Type B (for CPG customers)', which contain thirty-six and thirty-three questions respectively. These questions fall into five categories, according to the partnership participants targeted and the type of information they are intended to obtain. These categories are as follows.

- Category 1: These questions were asked to all participants of the survey. The information they intended to obtain was related to companies' attitudes towards the idea of supply chain partnership.

- Category 2: These questions were asked to the suppliers of supply chain partnerships. The information they intended to obtain was: 1) the determinants of supply chain partnership performance from the suppliers' perspective and 2) supplier-specific information regarding their supply chain partnerships.

- Category 3: These questions were asked to the customers of supply chain partnerships. The information they intended to obtain was: 1) the determinants of supply chain partnership performance from the customers' perspective and 2) customer-specific information regarding their supply chain partnerships.

- Category 4: A set of questions were asked to the suppliers of supply chain partnerships in order to measure the performance of their supply chain partnerships from the suppliers' perspective.

- Category 5: A set of questions were asked to the customers of supply chain partnerships in order to measure the performance of their supply chain partnerships from the customers' perspective.

Each of a pair of questionnaires was created by combining the above five elements of questions (Table III-10).

	Category 1	Category 2	Category 3	Category 4	Category 5
Type A	✓	✓		✓	
Type B	✓		✓		✓

Table III-10: The structure of the questionnaires

2.4 Development of Measures

2.4.1 Measurement Approach for Determinants of Supply Chain Partnership Performance

Firstly, thirty-six questions for CPG suppliers and thirty-three questions for CPG retailers were developed in English, on the basis of previous research that has measured five theoretical constructs of the partnership performance, namely: 1) trust, 2) partner asymmetry, 3) joint partnership management system, 4) relationship-specific assets, and 5) information technology. Two interviews were conducted with the head of Nestlé UK supply chain development[22] and his team members in order to check the appropriateness of measurement items. Then, the measurement items were checked by a survey expert[23] to ensure the appropriateness of structure and wordings. Then, these measures were translated into Korean. In order to preserve the measuring power of the questionnaire items during the translation, the translated questions were carefully reviewed by two Korean SCM academics[24] and nine field practitioners.

2.4.1.1 Information Exchange

Ten questions were developed to measure various aspect of information technology as a major determinant of performance of supply chain partnership. The aspects of

[22] Mr. Martin Green, the Head of Supply Chain Development, Nestlé UK, Croydon, UK
[23] Dr. Richard Wiggins, Social Research Methodology Centre, City University, London, UK
[24] Professor Jon, Joon-Soo, Sogang University, Seoul, Korea, and Dr. Hong, Eui, Cass Business School, London, the UK

information technology covered by these questions were: 1) structure of IT system and IT capacity for sharing information with partners, 2) willingness to share information with partners, and 3) type of information exchanged and quality of evaluation.

Structure of IT system and IT capacity for sharing information with partners

It is clear that if each partner has a unified data flow such as ERP, this will facilitate the process of supply chain partnership by increasing the efficiency of data flow (Chrisopher 1996, Simchi-Levis, Kaminsky & Simchi-Levis 1999, Shapiro 2000). According to the four-stage supply chain integration model developed by Stevens (1989), internal supply chain integration is possible after functional integration of the internal supply chain, and this leads to external collaboration among customers and suppliers. Shapiro (2000) argued that this internal supply chain integration is achieved by creating 'centralised databases' to which all business applications can have access, and applications such as ERP facilitates the creation and management of corporate databases, which offer transitional databases and are standardised across the company, thereby facilitating integration of supply chain activities. These centralised databases allow more efficient communication.

One question was developed on the basis of the above proposition to measure the degree of existence of integrated database system and approach methods for internal and external information exchange.

Question directed to both customers and suppliers:

- My company maintains an integrated database and access method to facilitate internal and/or external information sharing (Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree)

The performance of a supply chain partnership can be increase by improving the quality and quantity of information and the capacity to process it (Clemons & Row, 1993). In order to measure the capability to share information with their partners, two questions were developed; these are the capability to share 1) customised and 2) standardised information.

Questions directed to both customers and suppliers:

- My company has the ability to share standardised information externally with the customer/supplier (the company name of specific partner is shown here), (modified from

Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree)

- My company has the ability to share customised information externally with the customer/supplier, (the company name of specific partner is shown here), (modified from Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree)

Willingness to share information

'Willingness to share information' is an important aspect of information exchange. The willingness of each partner is measured by the following question. This question was also asked to their counter-parts in the partnership in order to increase the validity of answers.

Question directed to suppliers:

- The customer (the company name of specific partner is shown here) is willing to share SCM information with us (7-point Likert scale, strongly disagree – strongly agree).

Question directed to customers:

- The supplier (the company name of specific partner is shown here) is willing to share SCM information with us (7-point Likert scale, strongly disagree – strongly agree).

Types of information exchanged and its quality

Whipple, Frankel & Anselmi (1999) argued that the quality of information, which is measured by the accuracy, timeliness and appropriateness of the information, is closely linked with the performance of inter-firm partnerships. The questions to identify the types of information exchanged were developed on the based of the classification of information exchanged among supply chain partners by Lee & Whang (1998). They classified information exchanged among supply chain partners in six different categories, which are: 1) inventory level, 2) sales data, 3) order status for tracking, 4) sales forecast, 5) production/delivery schedule, and 6) others, such as performance metrics and capacity. Regarding the evaluation of the quality of information exchanged, a single perceptual measure, in the form of a 7-point Likert scale for the satisfaction of partners on the information they receive from their counterparts, was developed. The main rationale behind this single perceptual measure is that boundary-spanning members of companies (who are the main informants of this survey) are not capable of evaluating the quality of information in detail, as Whipple, Frankel, & Anselmi (1999) suggested.

Questions directed to suppliers: (Based on Lee & Whang 1998)

- Demand forecast information from the customer (the company name of the specific partner is shown here) (7-point Likert scale, very poor – excellent).
- Performance related information from the customer (the company name of the specific partner is shown here) (7-point Likert scale, very poor – excellent).
- Promotion related information from the customer, (the company name of the specific partner is shown here) (7-point Likert scale, very poor – excellent).
- Sales related information from the customer (the company name of the specific partner is shown here) such as POS data (7-point Likert scale, very poor – excellent).

Questions directed to customers: (Based on Lee & Whang 1998)

- Inventory level information from the supplier, (the company name of the specific partner is shown here), (7-point Likert scale, very poor – excellent).
- Order related information from the supplier, (the company name of the specific partner is shown here), (7-point Likert scale, very poor – excellent).

2.4.1.2 Trust

Trust is regarded as an important determinant of supply chain partnership performance. Parkhe (1993), Child & Faulkner (1998), Zaheer, McEvily, & Perrone (1998), and Whipple, Frankel, & Anselmi (1999) suggested that trust reduces uncertainty and opportunism and this enables partnerships to perform better. Four questions were developed in order to measure various aspects of trust in supply chain partnerships.

Questions directed to both customers and suppliers:

- The customer/supplier is one of our prime suppliers/customers, (the company name of the specific partner is shown here), (Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).
- The business relationship with the customer/supplier is based on trust, (the company name of the specific partner is shown here), (Parkhe, 1993, 7-point Likert scale, strongly disagree – strongly agree).

These questions were directed to both parties involved in the supply chain partnership. The same questions were asked to both parties for the purpose of cross-validation and to minimise asymmetry of perception of the level of trust among partners. If they regard each other as a prime partner, this indicates the existence of

high amount of trust in their partnership.

Questions directed to suppliers:

In a supply chain partnership in the CPG industry, larger customers such as major large discount stores tend to have higher bargaining power. As a result, large supermarkets and large discount stores as customers tend to exploit their mediated power, such as coercion, legal, legitimate and reward to influence their suppliers (Maloni & Benton, 2000) rather than non-mediated power such as trust. This question was directed to suppliers and designed to measure their trust for their customers by asking if the governance structure of their partnerships was based on non-mediated power such as trust.

- My company feels that the customer (the company name of the specific partner is shown here) leads the business relationship by exercising power, (Maloni & Benton, 2000, 7-point Likert scale, strongly disagree – strongly agree).

Question directed to Customers:

- My company intents to avoid exercising power to the supplier (the company name of the specific partner is shown here), (Maloni & Benton, 2000, 7-point Likert scale, strongly disagree – strongly agree).

2.4.1.3 Joint Partnership Management System

Well performing partnerships are known to have a high degree of joint partnership management system (Parkhe, 1993, Stuart, 1997, Moore, 1998, Saxton, 1999, Bowersox, Coss & Stank, 1999, Whipple, Frankel, & Ansemi 1999, Ellinger, 2000). Joint partnership management systems consist of 1) well-defined structure for developing, maintaining and monitoring partnerships, including role specification, 2) joint decision-making systems, and 3) risk and benefit sharing systems, all supported by regular and mutual communication between partners.

In total, six questions were adopted/developed to measure the above attributes of the joint partnership management system.

Questions directed to both customers and suppliers:

For the purpose of minimising perception asymmetry, the following questions were asked to both customers and suppliers to assess the degree of joint partnership management system of 1) partnership development management system, and 2) benefits/risks sharing system

- My company has guidelines for developing, maintaining and monitoring supply chain partnership, (Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).
- Benefits/risks from the business relationship with the customer/supplier (the company name of the specific partner is shown here) are fairly shared, (Modified from Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).
- My company clearly defines roles and responsibilities with the customer/supplier, (the company name of specific partner is shown here), (Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).

Questions directed to customers:

This question was designed to explore the degree to which there were rules of partnership management in the situation of leadership by customers, which is common in CPG supply chains.

- In leadership situations, my firm has clearly specified ranges of acceptable behaviour in supply chain partnership, (Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).

Questions directed to suppliers:

One of the important elements of a joint partnership management system is 'mutuality'. The first question was directed to suppliers to enquire about whether there is any opportunity for them to take part in their customers' decision-making processes customers, and the second question is about the existence of 'regular and mutual communication', which is an important enabler of joint partnership management systems.

- My company has a track record of taking part in strategic decision-making of the customer, (the company name of specific partner is shown here), (7-point Likert scale, strongly disagree – strongly agree).
- My company has regular communication with the customer on non-operational and operational issues, (the company name of the specific partner is shown here), (Modified from Bowersox, Closs & Stank, 1999), (7-point Likert scale, strongly disagree – strongly agree).

2.4.1.4 Partner Asymmetry

Non-complementary diversity or partner asymmetry is known to negatively affect the

performance of a partnership (Harrigan, 1988, Hamel, 1990, Parkhe, 1991 Saxton, 1997, Bowersox, 1999, Handfield, 2000). The possibility of partner asymmetry in supply chain partnerships exists at meso and micro conceptual levels of diversities in strategic direction and management practices, and organisation. Saxton (1997) and Bowersox (1999) concluded that these meso and micro conceptual levels of asymmetry influence the performance of supply chain partnerships negatively. Bleeke & Ernst (1993) and Faulkler (1995) similarly concluded that partners with less non-complementary diversity can achieve greater efficiency of co-operative work and, furthermore, tend to develop trust as well as positive learning processes between them more easily.

In this study, two questions are developed to measure diversity at the meso and micro conceptual levels. The items were taken from the study of Lambert, Emmelhainz, & Gardner in 1996. Originally, these researchers developed five questions as measures for the existence of partner asymmetry; however, during the process of the interviews with the field supply chain practitioners, they pointed out that three of these questions could not be answered by the target informants of this survey. Thus, these items were subsequently excluded from the survey instrument.

Questions directed to both customers and suppliers:

- The customer/supplier (the company name of the specific partner is shown here) has a similar degree of willingness to change compared to us (Modified from Lambert, Emmelhainz, & Gardner, 1996), (7-point Likert scale, strongly disagree – strongly agree).
- The customer/supplier (the company name of the specific partner is shown here) places as much importance and value on keeping commitments compared to us, (Modified from Lambert, Emmelhainz, & Gardner, 1996), (7-point Likert scale, strongly disagree – strongly agree).

2.4.1.5 Relationship Specific Assets

Relationship specific assets are known to have positive effect under certain conditions on the performance of collaborative inter-firm arrangements (Williamson, 1975, Dyer & Ouchi, 1993, Heide & Stamp, 1995, Dyer 1996, Artz 1999, Handfield 2000, Houston & Johnson 2000). In terms of supply chain partnership, where the information exchange is a major form of collaborative activities, Ellram (1992) and Stank, Crum & Arango (1999) underlined the importance of a tailored information

system as an important enabler for a successful supply chain partnership. For a number of previous studies on supply chain partnerships and asset specification, the data were only collected from the suppliers' side, as they focused on the OEM structure of supply chain partnerships. On the other hand, in other forms of supply chain partnership, partnership-specific investment is possible from both suppliers and customers. In order to avoid the above pitfall of past research, the following measures were asked to both customers and suppliers. Two questions are designed to measure the existence of relationship-specific assets from the perspectives of 1) IT relationship-specific assets and 2) non-IT relationship-specific assets.

Question directed to both customers and suppliers:

- My company has invested in technology designed to facilitate information exchange with the customer/supplier, (the company name of the specific partner is shown here), (modified from Bowersox, Closs & Stank, 1999, 7-point Likert scale, strongly disagree – strongly agree).
- My company has a track record of investing non-IT relationship specific assets, which is related to the customer/supplier (the company name of the specific partner is shown here), (Bowersox, Closs & Stank, 1999), (7-point Likert scale, strongly disagree – strongly agree).

2.4.2 Measurement Approach for Performance of Supply Chain Partnership

2.4.2.1 Appropriateness of Measures for the Performance of Supply Chain Partnership

As mentioned above, the majority of the studies in this field have been conducted on equity alliances, where more than one independent company were involved in equity relationships such as joint ventures. However, the nature of the majority of supply chain partnerships is closer to non-equity collaborations. This raises a major concern related to the appropriateness of adopting the measures used for measuring equity partnership performance for measuring supply chain partnership performance.

Geringer (1998) suggested that the motive behind the choice of an alliance form is a product of considerations that reflect the following factors: 1) differences in the organisations' strategic goals, 2) variation in the ranges and means of expected life spans of particular modes, 3) nationality of a partner organisation, 4) a mode's appropriateness or desirability in different contexts, and 5) the level of commitment

of the partner organisation. He concluded that these factors are likely to result in a difference in objective measures for the performance between non-equity and equity alliances and in subjective measures, as they produce different bases for satisfaction for the non-equity alliance (e.g. supply chain partnership). For example, it is obvious that certain objective measures such as stability of ownership may not be appropriate for the purpose of measuring the performance of supply chain partnerships, as they seldom include equity ownership. Using subjective measures for a non-equity alliance could give rise to similar problems. The subjective measures used in the previous studies were mainly designed to assess the level of perceptual satisfaction of the parent firms with the degree of contribution on various corporate objectives of the parent firms. However, in the case of supply chain partnerships, they are formed to achieve a rather more specific purpose, such as implementing collaborative forecasts. Thus, in order to measure the performance of supply chain partnerships, a special measure reflecting the level of perceptual satisfaction on the level of achievement on the supply chain partnership-specific objectives are need.

In the following section, the appropriateness of re-applying the existing measures is discussed.

2.4.2.2 Appropriateness of Objective Measures

Financial Measures

While a number of financial measures from primary and secondary sources are readily available for application to equity collaborations, few such measures are available for supply chain partnerships. In addition, using financial measures such as ROI, profitability, growth and cost position of the participants as an indicator of performance can be difficult, because 1) the absence of an equity relationship makes it difficult to assess the financial contribution of each partner of a supply chain partnership and 2) financial contribution to the partners' firms is often aggregated into the corporate-wide financial indicators.

Termination and Survival

Unlike the case of equity collaborations such as international joint ventures, there is no secondary data source for the information regarding the termination and survival of a supply chain partnership. Obtaining such information from primary and secondary data sources would be time-consuming and unreliable, as few companies

keep such records and often the only way to obtain the information is to extract it from other archival data or the memories of the personnel.

Stability

The stability of a collaborative inter-firm arrangement refers to the liquidation or significant changes of ownership of such arrangements. As supply chain partnerships do not generally include equity relationships, this measure is not of much use for the case of supply chain partnership performance.

Duration

A typical starting point of a supply chain partnership is a buyer-supplier relationship which begins as a 'transactional relationship'. If there is a certain degree of satisfaction with the transaction by both parties, and expectation of future transactions, resources, and shared long-term strategic goals, then the relationship may evolve into more collaborative form of buyer-supplier relationships. For this reason, applying this measure as an indicator of the performance of a supply chain partnership can be complicated due to the difficulty of identifying the precise length of the period for which two partners have been in a 'partnership'.

In conclusion, it may not be appropriate to make direct use of the three major objective measures and the financial measures used in previous studies for the performance of a supply chain partnership in their current forms. The development of measures for the supply chain partnership will be discussed in the later section of this thesis.

2.4.2.3 Appropriateness of Subjective Measures

Subjective perceptual measures have been employed to gauge the performance of a partnership and assess the level of satisfaction of partnership participants and the extent to which the partnership has achieved its objectives of forming such collaborative inter-firm arrangements (Geringer & Herbert, 1991, Glaister & Buckley, 1998). The majority of the previous research has covered many different type of inter-firm arrangement in the same population frame and studied them together; for example, the study by Glaister & Buckley (1998) included non-equity research alliances and international joint ventures in the same population frame. Thus, it was inevitable that they would select simpler and more generic measures, which can be used extensively over many different formats of alliance, such as a single perceptual measure of parents firms' satisfaction.

Instead of using simple and generic measures, a more sophisticated and supply chain partnership-oriented subject performance measure can be developed to measure the performance more effectively and comprehensively, as the type of partnership to be investigated in this research was confined to supply chains and the objectives of such partnerships are more specific.

2.4.2.4 Measures Used in this Research

As mentioned above, measuring the performance of a partnership is not easy and can sometimes be controversial. The main measures used for this study were mainly subjective measures, as discussed above; the major objective measures such as finance, duration, stability and termination were not appropriate for the measuring the performance of a non-equity collaborative inter-firm arrangement. The system for the measurement of supply chain partnership performance was developed on the basis of 1) the scheme for classifying alternate approaches for measuring business performance suggested by Venkatraman & Ramanujam (1986) and 2) the multi-dimensionality of partnership performance suggested by Kale, Dyer & Singh (2001).

Firstly, 'the scheme for classifying alternate approaches for measuring business performance' refers to the scheme for selecting different types of performance indicators and their sources. According to Venkatraman & Ramanujam (1986), when financial data from primary and secondary data sources are not available to measure business performance, the 'cell 4 (measurement approach E)' approach can be used to measure the performance. This approach is appropriate for measuring the performance of supply chain partnerships for the following reasons. Firstly, it can be difficult to separate the effect of well performing supply chain partnership from the aggregated financial data of the participants available from primary and secondary sources. Secondly, supply chain partnership performance operational data are not available from secondary data sources. Thus, the data on financial and operational indicators for the current research were collected from the primary source, which was the CGP supply chains themselves.

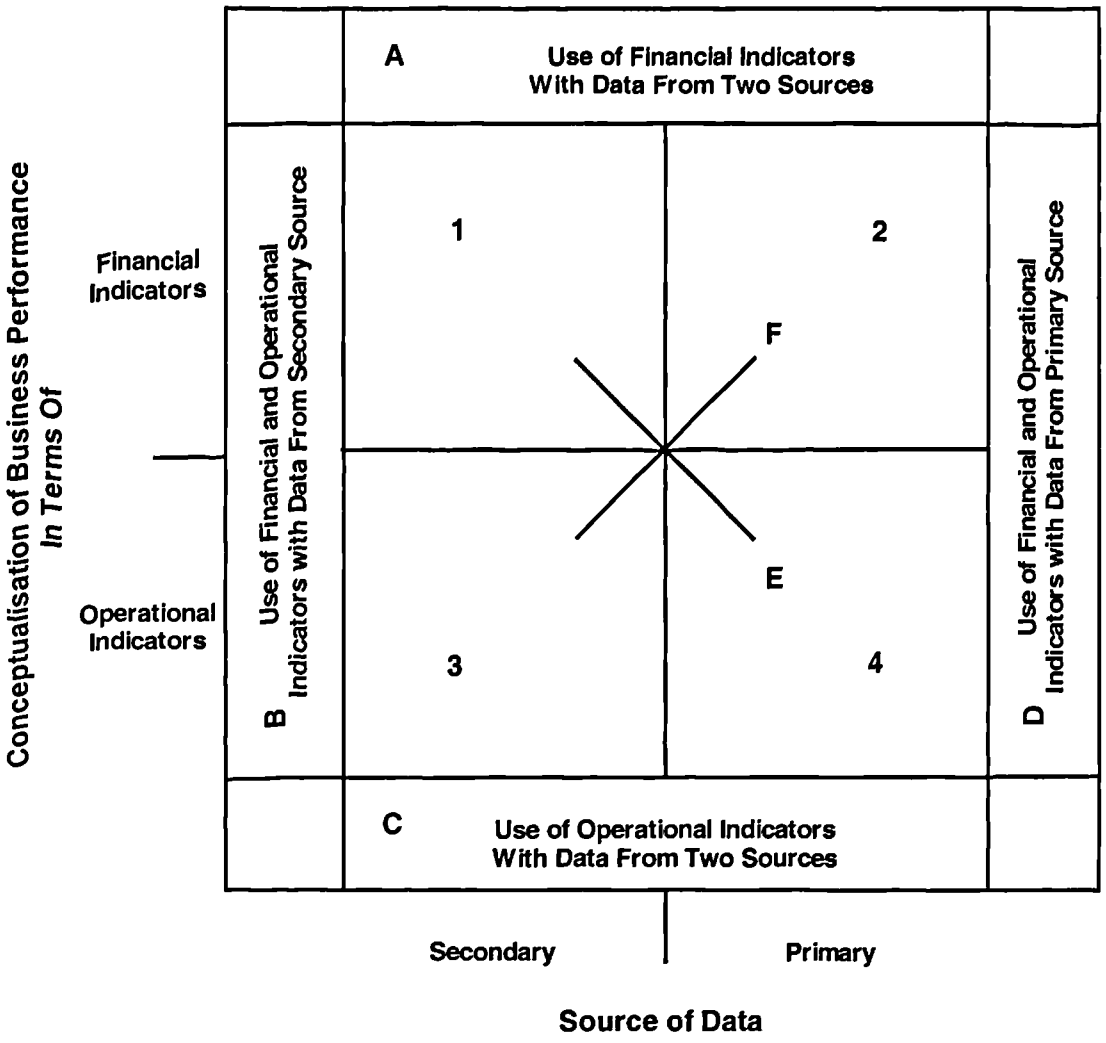


Figure III-1: The scheme for classifying alternate approaches for measuring business performance, (Source: Venkatraman & Ramanujam, Measurement of business performance in strategy research: A comparison of approaches. *Academy of Management Review*, 11 (4) 801-816, 1986)

Secondly, as mentioned above, the use of multiple measures helps researchers to cover different views on which aspects of performance to measure (Anderson, 1995, Glaister & Buckley, 1998), and understand how successful these measures indicate the performance to be. It also adds a great strength to the alliance research, as it provides broader and richer insights (Geringer, 1998). Thus, the concept of the multi-dimensionality of partnership performance suggested by Kale, Dyer & Singh (2001) was incorporated into the measurement development. They argued that the performance of a partnership should be viewed from multiple–dimensions, taking account of the extent of 1) achievement of its goals, 2) enhancement of the competitive position of the parent company, 3) learning, and 4) the harmony exhibited by the partners. The main idea of the multi-dimensional approach to performance measurement has been partially adopted for this study. Three

dimensions of measures were used to gauge the performance of supply chain partnerships from three different dimensions, 1) extent to which goals were achieved, 2) enhancement of company's competitive positions, and 3) contribution of partnership to participating companies at an SCM operational level.

2.4.2.5 Extent to which Goals were Achieved

One of the base motives of forming a partnership is making a positive contribution to the achievement of each party's own operational/strategic objectives. Unlike equity alliances, where the alliance itself often has a clear set of independent objectives, such as market penetration of an international joint venture, the objectives behind the forming of a supply chain partnership are often the pre-existing internal corporate objectives of each partner, such as decreasing inventory levels. A number of studies have set out to identify the goals of forming an alliance. Contractor & Lorange (1988) identified seven main goals of forming collaborative inter-firm arrangements. These are: 1) risk reduction, 2) economies of scale and/or rationalisation, 3) technology exchanges, 4) co-opting or blocking competition, 5) overcoming government or investment barriers, 6) facilitating international expansion, and 7) complementary contributions of partners in a value chain. The empirical study by Whipple (2000) identified several major motives of forming partnerships in supply chains. He found that the major motives of the participants in supply chain partnerships vary significantly depending on their locations on the supply chains. For example, for material suppliers the most important reason for forming a partnership is the reduction of lead-time. On the other hand, for customers, increasing customer service is the most important reason for forming a partnership.

Material Supplier	Customer	Service Supplier
1. Reduced cycle time/ lead time	Increased customer service	Increased customer service
2. Reduced inventory	Reduced cycle time/ lead time	Reduced cycle time/ lead time
3. Stabilised supply/ demand	Improved quality	Improved quality
4. Improved quality	Increased customer loyalty	Internal cost saving
5. Increased customer service	Increased customer involvement	Achieve core competency

Table III-11: Top five manufacturers' motives for alliance formation, (Source: Whipple J., Journal of Business & Industrial Marketing, Vol. 15 No. 5, 2000)

In this study, the extent of goal achievement was used as a measure of the performance of partnership. Measurement of the extent of goal achievement as an indicator of the performance of alliances was used by a number of authors such as

Parkhe (1993) and Kale, Dyer & Singh (2001).

In this study, participants were asked an open question which required them to identify three main objectives of their supply chain partnership with a specific partner. The main reasons behind the decision to adopt this open question are as follows. Firstly, the data collection for this study was targeted to multiple partners of supply chain partnerships. As Whipple's study suggested, supply chain partners tend to have many different objectives for taking part in a partnership and these objectives are not necessarily identical to those of their partners. Secondly, identifying and categorising motivations of forming partnerships is not the main purpose of this study. Initially, participants were asked to identify up to three of their goals, and were then requested to evaluate the extent to which these goals had been achieved.

Questions directed to both customers and suppliers:

- List as many as three main objectives of your supply chain partnership with the customer/supplier (the company name of the specific partner is shown here). After the completion of this, respondents are requested to evaluate the achievement of the goal(s), (7-point Likert scale, very poor – excellent).

2.4.2.6 Enhancement of Company's Competitive Positions

Well performing supply chain partnership have a positive influence not only on the operational level performance indicators, but also on the company's competitive position-related indicators such as the profit level of a participant's company. Eight subjective measures were used to measure this influence of supply chain partnership for the various attributes of companies' competitive positions.

The subjective measures used in this study were derived in the manner followed by Geringer & Herbert, (1991). The levels of satisfaction of the participants of supply chain partnerships on eight individual dimensions of performance were used. Originally, Geringer & Herbert (1991) and Glaister & Buckley (1998) measured fourteen individual dimensions of alliance performance and respondents were asked to rate the alliance's actual performance versus their initial projection. Six individual dimensions of performance, which were not appropriate to supply chain partnerships, were dropped in the current study. The idea of comparing initial projection of performance and actual performance of alliance suggested by the authors could not be adopted for this study, as often there is no clear starting date for a supply chain

partnership. This makes it difficult to obtain data for the initial projection of performance (unlikely other equity ventures, a buyer-seller relationship tends to naturally evolve into a state of partnership from an arm's-length transactional relationship).

Examples of the Subjective Performance Measures			
Single Perceptual Measure (Killing, 1983)	Three Point Measure of 'Poor, Satisfactory, Good' on the Managers' Overall Satisfaction with the Performance of a Collaborative Inter-firm Arrangement		
Multiple Perceptual Measures Geringer & Herbert (1991)	Overall Satisfaction	Your Satisfaction with alliance performance	
		Your Perception of your partner's satisfaction, Glaister & Buckley (1998)	
	Individual Dimension	Sales Level	Market Share
		Profitability	Cost Control
		Management of Venture	Technology Development
		Product Design	Manufacturing/Quality Control
		Labour Productivity	Marketing
		Distribution	Reputation
		Customer Service	Overall Performance

Table III-12: Examples of subjective measures for alliance performance (Source: Killing, 1983, Geringer & Herbert, 1991, Glaister & Buckley, 1998)

These measures used in this research were designed to obtain information regarding the perceptual satisfaction of participants with the contribution of the supply chain partnership on the eight individual dimension of their companies' competitive positions. In order to avoid the problem of performance perception asymmetry (Hamel, 1991), the same questions were asked to both participants of a partnership.

Questions directed to both customers and suppliers:

The supply chain partnership between my company and the customer/supplier (the company name of specific partner is shown here) positively influences:

- The profit of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The cost control of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The technology development of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The new product development of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The knowledge transfer to my company (Adopted from Geringer & Herbert (1991), 7-

point Likert scale, strongly disagree – strongly agree).

- The manufacturing and quality control of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The marketing activities of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).
- The customer service of my company (Adopted from Geringer & Herbert (1991), 7-point Likert scale, strongly disagree – strongly agree).

2.4.2.7 Contribution in Operational Level (Supply Chain Performance Level)

From the findings of Whipple (2000), it can be concluded that the majority of objectives of supply chain partnerships are closely linked to the supply chain performance indicators at an operational level, such as reduced inventories and reduced lead time. Thus, if the scope of a study on partnership performance is limited to the supply chain, the perceptual satisfaction of partners with a supply chain partnership at the operational level should be taken into consideration. For this reason, the new dimension of partnership performance measure, 'the contribution of the partnership at the operational level' was added in this study.

The questions measuring the operational contribution of a supply chain partnership were developed on the basis of SCOR 3.1, Level One Metrics. The Supply Chain Operations Reference Model (SCOR) is an initiative taken to improve supply chain performance through a measurement by the Supply Chain Council. SCOR is regarded as a well-established method to measure supply chain performance and it is continuously reviewed and modified.

At the time of writing, version 5.0 is the most recent version available, but detailed instructions for how to calculate the performance metrics are only available up to version 3.1. The SCOR 3.1 model has five performance attributes, which are 1) Reliability 2) Responsiveness 3) Flexibility 4) Costs, and 5) Assets, and each attribute has a set of detailed Level One metrics. The first three criteria deal with customer-facing performance measures, while the other two are concerned with the internal performance measures of the firm.

Performance Attribute	Performance Attribute Definition	Level 1 Metrics
Supply Chain Delivery Reliability	The performance of the supply chain in delivering: the correct product, to the correct place, at the correct time, in the correct condition and packaging, in the correct quantity, with the correct documentation, to the correct customer	• Delivery performance • Fill rates • Order-fulfilment lead-time • Perfect order fulfilment
Supply Chain Responsiveness	The velocity at which a supply chain provides products to the customer.	• Supply chain responsiveness
Supply Chain Flexibility	The agility of a supply chain in responding to marketplace changes to gain or maintain competitive advantage.	• Production flexibility
Supply Chain Costs	The costs associated with operating the supply chain.	• Total SCM cost • Value-added employee productivity • Warranty cost
Supply Chain Asset Management Efficiency	The effectiveness of an organisation in managing assets to support demand satisfaction. This includes the management of all assets: fixed and working capital.	• Cash to cash cycle time • Inventory days of supply • Asset turn

Table III-13: Five performance attributes to be measured, (Source: 1) Supply-Chain Operations Reference-Model SCOR Version 4.0, Supply-Chain Council, 2000, 2) SCOR Metrics Level 1 Primer, Supply-Chain Council, 2000)

In total, eight questions were developed with reference to SCOR 3.1 to measure the contribution of supply chain partnerships at the operational level. These questions were developed on the basis of the level one metrics from version 3.1, as the level one metrics reflect the current status of a supply chain operation, (Holmberg, 2000). These questions were to enquire about the contribution of the supply chain partnership on 1) reliability, 2) responsiveness, 3) cost management, and 4) asset management of their companies' supply chains.

Questions directed to both customers and suppliers:

The supply chain partnership between our company and the supplier/customer (the company name of the specific partner is shown here) positively influences:

- The increase of our forecasting accuracy (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).
- The increase of reduction of our inventory level (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).

Questions directed to suppliers:

- Lead time from receipt of an order from the customer (the company name of the specific partner is shown here) to the fulfilment of the order, (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).
- Supply chain responsiveness to the customer, (the company name of the specific partner

is shown here), (Adopted from SCOR Level One Metrics, 7-point Likert scale, strongly disagree – strongly agree).

- Cost reduction of all SCM activities related to the customer, (the company name of the specific partner is shown here), (Adopted from SCOR Level One Metrics, 7-point Likert scale, strongly disagree – strongly agree).

Questions directed to Customers:

- Lead time from order placement to the supplier, (the company name of the specific partner is shown here), to the receipt of the order, (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).
- Supply chain responsiveness of the supplier, (the company name of the specific partner is shown here), to my company, (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).
- Cost reduction of all SCM activities related to the supplier, (the company name of the specific partner is shown here), (Adopted from SCOR Level One Metrics), (7-point Likert scale, strongly disagree – strongly agree).

2.5 Process of Data Collection (Survey Method)

The initial preparation for data collection was initiated in Autumn 2003 by conducting preliminary interviews for the purpose of questionnaire development. The survey was conducted between June 2003 and October 2003 on participants in CPG supply chains in Korea. One thing that should be borne in mind is the timing of the survey and the economic situation. The survey was conducted during the busiest period for participants of Korean CPG supply chains, as the annual Harvest Festival (or the full-moon festival, 15^{th} of August, according to the lunar calendar) is around this time of the year. CPG retailers and suppliers usually experience peak sales during the festival season, and this could put strain on their supply chain partnerships. Also, the Korean economy was in recession at that time, and this could have introduced huge pressure for suppliers and retailers to cut their prices. As a result, such situations could distort the true picture of CPG supply chain partnerships in Korea.

2.5.1 Field Pre-Test of Questionnaires

Remenyi *et al.* (1998) advised conducting a field pre-test of questionnaires to identify deficiencies in design, administration and question wording. A field pre-test

helps researchers to find out how the data collection protocols and the survey instrument work under realistic condition (Fowler, 1993). A preliminary field interview was conducted in order to assist the development of a pair of questionnaires and the field pre-testing was carried out with three customers and six of their suppliers. The main focus of the field pre-test was to identify 1) if the instructions were clear, 2) if the questions were clear, and 3) if there were any problems in understanding what kind of answers were expected or in providing answers to the question. The participants of the field pre-test pointed out some ambiguity in wording and unclear translated SCM terminology on some questions. As the questionnaires were initially developed in English and then translated into Korean, these suggestions were taken seriously and corrected with the help of Korean SCM academics.

2.5.2 Administration of Survey

After the completion of the questionnaire design, SCM managers, purchasing managers and merchandisers of fifty-four companies (retailers) in the sampling frame were all initially contacted by letter saying "we would like to ask for your help on the research subject ..., we will contact you after one week, and if you do not want us to contact you, then please let us know". The reason behind approaching customers first is that customers have buyer power, which can encourage suppliers to take part in the survey. As a strategy to increase the response rate, the majority of the letters were personalised with the job titles and the names of the target informants. The names of the targeted informants and their contact numbers were obtained through phoning switchboards and our own contacts in these companies. A week from the initial mail-out of the introduction letters, forty-nine companies, which had not contacted us to inform us of their non-participation, were contacted by telephone to convince them to take part in the survey. During this process, the process of validating the qualification of the informants, which was their knowledge about the status of supply chain partnerships with their partners, was also conducted. After this initial telephone contact, initially 14 customers agreed to participate, but in the end two customers changed their minds and did not participate in the survey.

Twelve customers (four large discount store chains, three supermarket chains and five alternative retailers) agreed to participate the in survey. In the next stage, the instruction letters, containing 1) procedure of the survey, 2) definition of supply

chain partnership used in this study, and 3) guidelines for selection of suppliers were sent to the twelve companies. The customers were instructed to select their suppliers, which they considered themselves to be in partnership with according to the definition on the instruction, and to select a contact person in that supplier firm with whom they were currently working. Follow-up telephone calls to explain the above instructions in more detail were made to increase the chance of incorporating more supply chain partnerships in the data. Ultimately, contact details for ninety-two sales managers, logistics managers and account managers from suppliers were obtained.

In total, ninety-two questionnaires, tailor-made with the company names and the names of their supply chain partners, were sent out to the contact persons of the suppliers of twelve customers, with pre-addressed postage-paid envelopes. A covering letter, which explained the purpose of this survey and identified their counter-parts from customers' companies, was included in the survey package. Also, a separate letter ensuring absolute confidentiality was included, as some suppliers did not feel comfortable participating in a survey which involved their customers. In order to increase the response rate, the strategy of customers' 'buyer power' was used. Firstly, the introduction letter to suppliers contained the following sentence, for example: "your customer Mr. Lee from Samsung Tesco has agreed to take part in our survey and has given your name and contact details, as this survey requires the participation of Tesco's core suppliers". Secondly, the customers were asked to contact their suppliers by phone or email to encourage them to complete the questionnaires. Also, some questionnaires were sent out to suppliers with customers' letters encouraging the suppliers to participate. In addition to this strategy, follow-up letters and telephone calls were made to non-responding suppliers in order to increase the participation from suppliers.

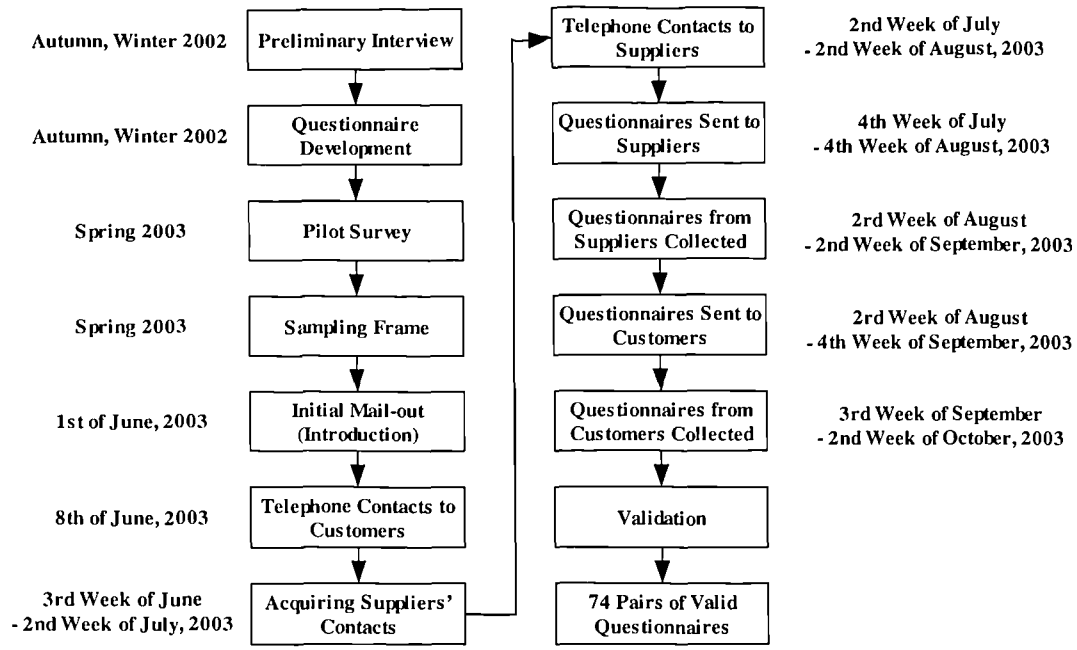


Figure III-2: The process of data collection

In total, eighty-three suppliers' responses were returned and three responses with excessive amount of missing data were discarded. The 'buyer power strategy' worked well, and the response rate for the supplier group was high. Then, eighty questionnaires were sent out to twelve customers (and were internally distributed to twenty-nine informants) and they were asked to fill in the relevant sections regarding their suppliers. Seventy-six questionnaires returned and two questionnaires with the excessive amount of missing data were later excluded. In addition, one of the measurement items for the partnership attribute 'information exchange', which is 'the frequency of receiving information' was later dropped due to the excessive number of missing values. The final number of fully validated responses was seventy-four pairs (a hundred and forty-eight questionnaires, twelve customers and seventy unique suppliers).

2.5.3 Sample Size Issue

The number of returned questionnaires, seventy-four pairs (a hundred and forty-eight questionnaires) may raise concerns that the data set is not large enough to produce valid results. However, seventy-four pairs can be regarded as sufficient for this research for the following reasons. Firstly, in an effort to avoid the statistical conclusion error, power analyses were conducted for two analytical techniques 1)

multiple regression analyses and 2) MANOVAs[25,26]. The results suggested that this number is sufficient to provide the power level of 80% for the both analyses.

- Ellram, L.M. (1995) "Partnering pitfalls and success factors", *International Journal of Purchasing and Materials Management*, **Spring** 35-44. **(80 pairs)**
- Heide, J.B. & Miner, A.S. (1992) "The shadow of the future: Effects of anticipated interaction and frequency of contact on buy-seller cooperation", *Academy of Management Journal*, **35** (2) 265-291. **(60 pairs)**
- Ellram, L.M. & Hendrick, T.E. (1995) "Partnering characteristics: A dyadic perspective", *Journal of Business Logistics*, **16** (1) 41-64. **(80 pairs)**
- Spekman, R.E., Salmond, D.J. & Lambe, C.J. (1997) "Consensus and collaboration: Norm-regulated behaviour in industrial marketing relationships.", *European Journal of Marketing*, **31** (11/12) 832-856. **(46 pairs)**

Secondly, by looking at previous studies that have used similar data collection methods covering both sides of collaborative inter-firm arrangements, seventy-four pairs of responses is more than average. Considering the difficulty involved in the data collection, seventy-four can be regarded as sufficient.

2.6 Quality of Survey

In order to ensure that the quality of the survey done in this research was acceptable, a checklist of seventeen attributes of an ideal survey was self-assessed. These attributes fall under six broad categories: 1) general attributes, 2) measurement error, 3) sampling error, 4) internal validity error, 5) statistical conclusion error, and 6) conclusion error. The result of the self-assessment of seventeen attributes suggested by Malhotra & Grover (1998) is discussed here.

[25] Please refer to sections V.3.3.1. and VI.3. for detailed information about the power analyses for multiple regression analyses and MANOVAs.
[26] Cluster analysis is a non-inference technique, so it does not require the power test

2.6.1 General Attributes

		Attributes
Y	1	Is the unit of analysis clearly defined for the study?
Y	2	Does the instrumentation consistently reflect that unit of analysis?
Y	3	Are the respondents chosen appropriate for the research question?
Y	4	Is any form of triangulation used to cross validate results?

Table III-14: Category 1 of the ideal attributes of survey

During the administration of the survey, a 'unit of analysis' was clearly defined and outlined in all survey instrumentation. Regarding the quality of the informants, extra efforts were made in order to validate the qualification of the informants during the initial process of contacting the customers and suppliers by asking them about their knowledge of their supply chain partnerships. Also, efforts were made to cross-validate the results by employing 1) written instrumentation and 2) multiple respondents (the same question was posed to both the supplier and customer of a supply chain partnership).

2.6.2 Measurement error

Measurement error represents one of the most significant sources of error in survey research, and it is difficult to be free from this error (Malhotra & Grover, 1998). In order to minimise this, the following steps were taken. Firstly, multi-item measures (except for the performance measure 'extent of goal achievement') were used to measure eight constructs. Secondly, content validity was ensured by 1) selecting and developing measures on the basis of the existing theories and 2) the review of the measures by a number of field SCM practitioners. Thirdly, a pilot survey was conducted with three customers and six of their suppliers in order ensure that the measurement error remained at a minimum. Also, Cronbach's α coefficients of eight constructs were calculated to assess the reliability of the measures (Table III-16). The Cronbach's α coefficients of all constructs, apart from RA, were greater than 0.6, which is the threshold of the reliability of a measure (Nunnally, 1967). The reason behind the low α coefficient (0.4263) of RA is that this construct was measured by the existence of IT and non-IT specific assets, which are not necessarily closely correlated all the time. However, testing construct validity and the use of confirmatory methods could not be done due to the strict sample size criteria posed by the construct validity testing techniques such as factor analysis and structural equation modelling (SEM).

		Attributes
Y	5	Are multi-item variables used?
Y	6	Is content validity assessed?
Y	7	Is field-based pre-testing of measures performed?
Y(1/2)	8	Is reliability assessed?
N	9	Is construct validity assessed?
Y	10	Are pilot data used for purifying measures or are existing validated measures adapted?
N	11	Are confirmatory methods used?

Table III-15: Category 2 of the ideal attributes of survey

Variables	Initial Number of Items	Cronbach's α Coefficient
IT	7	0.7658
Trust	3	0.6147
Joint partnership management system	6	0.6506
Relationship Specific Assets	2	0.4263
Partner Asymmetry	2	0.8467
Enhancement of Company's Competitive Position	9	0.9187
Contribution at SCM Operational Level	5	0.9513

Table III-16: Reliability tests for variables

2.6.3 Sampling error

In an effort to ensure that the sample frame was representative of the population of interest, the following points were addressed throughout the survey design and administration. Firstly, the sample frame was clearly defined and justified as Korean CPG industry supply chain participants. However, random sampling could not be carried out, due to the concern that random sampling would decrease the likelihood of selecting enough supplier-customer relationships at the stage of partnerships. Also, a significant effort was made to ensure that the response rates were higher than 20%. From the customer side, the response rate was 22.2% (12/54) and from the supplier side, the rate was 90.2% (83/92). The high response rate from the supplier side was the result of the buyer power strategy. As the final step towards ensuring that the sampling error remained at a minimum, the assessment of non-response bias was carried out using by the method suggested by Armstrong & Overton, (1977). The results suggested that no significant non-response bias existed in our data set.

		Attributes
Y	12	Is the sample frame defined and justified?
N	13	Is random sampling from the sample frame used?
Y	14	Is the response rate over 20%?
Y	15	Is non-response bias estimated?

Table III-17: Category 3 of the ideal attributes of survey

2.6.4 Internal Validity error

An effort to minimise the internal validity error was made by assessing the multicollinearity of variables during the process of all three analyses used in this study, which were 1) cluster analysis, 2) multiple regression analysis and 3) MANOVA[27]. However, other recommended methods such as follow-up interviews and tests of causality could not be done due to the research design of this study.

		Attributes
Y(1/2)	16	Are attempts made to establish the internal validity of the findings?

Table III-18: Category 4 of the ideal attributes of survey

2.6.5 Statistical conclusion error

As mentioned above, in order to avoid the statistical conclusion error, power analyses were conducted for two analytical techniques 1) multiple regression analyses and 2) MANOVA analyses.

		Attributes
Y	17	Is there sufficient statistical power to reduce statistical conclusion error?

Table III-19: Category 5 of the ideal attributes of survey

The final score of this self-assessment was 76.5% (13/17), which was above the average score of 62% from the 25 OM-related studies assessed by Malhotra & Grover (1998). On the basis of this, it can be concluded that the survey used for this study has acceptable quality.

3 Analytical Methods

This research aims to achieve three main research objectives: 1) development of a classification method for supply chain partnerships 2) identification of the factors influencing the success of a supply chain partnership and estimation of performance models, and 3) identification of perceptual differences in the performance of partnerships and the characteristics of their supply chain partnerships, and their association with partnership performance. In order to achieve these aims, three

[27] Please refer to sections IV.4.4.2. and V.5.5 for detailed information on testing for the existence of multicollinearity at univariate and multivariate levels.

multivariate data analysis methods are needed, which are 1) cluster analysis, 2) multiple regression analysis and 3) MANOVA analysis.

Hair *et al.* (1998) underlined the fact that the successful completion of a multivariate analysis involves multiple steps, from problem definition to critical diagnosis of the results. They suggested 'the six-step model building process'. As can be seen in Figure III-3, this framework contains the following six steps and provides guidelines for developing, interpreting and validating multivariate analyses.

Throughout this research, this framework was adopted in order to ensure that the process of multivariate analyses in this research was applied correctly and the results in all three analyses were valid.

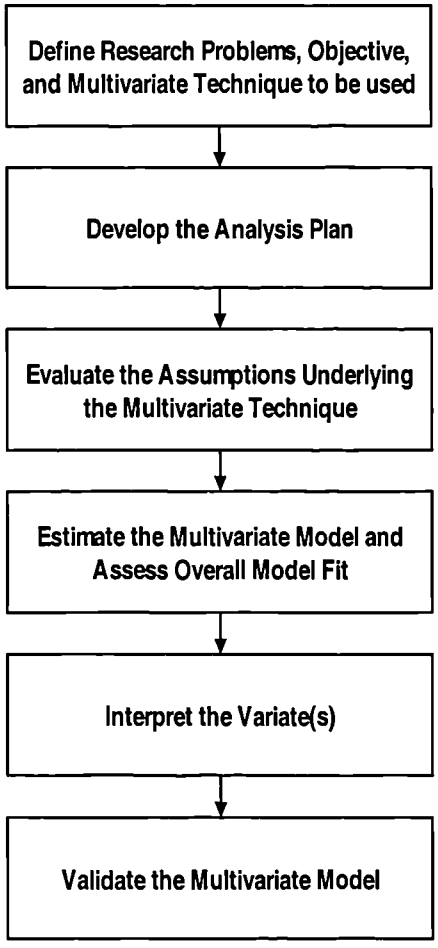


Figure III-3: A Six-stage, structured approach to multivariate model building, (Source: J. F. Hair, *et al.*, Multivariate Data Analysis,. 1998)

3.1 Classification of Supply Chain Partnerships

The first objective of this research is to classify supply chain partnerships according to the five collaborative elements: 1) information exchange, 2) trust, 3) joint

partnership management system, 4) relationship specific asset, and 5) partner asymmetry.

The main analytical methodology to be used for the purpose of classification supply chain partnerships is 'cluster analysis'. The definition of cluster analysis given by Hair *et al.* (1998) is that it is "a group of multivariate techniques whose primary purpose is to group objects based on the characteristics they possess". Cluster analysis classifies objects so that each object is close to others in the cluster in terms of predetermined selection criteria. As a result, clusters of objects should have high internal homogeneity and high external heterogeneity". The main rationale behind the use of cluster analysis for the purpose of classification of supply chain partnerships are 1) cluster analysis is most frequently used analytical method for classification purposes and 2) cluster analysis has been extensively used for exploratory purposes and the formation of a taxonomy, which is an empirically based classification of objects (Hair *et al.*, 1998, Punj & Stewart, 1983). This is particularly useful for the field of supply chain research, which is relatively a young academic discipline and still contains considerable uncertainty over the concepts, definitions and typology of issues related to supply chain partnerships.

However, cluster analysis is known to have the following weaknesses. Firstly, cluster analysis suffers from the fact that the procedures by which clusters are produced are not based on probabilistic statistics, and it is a purely empirically based method (Singh, 1990 and Punj & Stewart, 1983). In other words, cluster analysis does not create clusters by statistical inference from a sample to a population. Furthermore, the cluster membership for any number of solutions is dependent upon many elements of the procedure and many different solutions. For this reason, multiple and significantly different clusters solutions can be obtained by varying one or more elements of the analysis (Hair *et al.*, 1998). Therefore, it does not always produce the best solution and it is often not straightforward to decide which is the optimal solution (Singh, 1990). Secondly, the selection of variables for the similarity measure can have a huge impact on the solution created by the cluster analysis. However, there are few efficient statistical tests to decide the selection of variables, (Hair *et al.*, 1998). Thus, thorough theoretical consideration is required before selecting variables for analysis. Finally, cluster solutions can suffer from the lack of reliability and validity.

The application of cluster analysis for the classification of supply chain partnership in this research is based on the six-step cluster analysis decision process suggested by Hair *et al.* (1998). In addition to this, Punj & Stewart's two-stage clustering is used in order to apply non-hierarchical clustering algorithms, which are known to out-perform the hierarchical algorithms with predetermined cluster numbers and seed points by determining the number of clusters and seed points.

3.1.1 Objectives of Cluster Analysis (Stage 1)

As an initial stage, two necessary issues, which are 1) defining research objectives, and 2) selecting cluster variable, need to be addressed.

Firstly, the objective of cluster analysis should be specified. There are three major uses of cluster analysis, namely: 1) taxonomy description, 2) data simplification and 3) relationship identification. The main objective of using cluster analysis in this research is to segment objectives (supply chain partnerships) into groups with similar supply chain partnership performance attributes.

Secondly, the process of selecting which variables are used to characterise the objects to be clustered should be carried out. Hair *et al.* (1998) underlined that this selection process must be carried out with regard to the existing theories and practical considerations. Punj & Stewart (1984) also argued that the basis for classification must be carefully chosen, as this can distort the outcome of cluster analysis. They also suggested that selection of variables should be carefully based on existing theories.

3.1.2 Research Design in Cluster Analysis (Stage 2)

In the second stage, three issues must be addressed before the process of partitioning; those are: 1) Can outliers be detected and, if so, should they be deleted? 2) How should object similarity be measured? 3) Should the data be standardised?

Firstly, the issue of outliers has to be addressed, as cluster analysis can be especially sensitive to the existence of outliers. Outliers imply the possibility of the existence of true aberrant observations, which are not representative of the general population, or under-representation of groups in the data, which may be caused by under-sampling of actual group(s) in the population. The three-step approach for detecting outliers, which is a combination of 1) univariate outlier detection, 2) bivariate outlier

detection, and 3) multivariate outlier detection using Mahalanobis D^2 measures, was used in this research.

Secondly, a similarity measure has to be chosen. A similarity measure is a measure of correspondence, or resemblance, between objects to be clustered (Hair *et al.*, 1998). They suggested the use of the three most commonly used inter-object similarity measures, 1) correctional measures, 2) distance measures, and 3) association measures. Each measure is known to have distinctive uses and drawbacks; see Table III-20. In this research, the Squared Euclidean measure was used for the analysis[28].

Similarity Measures	Description
Correlation Measures	Gauges similarity among observations by examining the correspondence of patterns across characters. However, these measures are hardly used as the emphasis of these measures is on the patterns of values.
Distance Measures	Often used by researchers, as they represent similarity as the proximity of observations to one another across the variables. Unlikely to correlation measures, the focus being on the magnitude of values. As a result, clusters created by distance tend have more similar values across the set of variables; on the other hand, those of correlation measures may not have similar values but have similar patterns. The two most commonly used distance measures are 1) Euclidean distance and 2) City block approach. As these measures are using distance, there is a possibility of the problem of inconsistencies between different cluster solutions when different scales are adopted. In order to tackle this problem, Mahalanobis distance (D^2) or squared Euclidean distance, which directly incorporates a standardisation process, is used.
Association Measures	Used when data are in non-metric terms such as nominal or ordinal format.

Table III-20: Types of similarity measure, (Source: J. F. Hair, *et al.*, Multivariate Data Analysis,. 1998)

The third issue to be considered after selection of a similarity measure is the need for standardisation of data. The reason behind this is that many distance measures are sensitive to differing scales and magnitudes of variables. The benefits of such standardisation are that 1) it facilitates the process of comparison of the variables, as they are on the same scale and 2) it eliminates the effect of the scale difference, not only among variables but also in the same variable (Hair *et al.* 1998). In terms of cluster analysis for this research, the process of standardisation of the data was omitted, as the difference among the scales of the five partnership performance attributes was not significant enough to introduce a negative influence on the similarity measure. In addition, the similarity measure used in this research, the Squared Euclidean measure, incorporates the process of standardisation.

3.1.3 Assumptions in Cluster Analysis (Stage 3)

Cluster analysis is not a statistical inference technique, but an objective and empirical

[28] For detailed justification of the choice of this measure and further information, please refer to section IV.3.2

methodology for seeking similarity in structural characteristics in the data, (Punj & Stewart, 1984, Singh, 1990, Hair *et al.*, 1998). For this reason, assumptions such as normality, linearity and homoscedasticity are not significantly important considerations for cluster analysis. However, the issues of representativeness of the sample and the impact of multicollinearity must be addressed. Representativeness of the sample is critical, as the clusters are derived in the hope that the obtained sample is truly representative of the population. Thus, the violation of this assumption can decrease the quality of cluster solutions. Multicollinearity among the variables may have adverse effects on the analysis, as it causes the related variables to be weighted more heavily, thereby receiving improper emphasis in the analysis.

3.1.4 Deriving Clusters and Accessing Overall Fit (Stage 4)

The fourth stage is called the 'partition phase'. In this phase, the following three issues have to be addressed: 1) selection of an appropriate clustering algorithm, 2) the number of clusters to be formed, and 3) re-specification of cluster analysis.

Firstly, an appropriate clustering algorithm has to be selected, as the selection of a clustering algorithm is critical for the quality of the final outcome of the cluster solution. These algorithms are broadly categorised into two groups: 1) hierarchical cluster procedures and 2) non-hierarchical procedures. Hierarchical clustering procedures involve the construction of a hierarchy of structure. The main characteristic of these procedures is that the results at an earlier stage are always nested within the results at a later stage, creating a similarity tree (Hair *et al.*, 1998). Hair *et al.* (1998) suggest five popular agglomerative algorithms, which are 1) single linkage, 2) complete linkage, 3) average linkage, 4) Ward's method, and 5) the centroid method (Table III-21).

Clustering Methods	Description
Single Linkage	Based on minimum distance measure. It detects the two objects separated by the shortest distance and places them in the first cluster. Then the next-shortest distance is found, and either a third object joins the first two to form a cluster, or a new two-member duster is formed. This process is repeated until all objects are in one cluster.
Complete Linkage	Similar to single linkage except that the cluster criterion is based on maximum distance. The maximum distance between individuals in each duster represents the smallest (minimum-diameter) sphere that can enclose all objects in both clusters. Hair Jr. et al. (1998) suggested that this method removes the snaking or chaining problem and is useful to visualise the measures, as it reflects the similarity of the most similar pair or least similar pair of objects.
Average Linkage	In its initial stage, the process is similar to that of the single and complete linkage. The difference is that the clustering criterion is the average distance from all individuals in one cluster to all individuals in another. Hair Jr. et al. (1998) pointed out that this measure could be biased toward the production of clusters with approximately the same variance.
Ward's Method	In this method, the distance between two clusters is the sum of squares between the two clusters summed over all variables. At each stage in the clustering procedure, the within-cluster sum of squares is minimised over all partitions (the complete set of disjoint or separate clusters) obtainable by combing two clusters from the previous stage. This procedure tends to combine clusters with a small number of observations. It is also biased toward the production clusters with approximately the same number of observations.
Centroid Method	In this method, the distance between two clusters is the distance between their centroids. The main advantage of this method is that this is less sensitive to the presence of outliers than other hierarchical cluster procedures.

Table III-21: Types of hierarchical partitioning algorithms, (Source: J. F. Hair, *et al.*, Multivariate Data Analysis,. 1998)

Non-hierarchical clustering procedures form clusters by assigning objects into clusters with a pre-determined number of clusters to be formed. Thus, these methods do not involve the treelike construction process used in hierarchical clustering procedures. There are three major non-hierarchical clustering methods, which are 1) sequential threshold, 2) parallel threshold, 3) K-means, 4) hill-climbing method, and 5) combination method (Table III-22).

Clustering Methods	Description
Sequential Linkage	This method initiates partitioning by selecting one cluster seed and includes all objects within a pre-specified distance. When all objects within the distance are included, a second cluster seed is selected, then the same process is repeated until all objects are assigned.
Parallel Linkage	In contrast, the parallel threshold method selects several threshold distance to the nearest seed. As the process evolves, threshold distances can be adjusted to include fewer or more objects in the clusters. Also, in some variants of this method, objects remain un-clustered if they are outside the pre-specified threshold distance from any cluster seed.
K-means	This method is similar to the other two non-hierarchical procedures except that it allows for reassignment of objects. Objects are reassigned by moving them to the cluster whose centroid is closest to that objects. This process of reassignment continues until every object is assigned to the cluster with the nearest centroid.
Hill-Climbing Method	Unlikely K-mean, hill-climbing method does not assign but move objects from one cluster to another if a particular statistical criterion is obtained. This process of reassignment repeats until optimisation occurs.
Combination Method	Combines both the K-means and the Hill-Climbing method.

Table III-22: Types of non-hierarchical partitioning algorithms, (Source: 1) Hair, *et al.*,

Multivariate Data Analysis, 1998, 2) Punj, G. & Stewart, D.W., Cluster analysis in marketing research: review and suggestions for application. *Journal of Marketing Research,* 134-150, 1983)

Hair *et al.* (1998) argued that there is no definitely superior clustering algorithm, as different research questions require different algorithms for different situations, such as characteristics of data. Recently, a drastic increase in computing power has enabled more researchers to gain access to non-hierarchical clustering procedures. Non-hierarchical clustering procedures are known to be less susceptible to outliers and inclusion of irrelevant variables. However, these benefits are only realised when non-random seed points are specified. If non-hierarchical clustering procedures are applied with random seed points, their outcomes are known to be notably inferior to the hierarchical technique. Punj & Stewart (1983) conducted research which investigated twelve studies, evaluating clustering algorithms by comparing the results of different clustering algorithms applied to the same data sets. Their conclusion can be summarised as follows, (Table III-23).

- Ward's methods, average linkage and K-means appear to outperform all other methods.
- Ward's methods outperform the average link method providing that there is no presence of outliers.
- K-means outperform both Ward's methods and average linkage, if a non-random starting point is specified.
- If K-means are used to cluster objects with random starting points, it appears inferior to other methods. However, K-means are more robust than any other hierarchical methods with respect to the presence of outliers, error perturbations of the distance measures, and the choice of the distance measures.
- Selection of similarity measures does not appear to be critical to the quality of the final outcomes.
- K-means are more sensitive to the presence of one or more spurious attribution or dimensions than other non-hierarchical methods.
- K-means shows less decrement in performance as coverage increases than hierarchical methods.

Table III-23: The performance of partitioning methods, (Source: Stewart, D.W., Cluster analysis in marketing research: review and suggestions for application. *Journal of Marketing Research, 1983,* 134-150, 1983)

The second issue to be addressed in stage four is number of clusters to be formed. As there are no internal statistical criteria used for determining number of clusters to be formed, many researchers have been using various ad hoc procedures which are, in some cases, complicated to compute.

Hair *et al.* (1998) suggested two approaches, which can help researchers to determine how many clusters should be formed. Firstly, examining similarity measures at each successive step was suggested. If there is a sudden increase of the successive values, then researchers can select the prior cluster solution on the logic that its combination has caused a substantial decrease in similarity. Secondly, using statistical tests such as point-biserial/ tau correlation, CCC, the Pseudo t-test or the likelihood ratio can help researchers to determine the number of clusters. In addition, they recommended

compensation for the empirical judgement by the conceptualisation of theoretical relationships that may suggest a natural number of clusters. In this research, firstly, a visual inspection of the plotted cluster criterion was carried out and then CCC and Pseudo t-test statistics were calculated to make the final decision on the number of clusters in the solution.

As discussed above, the non-hierarchical method is preferable; however, seed points and the specification of number of clusters should be determined in advance. Punj & Stewart (1983) suggested a two-stage procedure which assists researchers to select seed points and decide on the number of clusters. In the first step, two hierarchical methods, the average link method or Ward's method, which are known to outperform the other hierarchical methods, are used to obtain a first approximation of a solution. On the basis of this, seed points and the candidate number of clusters can be determined. In addition, outliers from data can be detected and eliminated, so the refined data can be used in the second step. Then, in the second step, a non-hierarchical method can be introduced for the refinement of the clusters.

3.1.5 Interpretation of Clusters (Stage 5)

This stage involves examining each cluster in terms of the cluster variate, in order to name or assign labels that accurately describe the nature of the clusters (Hair *et al.*, 1998). In this stage, the practical significance of the clusters in meeting the objective of the research is considered, whereas in stage 4, the distinctiveness of clusters is examined. One frequently used measure at the beginning of interpretation is the 'cluster centroid'.

3.2 Factors Influencing Success of Supply Chain Partnerships

'Multiple regression analysis is a statistical technique that can be used to analyse the relationship between a single dependent (criterion) variable and several independent (predictor) variables' (Hair *et al.*, 1998). Multiple regression analysis has been frequently used in data analysis for the purpose of testing the significance of the relationship between factors and the performance of various types of collaborative inter-firm arrangement (Harrigan, 1988, Heide & Miner, 1992, Dyer, 1996, Saxton, 1997, Spekman, Kamauf & Myhr, 1998, Jap, 1999, Glaister & Buckley, 1999, Ellinger, 2000). Another analytical technique, structural equation modelling (SEM), was originally considered for use in this study, as it covers the issue of validity and

causality, which multiple regression analyses do not. However, SEM requires a large sample size, with a ration of between 20:1 and 5:1 (sample size: number of model parameters; Kline, 1998), and the sample size of 74 for this research with the given number of parameters was not big enough to apply SEM.

In order to ensure the validity of the final results, the six-step model building process developed by Hair *et al.* (1998) was used to ensure that the requirements of each step, from the problem definition to the critical diagnosis of the results, were met.

3.2.1 Objectives of Multiple Regression (Stage 1)

The necessary starting point for multiple regression analysis is clarification of the objectives of the research. Due to the flexibility and adaptability of the technique, it can be used for almost any dependence relationship, but the main uses are 1) prediction of the dependent variable with a set of independent variables and 2) explanation of the degree and character of the relationship between a dependent variable and a set of independent variables (Hair *et al.,* 1998). However, these two objectives are not mutually exclusive and this research aimed to achieve the two goals simultaneously.

3.2.2 Research Design of a Multiple Regression Analysis (Stage 2)

In stage 2, two important issues, which are 1) sample size and 2) adding control variables, should be addressed.

Hair *et al.* (1998) underlined that the sample size is the most influential single element under the control of the researchers at the research design stage. The sample size has a direct influence on 1) statistical power and 2) generalisability of the result. The sample size of the data has a direct impact on the statistical power of a multiple regression. 'Statistical power' in multiple regression means the probability of detecting as statistically significant a specific level of R^2 or a regression coefficient at a specified significance level for a specific sample size (Cohen 1988). Hair *et al.* (1998) recommended that during the survey design, the researcher should plan the target sample size to ensure detection of significant R^2 more than 80% of time. In this research, the sample size of 74 provides enough power to detect R^2 more than 80% of time.

One of the limitations faced by multiple regression is that it only can represent linear

relationships between metric variables. However, the creation of new variables by transformation of non-linear variables, and the creation of dummy variables, can manage the above limitation and provide flexibility and representation of a wide range of relationships. In terms of creation of dummy variables, indicator coding and effect coding are commonly used. In addition to these, when an independent-dependent relationship is affected by another independent variable, which is called the 'moderator effect', again the creation of new variable is required.

In this research, one non-metric variable, 'type of retailer', was indicator coded into two dummy variables.

3.2.3 Prior Assessment of Assumptions in Multiple Regression (Stage 3)

The assumptions underlying multiple regression analysis are critical, as the estimation of regression lines is based on these assumptions. These assumptions apply to both individual variables and the variate. Before a process of estimation begins, three assumptions of individual variables should be assessed; these are 1) linearity, 2) homoscedasicity, and 3) normality. In this research, the linearity of individual variables was assessed by plotting partial regression plots, and homoscedasicity was assessed by visual inspection of 15 residual plots to see whether all the points were evenly and randomly distributed around zero (Appendix 2). In terms of normality of individual variables, the calculation of Kolomogorov-Smirnov and Shapiro-Wilk test statistics and the plotting of normal Q-Q plots were conducted.

3.2.4 Estimating Regression Model and Assessing Overall Fit (Stage 4)

In stage four, three important tasks should be carried out, which are 1) selecting a method for the regression model to be estimated, 2) assessing the statistical significance of the overall model, and 3) detecting influential observations.

Firstly, there are two methods of specifying the model to be estimated, which are 1) confirmatory specification and 2) sequential search methods. In confirmatory specification, researchers completely specify the set of independent variables to be included. By using this method, researchers can have total control over the variable selection. On the other hand, in sequential search methods, variables are added or deleted until some overall criterion measure is achieved. The most frequently used sequential search methods are 1) stepwise estimation and 2) forward addition and

backward addition. In this research, hypothesis tests were conducted by a series of simple regression analyses, then the stepwise method was employed to estimate three performance models of supply chain partnerships.

Secondly, upon completion of the estimation, the significance of the overall model can be tested by use of the F ratio, which is testing the hypothesis that the amount of variation explained by the regression model is more than the variation explained by the average.

$$F \text{ ratio} = \frac{\dfrac{\text{Sum of squared errors}_{\text{regression}}}{\text{Degree of freedom}_{\text{regression}}}}{\dfrac{\text{Sum of squred errors}_{\text{total}}}{\text{Degrees of freedom}_{\text{residual}}}} = \frac{SSE_{\text{regression}} / df_{\text{regression}}}{SSE_{\text{total}} / df_{\text{residual}}}$$

Equation III-1: Test statistic F ratio calculation, (Source: J. F. Hair, *et al.*, Multivariate Data Analysis, 1998)

Finally, the process of identifying influential observation should be conducted, as they can sometimes significantly distort the results of the estimation. Influential observations are usually in one of three forms, which are 1) outliers, 2) leverage points, and 3) influentials. In this study, outliers were identified by examining three forms of residuals, 1) standardised, 2) studentised and 3) deleted residuals. The threshold for identifying possible outliers with a fairly large sample (more than 50) is 1.96 (Hair *et al.*, 1998). As a next step, the leverage point should be identified. Leverage points refer to those observations that are substantially different from the remaining observations on one or more independent variables. Hat value can be used to identify the leverage point and its cut-off point is calculated by the formula $(2(k + 1)/n)$. Also, the Mahalanobis distance may be calculated to detect possible leverage points. The processes of detecting the above outliers and leverage points serve mainly to identify outlying points on the predictor and criterion variables but not the influence of single observations on the result. Therefore, as a final step, four single case diagnostics, which are 1) DFBETA, 2) Cook's distance, 3) COVRATIO, and 4) SDFFIT, are used to detect influential observations. These indicators measure the influence of deleting one or more observations and observing the changes in the regression results in terms of the residuals, individual coefficient, or overall model fit.

Single Case Diagnostics	Description	Cut-off Points/Thresholds
DFBETA	Shows the impact of deleting a single observation on each regression coefficient	$\pm 2/\sqrt{n}$
Cook's Distance	Captures the impact of an observation from 1) the size of changes in the predicted values when the case is omitted and 2) the observation's distance from the other observations (leverage).	$4/(n-k-1)$
COVRATIO	Is similar to Cook's distance; estimates the effect of the observation on the efficiency of the estimation process	$1 \pm 3p/n$
SDFFIT	Measures the degree to which the fitted values change when the case is deleted	$2\sqrt{(k+1)/(n-k-1)}$

Table III-24: Single case diagnostics and the calculation of cut-off points and thresholds[29]

3.2.5 Interpreting the Regression Variate (Stage 5)

In this stage, the regression variate is interpreted by evaluating the estimated regression coefficients for their explanation of the dependent vaiables. Interpretation is done by 1) examining beta coefficients and 2) assessing multicollinearity. Using beta coefficients is a convenient way of reflecting the relative impact on the dependent variable of a change of one standard deviation in variables without the influence of different units of measurement (Hair *et al.*, 1998). Also, the existence of multicollinearity should be checked, as the presence of multicollinearity 1) makes the process of separating the effects of individuals more difficult and 2) significantly influences the estimation of the regression coefficients and their statistical significance tests. In this research, three methods of detecting multicollinearity were conducted. These were: 1) the tolerance level, 2) the variance of inflation factor (VIF) and 3) the two-part process for detecting the existence of strong multicollinearity, which firstly identifies all indices above 30, and then identifies the portion of variance greater than 0.90 of the variables of these indices.

3.3 Perception Asymmetry and Performance of Supply Chain Partnership

The third research objective is to answer the following two questions: 1 Do suppliers and customers see things differently, and if yes, then in which aspect of supply chain partnerships do their views differ? 2) Is this difference in any way related to the performance of the supply chain? In order to answer these questions, two analytical methods, 1) MANOVA and 2) Pearson's correlations, were used. Multivariate analysis of variance is the multivariate extension of the univariate

[29] The formulas for calculations cut-off points were from Hair, J *et al* 1998 Multivariate Data Analysis and 2

techniques for assessing the differences between group means. In MANOVA, the null hypothesis tested is the equality of vectors of means on multiple dependent variables across group (Hair *et al.*, 1998).

As with the two previous analytical methods, 'the six-step model building process' by Hair *et al.* (1998) was used to ensure that the requirements of each step, from the problem definition to the critical diagnosis of the result, were met.

In the following discussion, the focus of the methodological review is on the 'two-group MANOVA'; thus, reviews of other types of ANOVA and MANOVA are omitted.

3.3.1 Objectives of MANOVA (Stage 1)

As an initial stage, two important issues should be addressed. Firstly, the objectives of using MANOVA should be determined. Hair *et al.* (1998) suggested that the selection of the MANOVA is based on the desire to analyse a dependence relationship represented as the differences in a set of dependent measures across a series of groups formed by one or more categorical independent measures. Three categories of the multivariate problems, where MANOVA can applied as a resolution, are 1) multiple univariate questions, 2) structured multivariate questions, and 3) intrinsically multivariate questions (Hair *et al.* 1998). Once the problem is identified as suitable for MANOVA, then the process of selecting the dependent measures should be conducted. Only variables with a sound conceptual or theoretical basis should be included. For this research, a total of eight dependent variables were included for two MANOVAs and all variables have a sufficient conceptual or theoretical basis.

3.3.2 Research Design of MANOVA (Stage 2)

The most important issue to be dealt at this stage of the two-group MANOVA is the sample size requirement. Hair *et al.* (1998) suggested that the minimum recommended cell size is twenty observations, and at a minimum, the sample in each cell must be greater than the number of independent variable. In addition to this, the statistical power programme Gpower[30] was used to ensure that the power level with 1) the given sample size, 2) medium effect size, 3) given α level, 4) the number of

Field, A. 2003. Discovering Statistics, Using SPSS

[30] Gpower is a freeware software application developed by Heinrich-Heine-Universität, Düsseldorf

dependent variables, and 5) the number of the grouping variable, was higher than the recommended power level 0.80.

3.3.3 Assumptions of MANOVA (Stage 3)

Stevens (1992) and Hair *et al.* (1998) suggested that three assumptions need to be met for valid MANOVA results. These assumptions are: 1) the observations must be independent, 2) the variance-covariance matrices must be equal for all treatment groups, and 3) the set of p-dependent variables must follow a multivariate normal distribution. In addition, the possibility of the existence of linearity, multicollinearty and outliers should be examined. The first assumption of independence is tested by Bartlett's test of sphericity. The assumption of homogeneity is tested at univariate and multivariate levels. To test for univariate homogeneity, Levene's Test of Equality of Error Variance is used, and at the multivariate level homogeneity is tested by using Box's M test. Regarding the normality assumption, due to the lack of a direct test for multivariate normality, univariate normality tests are used instead. The reason behind this is that even though univariate normality is not a guarantee of multivariate normality, if all variables meet this requirement, then the effect of the violation of this assumption is minimal (Hair *et al.* 1998). Along with the visual inspection of histograms and Normal Q-Q plots of each variable, Kolomogorov-Smirnov and Shapiro-Wilk test statistics are used to test this assumption.

In addition to the assumption check, outliers should be detected, as the MANOVA is especially sensitive to outliers and their impact on the Type I error. The three-step approach for detecting outliers suggested by Hair *et al.* (1998) was used.

3.3.4 Estimation of the MANOVA Model and Assessing Overall Fit (Stage 4)

Upon completion of the assumption tests, an assessment of significant differences among groups formed by the treatment(s) should be carried out. The four most popular criteria for significance testing are 1) Roy's Largest Root, 2) Wilks's Lambda, 3) Hostelling's T^2, and 4) Pillai-Barlett Trace. Their descriptions and the formulae for their calculation are presented in Table III-25.

Significance Testing	Description	Calculation
Roy's Largest Root	Is the sum of the proportion of explained variance on the discriminant functions	$V = \sum_{i=1}^{s} \frac{\lambda_i}{1+\lambda_i}$
Wilks's Lambda	Is the product of the unexplained variance on each of the variates. So it represents the ratio of error variance to total variance for each variate	$\Lambda = \prod_{i=1}^{s} \frac{1}{1+\lambda_i}$
Hostelling's T^2	Is the sum of the eigenvalues for each variate. It is the sum of SS_M/SS_R for each of the variates	$T = \sum_{i=1}^{s} \lambda_i$
Pillai-Barlett Trace	Is the eigenvalue for the first variate	largest root = $\lambda_{largest}$

Table III-25: The descriptions and formulas for four major criteria for significance testing, (Source: Field, A., Discovering statistics, using SPSS for Windows, 2003)

In this study, as our interest lies in the difference in perceptions of five attributes of a supply chain partnership, Hotelling's T^2, which is the specialised form of MANOVA for two-group cases, was employed. According to Hair *et al.* (1998), Hotelling's T^2 provides a statistical test of the variate formed from the dependent variables that produces the greatest group differences and tackles the problem of inflation of Type I errors. In addition, Roy's Largest Root, Wilks's Lambda, and Pillai-Barlett Trace were used to assist the significance test.

3.3.5 Interpretation of the MANOVA Results (Stage 5)

Once the statistical significance of the treatments has been assessed, the process of interpretation of the results may be carried out through three methods: 1) interpreting the effects of covariates (if employed), 2) assessing which dependent variable(s) exhibited differences across the groups; or 3) identifying which groups differ on a single dependent variable or the entire dependent variate. In order to do the above, firstly the examination of SSCP matrices is performed in order to check whether the MANOVAs were significant due to the relationship between dependent variables rather than individual differences. Secondly, separate ANOVAs are performed on each of the dependent variables to assess which individual variables are contributing the significant MANOVA models.

IV. Results I: Classification Scheme and Evolution of Supply Chain Partnerships

1 Introduction

The first research objective of this research is to develop a classification scheme of supply chain partnership using the five determinants of the performance of a partnership, which are 1) information exchange, 2) trust, 3) joint partnership management system, 4) relationship specific assets, and 5) partner asymmetry. In order to achieve this, the cluster analysis approach was employed due to its usefulness for building taxonomy and classification methods.

In chapter four, the result of the cluster analysis and a classification scheme for supply chain partnership developed are presented. Also, the academic contribution of this research and the managerial implication of 'partnership growth management' based on the results are discussed here.

The data collection for the cluster analysis was conducted using retailers (customers) and manufacturers (suppliers) from the Korean CPG supply chain. A combination of Hair's six-step multivariate decision process with Punj & Steward's two-step clustering were used to find the final cluster solution.

2 Objective of Cluster Analysis and Selection of Variables

In the first stage of the analysis, two important issues – the research objective and selection of the variables - were addressed. The research objective was mentioned in the introduction section.

2.1 Selection of Variables

The five collaborative elements of a supply chain partnership, 1) IT, 2) trust, 3) joint partnership management system, 4) relationship specific assets, and 5) partner asymmetry were selected for the classification of supply chain partnerships. These collaborative elements have been frequently reviewed by academics as major determinants of the performance of various forms of collaborative inter-firm arrangements.[31] For this reason, these variables are considered adequate to be used for the purpose of segmentation.

[31] Please refer to the literature review section II.4.4 for a detailed review of these variables.

3 Research Design in Cluster Analysis

In the stage two, the issues addressed are 1) detection of outliers, 2) selection of similarity measures, and 3) data standardisation.

3.1 Detecting Outliers

According to Hair *et al.* (1998), the results of cluster analysis can be especially sensitive to the existence of outliers; thus, it is important to exclude outliers before proceeding with the main analysis. The three-step approach for detecting outliers suggested by Hair *et al.* (1998) was used. Their detection approach is designed to maximise the chance of detecting true outliers by combining outlier identification procedures from univariate, bivariate and multivariate perspectives.

3.1.1 Univariate Outlier Detection

For the seventy-four observations of all five variables, 1) IT, 2) trust, 3) joint partnership management system, 4) relationship specific asset, and 5) partnership asymmetry, the sample means and sigma values are presented in Table IV-1. None of the observations from the five variables exceeded the standard score of 2.5, which was an appropriate score for a sample size of less than 80 observations (Hair *et al.*, 1998). Thus, from the univariate perspective, none of the five variables had significant univariate outliers.

Variable	IT	TR	JS	RA	PA
Range	30.0 - 65.4	19.0 - 39.0	28.0 - 53.0	3.0 -19.0	12.0 - 28.0
Location estimates:					
Sample mean	47.682	29.865	38.865	9.784	20.919
Sample median	46.833	30.000	39.000	9.000	21.000
Trimmed mean	47.498	30.002	38.672	9.575	20.961
Winsorised mean	47.739	29.851	38.770	9.703	20.973
Scale estimates:					
Sample std. deviation	9.165	4.361	6.236	3.837	3.580
MAD/0.6745	9.884	4.448	7.413	2.965	4.447
Sbi	9.518	4.468	6.442	3.944	3.643
Winsorized sigma	8.720	4.037	6.192	3.342	3.441
Grubbs' Test					
Test statistic	1.929	2.491	2.106	2.402	2.402
P-Value	1.000	0.824	1.000	1.000	1.000

Table IV-1: The outcomes of outlier identification from statgraphics for the five performance determinants of the performance of supply chain partnership.

3.1.2 Bivariate Outlier Detection

The second stage of outlier detection was conducted by superimposing an ellipse representing a specified interval with 90% confidence level for a bivariate normal

distribution over the scatter-plot for the five collaborative elements plotted against other variables (the performance of partnerships), which is not included in the analysis.

	Univariate Outliers Cases with Z Scores Exceeding 2.5	Bivariate Outliers Cases Lying Outside the 90% Confidence Interval Ellipse
Performance with	Cases	Cases
IT	None	9, **14**, 15, 51, 62
Trust	None	**14**, 26, 49, 60, 71
Joint Structure	None	**14**, 24, 73, 74
Relationship Asset	None	**14**, 34, 35, 37, 42, 43, 59, 63
Partner Asymmetry	None	**14**, 59, 60, 74

Table IV-2: Univariate outilers cases with z score exceeding 2.5 and bivariate outliers cases lying outside the 90% confidence interval ellipse.

Table IV-2 represents observations falling outside of the ellipses. As the confidence interval is 90%, it is to be expected that some observations will fall outside the ellipse. The observation fourteen appeared as a possible outlier on all five variables, and this indicated that this observation was probably a bivariate outlier.

3.1.3 Multivariate Outliners Detection

As a final step in the identification of possible outliers, mulitvariate outliers were assessed using the Mahalanobis D^2 measure, as it measures the position of each observation compared with the centre of all observations on a set of variables (Hair *et al.*, 1998). A conservative level of .001 was used as the threshold value for designating multivariate outliers and the result suggested that none of the observations in the data set were identified as significantly different at the .001 level (Appendix 1).

The results of the above three diagnostic tests indicated that observation number fourteen appeared repeatedly in the bivariate test. This indicated that observation fourteen was a true aberrant observation, which was not representative of the general population. Therefore, observation fourteen was excluded before the main analysis. Exclusion of observation fourteen was important, as the clustering algorithm to be used is known to be very sensitive to the existence of outliers (Punj & Stewart, 1983).

3.2 Selecting Similarity Measures and Standardisation

A distance measure, the squared Euclidean distance, was selected as the similarity measure for this analysis, as the forms of the data for two dimensions are metric.

$$d_{ij} = \sum_{k=1}^{p} (x_{ik} - x_{jk})^2$$

Equation IV-1: Squared Euclidean distance similarity measure, (Source: Everitt. B, Landau. S, Leese M: Cluster analysis 4th Edition, 2001)

Correlation measures were ruled out, as the emphasis of these measures is on the pattern of variables, not on the magnitude of values. Standardisation of data was not performed for the following reasons. Firstly, the measurement approaches for the five determinants were on a 7-point Likert scale. Secondly, squared Euclidean distance incorporates the process of standardisation. Thirdly, avoiding unnecessary standardisation can preserve any possible natural relationship reflected by the scale.

4 Assumptions in Cluster Analysis

In the third step, two important assumptions of cluster analysis, which are 1) the representativeness of the sample and 2) multicollinearity, were assessed.

4.1 Representativeness of the Sample[32]

Representativeness of the sample is critical, as the clusters are derived in the hope that the obtained sample is truly representative of the population. Thus, the violation of this assumption can decrease the quality of cluster solutions. The data for the cluster analysis can be regarded as representative for the following reasons.

Firstly, the sampling frame consisted of fifty-four CPG companies (thirty-four large discount store chains, ten supermarket chains, five Internet shopping outlets and five TV home shopping channels) in the category of CPG retailers, and they were selected from various sources such as the publications from the Korea National Statistical Office, the Ministry of Trade, Energy and Industry and the Korea Chainstore Association. As mentioned above in the section III.2.2.1, all the large discount store chains were included in the sample frame. The majority of the participants of the survey from the large discount store chain sectors are major players in Korea. For example, E-Mart, Samsung Tesco, Wal-Mart and Carrefour, which are among the top five large discount store chains, were the main participants of this survey. Regarding the supermarket sector, the top ten supermarket chains were selected and three of them participated in this survey, as selecting large supermarket chains with high annual turnover can lead to a better chance of spotting supply chain

[32] For detailed information on how the sample is drawn, please refer to the data collection methodology section III.2.2.2.

partnerships. The same logic was applied when selecting ten alternative CPG retailers, four of which took part in this survey.

Secondly, it was a targeted survey for boundary-spanning personnel of these major retailers such as merchandisers, logistics managers and procurement managers, and sales managers, logistics managers and account managers from their major suppliers. These participants were qualified informants, who understood the situations of the supply chain and the partnership itself. Also, as an initial stage in the survey process, the retailers who had agreed to participate this survey, were asked to provide contact details for their major suppliers, who they regarded as supply chain partners. Supply chain partnerships are more likely to exist in business relationships between retailers and their major suppliers due to the size of transaction, which can justify this form of resource allocation. Therefore, the data collected for this research by targeting key informants can be viewed as representative, as it is more likely to reflect the true structure of supply chain partnerships in Korean CPG retail supply chains.

Thirdly, as mentioned in the section III.2.3.1, a pair of questionnaires containing the same measures was presented to both the supplier and the retailer of a supply chain in order to minimise the perception asymmetry on the five collaborative elements. In total, eighteen questions for retailers and nineteen questions for their suppliers were asked. Fourteen of these questions were asked to both parties to measure the same attributes of their partnerships and to minimise the effect of perception asymmetry. Unlike other similar studies, where the questionnaires were posed only to one side of partnership, the present study's data represent a less biased and more integrated view of the structure of supply chain partnerships in CPG retail supply chains.

4.2 Existence of Multicollinearity

Multicollinearity among the variables may have adverse effects on cluster analysis, as it causes the related variables to be weighted more heavily, thereby receiving improper emphasis in the analysis.

The examination of multicollinearity of the five collaborative elements of supply chain partnerships was carried out. A linear regression with another variable, PE (performance of partnership), which was not included in the analysis, was performed to obtain 1) the tolerance value and 2) the Variance of Inflation factor (VIF). The tolerance value and VIF show the degree to which each independent variable is

explained by other independent variables. Hair *et al.* (1998) suggested that independent variables with tolerance values below 0.10 and over 10 can be suspected to have multicollinearity with other variables. The test results in Table IV-3 suggest that there was no obvious multicollinearity among the five determinants of the performance of supply chain partnerships.

Collinearity Statistics		
Determinants	**Tolerance**	**VIF**
IT	0.39874	2.507901
Trust	0.491211	2.035787
Joint Structure	0.306946	3.257902
Relationship Asset	0.820766	1.218374
Partner Asymmetry	0.404124	2.474488

Table IV-3: Test for multicollinearity for the five determinants of the performance of supply chain partnership

5 Deriving Clusters and Accessing Overall Fit

In order to use non-hierarchical partitioning algorithms, which are known to perform better than hierarchical algorithms, Punj & Stewart's two-stage clustering method was used. Their method enables the researcher to obtain pre-selected seeds points and the cluster number, which are essential pre-conditions to obtain optimum cluster solutions from non-hierarchical partitioning algorithms.

5.1 Hierarchical Cluster Analysis with Ward's Method

As Punj & Stewart (1983) suggested, Ward's method was selected to minimise within-cluster differences and the possibility of encountering the chaining problem, which is common in the single-linkage method. This method measures the distance between two groups (G_1 and G_2) of observations with the following formula (Garrette & Dussauge, 1995).

$$d^2(G_1, G_2) = \frac{n_1 n_2}{n(n_1 + n_2)} d^2(g_1, g_2)$$

Equation IV-2: Ward's Method, (Source: Everitt. B, Landau. S, Leese M: Cluster analysis 4th Edition, 2001)

5.1.1 Selection of Number of Clusters

The combination approach, using four criteria, was used to determine the number of clusters to be formed. These criteria are 1) agglomeration coefficient, 2) absence of outliers, 3) distinctive profile approach and 4) cubic clustering criterion (CCC), and Pseudo F test. Firstly, the agglomeration coefficient is a useful stopping rule to

determine the number of clusters, as a sudden percentage increase in the coefficient may signal that two very different clusters are merged (Everitt, Landau & Leese, 2001).

Number of Clusters	Agglomeration Coefficient[33]	% Change in Coefficient to Next Level
7	2560.98	12.16%
6	2877.74	12.37%
5	3223.25	12.01%
4	3647.35	13.16%
3	4414.58	21.04%
2	5979.23	35.44%
1	11956.39	99.97%

Table IV-4: Analysis of agglomeration coefficient for hierarchical analysis

The result of the analysis of clustering agglomeration indicated large increases in agglomeration coefficient, going from clusters four to three (3,647.35 => 4414.58, 21.04%), three to two (4414.58 => 5979.23, 35.44%) and two to one (5979.23 => 11,956, 99.97%), Graph (IV-1). These indicate that these three combinations caused substantial decreases in similarity. Thus, the two-, three- and four-cluster solutions were examined with three more criteria to determine the final number of clusters in the solution.

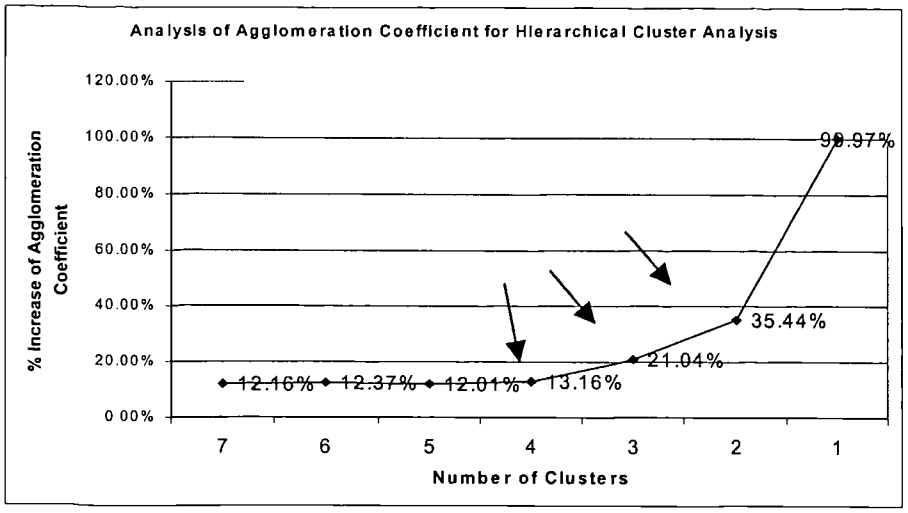
Secondly, the dendrogram[34] and agglomeration schedule[35] were used to identify outliers with the purpose of determining the number of clusters[36]. The examination of these suggested that there was no potential candidate for outlier, as there was no form of single member clusters or clusters with small number of observations under the 17 cluster solutions. Thus, it was not necessary to carry out re-specification of the cluster analysis and it was possible to proceed with the two-, three- and four-cluster solutions for the further examination due to the absence of outliers.

[33] The agglomeration coefficient refers to the squared distance between the two cases of clusters being combined. If there is a large agglomeration coefficient or a big percentage increase, this may imply that very clusters are combined (Hair *et al.*, 1998).

[34] The dendrogram is a visual representation of the steps in a hierarchical clustering solution that shows the clusters being combined and the values of the distance coefficients at each step. Connected vertical lines designate joined cases. The dendrogram rescales the actual distances to numbers between 0 and 25, preserving the ratio of the distances between steps.

[35] The agglomeration schedule shows every step of the cluster agglomeration. If you have *n* cases, in the first step, it creates *n*-1 clusters, in the second step *n*-2 clusters and so on until the last step, where it has agglomerated all cases into one cluster. It shows all agglomeration coefficients at each step from *n*-1 to 1 (SPSS Base 10.0 User's Guide, 2000)

[36] Please see the Appendix 1 for the dendrogram and agglomeration schedule.



Graph IV-1: Percentage increase of agglomeration coefficient

Thirdly, profiling of the two-, three- and four-cluster solutions was conducted to determine the final cluster solutions to examine. Increasing the number of clusters can improve the representation of distinct groups that may reflect an underlying structure. Examination of the clustering variable mean values suggested that two clusters are very similar to each other. Regarding the two-cluster solution, cluster 1 has higher values on all of five determinants than cluster 2. This pattern of high-low differences among clusters existed in the four-cluster solution as well. However, in the three-cluster solution, this high-low pattern did not exist in the variable Partner Asymmetry. This might indicate that the three-cluster solution did not represent the structure better than two- or four-cluster solutions. In addition, the clustering variables in the two, three, and four cluster solutions differ in a statistically significant manner across the clusters at .01.

Clustering Variable Mean Values							
Cluster	Number	IT	Trust	JS	RA	PA[37]	Cluster Size
Two	1	54.139211	32.342105	43.868421	10.973684	23.2894737	38
	2	41.147429	27.342857	33.628571	8.6857143	18.3714286	35
Three	1	50.0575	31.583333	41.708333	9.875	22.3333333	24
	2	41.147429	27.342857	33.628571	8.6857143	18.3714286	35
	3	61.136429	33.642857	47.571429	12.857143	12.8571429	14
Four	1	50.0575	31.583333	41.708333	9.875	22.3333333	24
	2	45.614444	27.722222	34.277778	9	18.6666667	18
	3	36.417647	26.941176	32.941176	8.3529412	18.0588235	17
	4	61.136429	33.642857	47.571429	12.857143	24.9285714	14

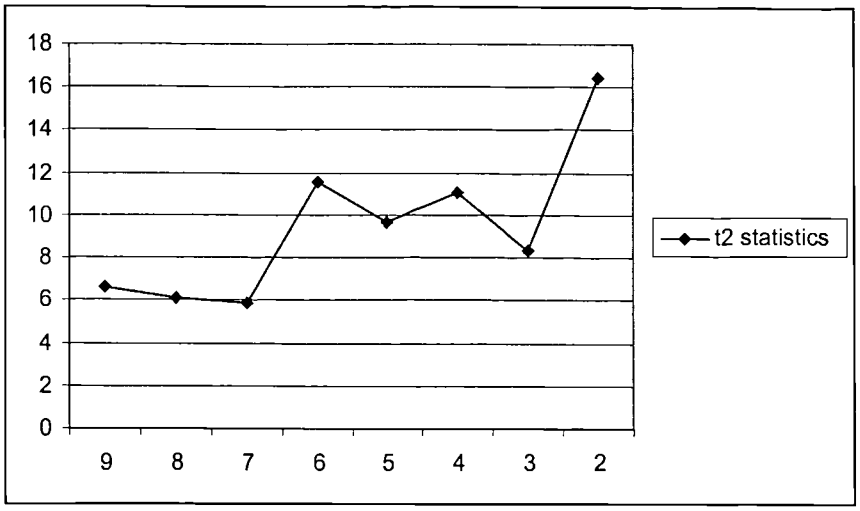
Significance Testing of Difference between Cluster Centres						
Two Cluster Solution	SS	df	MS	F	P-value	F crit
IT	3075.1495	1	3075.1495	78.694667	0.000	3.9758135
Trust	455.34248	1	455.34248	35.9839	0.000	3.9758135
JS	1910.3632	1	1910.3632	154.04168	0.000	3.9758135
RA	95.37387	1	95.37387	7.2615814	0.009	3.9758135
PA	440.67032	1	440.67032	63.336846	0.000	3.9758135
Three Cluster Solution	SS	df	MS	F	P-value	F crit
IT	4160.453	2	2080.2265	86.205991	0.000	3.1276812
Trust	492.84749	2	246.42374	20.036002	0.000	3.1276812
JS	2214.3184	2	1107.1592	134.4203	0.000	3.1276812
RA	174.00827	2	87.004134	7.1324707	0.002	3.1276812
PA	798.04123	2	399.02061	38.835794	0.000	3.1276812
Four Cluster Solution	SS	df	MS	F	P-value	F crit
IT	4899.9333	3	1633.3111	118.66977	0.000	2.7374938
Trust	498.18092	3	166.06031	13.391962	0.000	2.7374938
JS	2229.9375	3	743.31251	91.433374	0.000	2.7374938
RA	177.66877	3	59.222924	4.8062547	0.004	2.7374938
PA	503.45445	3	167.81815	26.853826	0.000	2.7374938

Table IV-5: Clustering variable profiles for the two-, three- and four-cluster solutions from the hierarchical cluster analysis

Even though it is clear from Table IV-5 that the four-cluster solution shows a more well-defined structure and more variation in terms of the clustering variables, it is too premature to conclude the number of clusters. All of the above three indicators at this stage suggest that the two- or four-cluster solutions can be carried forward into step two, non-hierarchical analysis.

Everitt, Landau & Leese (2001) argued that the above method of using dendrogramme and agglomeration schedules may be very subjective, and the decision about the number of clusters is often subject to the user's prior expectations. Thus, as a final method, two more formal techniques, which are 1) t^2 statistics and 2) cubic clustering criterion (CCC), were used to make a decision regarding the final number of the cluster solution. Milligan & Cooper (1985) carried out a series of

assessments for the thirty stopping rules and concluded that CCC and the Pseudo F test are relatively well performing stopping rules. CCC and Pseudo F were calculated by using SAS, but the outcomes of CCCs were all negative for two or more clusters, and this might suggest a unimodal or long-tailed distribution. For this reason, the t^2 statistics were used to make a final decision on the number of clusters in the solution. Milligan & Cooper (1985) suggested that inflections in the t^2 statistics could suggest possible cluster stops. As can be seen from Graph IV-2, there are two distinctive inflection points, which are the six- and four-cluster solutions.



Graph IV-2: t^2 statistics of the cluster analysis based on Ward method

Everitt, Landau & Leese (2001) advised that using formal techniques for determining the number of clusters alone is not recommended, but a combination of all possible means should be used to make a final decision. The initial diagnosis with the dendrogram and agglomeration schedule indicated two- to four-cluster solutions, and the t^2 statistics confirms that the four-cluster solution is optimal. As a result of four different methods of determining the final number of clusters, the four-cluster solution was carried forwards for the final cluster analysis with the better-performing performing k-mean method.

5.1.2 Selection of Initial Seed Points

From the hierarchical cluster analysis with Ward's method algorithm, the following cluster centroids (seed points) were obtained (Table IV-6). These seed points were carried forwards for non-hierarchical analysis, as specifying initial seed points can significantly increase the efficiency of a non-hierarchical algorithm (Punj & Stewart,

[37] The higher score is the less 'partner asymmetry' exists

1983).

Cluster	IT	Trust	JS	RA	PA
1	50.058	31.583	41.708	9.875	22.333
2	45.614	27.722	34.278	9.000	18.667
3	36.418	26.941	32.941	8.353	18.059
4	61.136	33.643	47.571	12.857	24.929

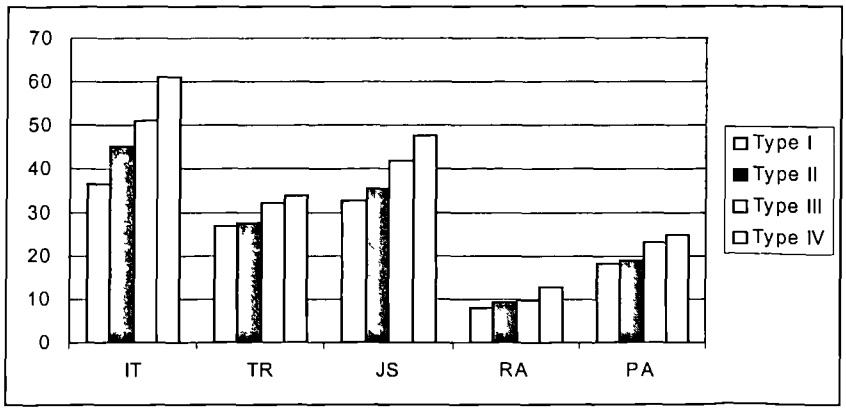
Table IV-6: The initial seed points (cluster centroids for four cluster solution)

5.2 Non-hierarchical Cluster Analysis with K-means

The second step is the use of K-means algorithms, as non-hierarchical algorithms are known to out-perform the majority of hierarchical algorithms. As a pre-requirement for the optimum solution, the seed points and the possible number of clusters from the first step were used, where the hierarchical cluster analysis with Ward's method algorithm was employed. The results are shown in Table IV-7 and Graph IV-3 for the four-cluster solution.

	Mean Values				
Final Cluster Centres (Size)	IT	Trust	JS	RA	PA[38]
1 (21) Type III	51.00	32.19	41.76	9.76	22.95
2 (21) Type II	45.24	27.57	35.57	9.48	18.92
3 (17) Type I	36.50	27.06	32.59	8.06	18.41
4 (14) Type IV	61.14	33.64	47.57	12.86	24.93
Statistical Significance of Cluster Differences					
F-Value	137.647	16.090	74.777	5.021	35.056
Significance	0.000	0.000	0.000	0.003	0.000

Table IV-7: Clustering variable profiles for the final four cluster solutions from the non-hierarchical cluster analysis with initial seed points from the hierarchical results



Graph IV-3: Clustering variable profiles for the final four cluster solutions (Type I-IV)

The result suggests that the cluster profile of the four-clusters solution from K-means

[38] The higher PA score is the less 'partner asymmetry' exists

methods was similar to that from the hierarchical procedure. In terms of cluster size, the cluster sizes were close to those from the hierarchical procedure, varying in size at the most by four. The correspondence and stability of the cluster solution between the non-hierarchical and hierarchical methods confirmed the results, subject to theoretical and practical acceptance.

6 Description of the Clusters

The final four-cluster solution on the basis of all seventy-three cases was developed on the basis of the cluster means and the examination of the individual questionnaire items. The following items were used to measure five supply chain performance determinants (Table IV-8).

Supply Chain Partnership Performance Determinants	Indicators
Information Exchange	a) Capacity of external information sharing in general
	b) Capacity of information exchange of 1) standardised and 2) customised information exchange with its specific partner
	c) Willingness to share 1) operational and 2) strategic SCM information with its specific partner
	d) Types of information exchanged with specific partner
	e) Quality of information they receive from specific partner
Trust	a) Perceptual trust of specific partner
	b) Abuse of customers' buyer power
	c) Prime customer/supplier
Joint Partnership Management	a) Existence of formalised guideline for supply chain partnership management
	b) Existence of well defined roles and responsibility of engaging partnerships
	c) Opportunity for suppliers' participation in the decision making process of their customers
	d) Existence of regular communication opportunities regarding SCM issues
	e) Existence of benefit and risk sharing system
Relationship Specific Asset	a) Existence of IT investment for the partnership with the specific partner
	b) Existence of Non-IT investment for the partnership with the specific partner
Partner Asymmetry	a) Degree of partner asymmetry with the specific partners in 'willingness to change'
	b) Degree of partner asymmetry with the specific partners in 'keeping commitment'

Table IV-8: Measurement items for five determinants of performance of supply chain partnership

6.1 Type I Supply Chain Partnership

The first group of the supply chain partnership was named as 'Type I supply chain partnership'. Type I partnership classifies 23.2 % (seventeen cases) of the sample and represents the most basic and loosest form of a supply chain partnership. The means for the five determinants of supply chain partnership performance for this group were the lowest among the four categories of supply chain partnership suggested by the cluster analysis.

6.2 Type II Supply Chain Partnership

The second group of supply chain partnerships was named 'Type II supply chain partnership'. Type II partnerships account for 28.8% of the sample (twenty-two cases) and represent a more collaborative form of supply chain partnership than Type I. Type II supply chain partnerships differed to Type I in respect of two aspects: 1) level of information exchange (IT) and 2) joint partnership management system (JS). As can be seen from Table IV-9, the t-tests for differences between means suggested that IT and JS of Type II partnerships are significantly higher than those of Type I supply chain partnerships at .05.

t-Tests for the Mean Difference between the Type I and Type II Assuming Unequal Variances							
	Type	II	I		Type	II	I
IT	Mean	45.240	36.501	RA	Mean	9.476	8.059
	Variance	10.689	10.885		Variance	9.162	4.934
	Hypothesized Mean Difference	0			Hypothesized Mean Difference	0	
	df	34			df	36	
	t Stat	8.152			t Stat	1.663	
	P(T<=t) two-tail	0.000			P(T<=t) two-tail	0.105	
	t Critical two-tail	2.032			t Critical two-tail	2.028	
TR	Mean	27.571	27.059	PA	Mean	18.286	18.412
	Variance	8.057	17.934		Variance	6.414	6.257
	Hypothesized Mean Difference	0			Hypothesized Mean Difference	0	
	df	27			df	35	
	t Stat	0.427			t Stat	-0.154	
	P(T<=t) two-tail	0.672			P(T<=t) two-tail	0.879	
	t Critical two-tail	2.052			t Critical two-tail	2.032	
JS	Mean	35.571	32.588				
	Variance	12.457	10.757				
	Hypothesized Mean Difference	0					
	df	35					
	t Stat	2.694					
	P(T<=t) two-tail	0.011					
	t Critical two-tail	2.030					

Table IV-9: t-Tests for the mean difference between the Type I and Type II assuming unequal variances

6.3 Type III Supply Chain Partnership

The third group of the supply chain partnership was termed 'Type III supply chain partnership'. Type III partnerships accounted for 28.8% of the sample (twenty-two cases). The partnerships that belonged to Type III had a higher degree of four performance determinants, which were 1) information exchange, 2) trust, 3) joint partnership management structure, and 4) partner symmetry, as compared to 'Type II partnerships'. The result of the ANOVA suggested that there was no significant mean

difference in the degree of relationship specific assets among partnerships that belonged to types I, II and III.

t-Tests for the Mean Difference between the Cluster 3 and 4 Assuming Unequal Variances							
	Type	III	II		Type	III	II
IT	Mean	50.999	45.240	PA	Mean	9.762	9.476
	Variance	17.878	10.689		Variance	13.090	9.162
	Hypothesised Mean Difference	0			Hypothesised Mean Difference	0	
	df	38			df	39	
	t Stat	4.937			t Stat	0.278	
	P(T<=t) two-tail	0.000			P(T<=t) two-tail	0.783	
	t Critical two-tail	2.024			t Critical two-tail	2.023	
TR	Mean	32.190	27.571	RA	Mean	22.952	18.286
	Variance	15.262	8.057		Variance	5.348	6.414
	Hypothesised Mean Difference	0			Hypothesised Mean Difference	0	
	df	37			df	40	
	t Stat	4.383			t Stat	1.685	
	P(T<=t) two-tail	0.000			P(T<=t) two-tail	0.783	
	t Critical two-tail	2.026			t Critical two-tail	2.023	
JS	Mean	41.762	35.571	ANOVA	Type I, II and III on RA		
	Variance	7.990	12.457		SS	27.877	
	Hypothesised Mean Difference	0			df	2	
	df	38			MS	13.938	
	t Stat	6.274			f	1.291	
	P(T<=t) two-tail	0.000			P-value	0.283	
	t Critical two-tail	2.024			F Crit	3.153	

Table IV-10: t-tests for the mean difference between the Type II and Type III and assuming unequal variances and ANOVA for Type I, II and III on relationship specific assets

6.4 Type IV Supply Chain Partnership

The final group of supply chain partnerships was termed 'Type IV supply chain partnership'. These partnerships represented 19.2% of the sample (fourteen cases), (Table IV-11). The partnerships belonging to Type IV have the highest degree of four performance determinants than any other type of supply chain partnership. However, the mean value of the level of trust is not significantly different from that of Type III.

t-Tests for the Mean Difference between the Cluster 3 and 4 Assuming Unequal Variances							
	Type	*IV*	*III*		Type	*IV*	*III*
IT	Mean	61.136	50.999	RA	Mean	12.857	9.762
	Variance	7.097	17.878		Variance	24.593	13.090
	Hypothesised Mean Difference	0			Hypothesised Mean Difference	0	
	df	33			df	22	
	t Stat	8.699			t Stat	2.001	
	P(T<=t) two-tail	0.000			P(T<=t) two-tail	0.049	
	t Critical two-tail	2.035			t Critical two-tail	2.2.074028	
TR	Mean	33.643	32.190	PA	Mean	24.929	22.952
	Variance	3.324	15.262		Variance	2.687	5.348
	Hypothesised Mean Difference	0			Hypothesised Mean Difference	0	
	df	30			df	33	
	t Stat	1.479			t Stat	2.957	
	P(T<=t) two-tail	0.150			P(T<=t) two-tail	0.006	
	t Critical two-tail	2.042			t Critical two-tail	2.035	
JS	Mean	47.571	41.762				
	Variance	5.802	7.990				
	Hypothesised Mean Difference	0					
	df	31					
	t Stat	6.516					
	P(T<=t) two-tail	0.000					
	t Critical two-tail	2.040					

Table IV-11: t-tests for the mean difference between the Type III and Type IV

7 Validation and Profiling of the Clusters

A two-step approach was adopted to assess the validity of the cluster solution. In order to test the stability of the cluster solution, the second non-hierarchical k-means analysis was performed with random seed points. The outcome is illustrated in Table IV-12.

Four-Cluster Solution, Clustering Variable Mean Value (Final Cluster Solution)						
	IT	TR	JS	PA	RA	Size
Type I	37.4175	26.65	32.55	8.15	18	20
Type II	46.4152	28.1364	36.7727	10.4091	19.0909	22
Type III	50.9625	33.1875	42.25	8.5	23.5	16
Type VI	60.8378	33.5333	47.2	12.8667	24.8	15

Table IV-12: Clustering variables profiles for the four-cluster solution from the non-hierarchical cluster analysis with random seed points

The outcome of the second analysis suggests that even though there are some differences in terms of the membership and the size of the clusters, overall, the cluster size are comparable for each solution. Also, the cluster profiles are similar to each other. This outcome confirms that there is a consistency between the first cluster solution and the second solution. As a second step to ensure the validity of the cluster solution, the predictive validity was assessed. Hair, *et al.* (1998) suggested the inclusion of other variables, which are not included in the analysis but are

empirically and theoretically known to have relationships, in order to check whether there are significant differences in these variables across the clusters.

Predictive Validity	Profiling of Clusters					
	Type I	Type II	Type III	Type VI	F Value	Significance
	156.0667	156.7643	175.4302	189.7143	2.737494	0.000

Table IV-13: ANOVA test of the means the performance of supply chain partnership, Type I , II, III and IV

The variable 'performance of supply chain partnership' was considered to assess the predictive validity. Various literature sources have suggested a definite relationship between the five determinants and the variable 'performance of supply chain partnership'. The univariate *F* ratio suggests that the means of the four types of partnership were significantly different.

8 Academic Contribution: Classification Scheme for Supply Chain Partnerships

In summary, the results of the cluster analysis provide one important contribution to the existing literature on supply chain partnerships, which is a classification scheme for supply chain partnerships according to five performance variables.4 The result of the cluster analysis shows how four distinctive patterns of supply chain partnerships exist in the survey data. These four patterns were named 1) stagnated basic supply chain partnerships, 2) developing basic supply chain partnership, 3) moderately collaborative supply chain partnerships, and 4) highly collaborative supply chain partnerships, in order to reflect the distinctive characteristics of each category. On the basis of these findings, the classification of supply chain partnerships becomes possible.

Type of SCPs	Elements	Description
Stagnated Basic Partnership	IT	- Weakest IT capacity for internal & external (particularly weak) information exchange - Not capable of sharing standardised or customised information - Lowest satisfaction with information exchange, diversity of information exchanged and willingness to exchange
	JS	- Customer-led partnerships (no participation of suppliers) - Unfair risk/benefit sharing system - No formalised guidelines - No regular communication route
	TR	- Buyer power is the major form of partnership governance - Reluctantly agree that their partnerships are based on trust
	RA	- None
	PA	- Highest
	Comment	- Short-term benefit oriented partnerships - Stagnated due to the lack of interest and willingness in developing them to more collaborative partnerships - Mostly partnerships among small and medium sized retailers and manufacturers, alternative CPG retailers

Developing Basic Partnership	**IT**	- Weak IT capacity, overall some internal but weak external information exchange capacity, more obvious on suppliers' side - Little standardised or customised information exchange due to restricted capacity from suppliers' side - However, strong intention to expand current information exchange
	JS	- Customer-led partnerships with little suppliers' participation - Fairer risk/benefit sharing system than previous one, but suppliers not happy - Basic level of formalised guideline
	TR	- Similar to 'Stagnated Basic Partnership'
	RA	- Little on IT but none on non-IT assets
	PA	- High
	Comment	- Currently short-term benefit oriented partnerships similar to 'Stagnated Basic Partnership' - However, both show strong intention to develop their partnerships into more collaborative ones - Majority of the partnerships are among medium sized manufacturers and supermarket chains and alternative retailers
Moderately Collaborative Partnership	**IT**	- Sufficient IT capacity from both suppliers and customers for internal and external information exchange - Exchange of standardised information but limited customised - Positive evaluation on information exchanged and various information exchanged - Strong intention to expand current information exchange
	JS	- More supplier participants on the joint management of partnerships - Fairer risk/benefit sharing system - Some degree of regular communication - Fairly well defined guidelines
	TR	- Both agree that their partnerships are based on truth - Abuse of buyer power still problem - Regard each other as prime customer/suppliers
	RA	- Some degree of IT partnership specific assets but few non-IT assets
	PA	- Medium
	Comment	- More long-term benefit-oriented partnerships - Well functioning partnerships - More collaborative elements such as trust and joint management - Large discount stores and supermarket chains. Well known manufacturers
Highly Collaborative Partnership	**IT**	- The most sophisticated SC IT system for external/internal information exchange - Highest satisfaction with information exchange and the most diverse information exchanged - Balanced IT capacity, suppliers posses similar level of IT capacity to their customers
	JS	- Jointly managed partnerships - Best structured partnership management system - Fairest risk/benefit sharing system
	TR	- Strongest mutual trust - Abuse of buyer power still remains a problem and the suppliers are the least happy (requires more research)
	RA	- Sufficient amount of non-IT and IT investment for partnerships
	PA	- Lowest
	Comment	- Long-term benefits oriented partnerships - Existence of partnership specific assets - Strong mutuality exists

Table IV-14: The classification scheme for supply chain partnerships

8.1 Stagnated Basic Supply Chain Partnerships (Type I)

On the basis of the results from the cluster analysis, Type I partnership is named as 'Stagnated Basic Supply Chain Partnership'. Partnerships in Stagnated Basic Supply Chain Partnership have the lowest levels of all five collaborative elements. According to the definition of the partnership used in this study, 'partnership' refers to 'an inter-organisational relationship with varying degrees of partnership elements with no equity involvement' (Cooper & Gardner, 1993, Harland 1996). The supply chain arrangement between suppliers and customers in the first category can fall under this broad definition of partnership and can be regarded as a 'partnerships', as they are a more collaborative form of supply chain arrangement than arm's-length/transactional relationships due to the existence of some degree of collaborative activities, such as limited information exchange. Overall, supply chain partnerships belonging to this category can be considered as an extended form of arm's-length or transactional relationships. The survey data indicate that the motivations for forming and maintaining such partnerships are mainly to achieve short-term and basic operational needs such as lower prices, securing seasonal supply etc. For this reason, the further development of the partnership towards a more collaborative form could be limited or not intended, as long as their needs are met by their partnerships and no further needs emerge. The survey data support this proposition, as the mean value of the response to the question, 'my company is intending to establish a closer partnership with our partner' was the lowest among the four types of the partnership. The majority of the participants in 'Stagnated Basic Supply Chain Partnerships' are relatively small in their annual turnover, and in terms of the mode of retailer they are either alternative retailers (TV and Internet) or supermarket chains, which are also known to be lacking in collaborative capacity.

The majority of the retailers (customers) in this category have a limited degree (the lowest among four different types of supply chain partnerships) of IT capacity for external information sharing; however, their suppliers have a even lower and more limited capability for external information sharing. In general, the participants in the Type I partnerships are not capable of sharing standardised or customised supply chain related information with their specific partners and the number of SCM related information they exchange with their partners is very limited and at a basic level. There is little or no IT investment by the retailers in this category targeted for their

specific partners for the purpose of information sharing. This tendency towards insufficient IT investment becomes more obvious on the suppliers' side, as the majority of companies in the category of suppliers have lower annual turnover than those of the other three groups. Consequently, both suppliers and customers are not very satisfied at all with the quality of the limited information they exchange occasionally. However, the majority of the companies in this group show some, albeit limited, degree of willingness and desire to share more transactional and strategic SCM information with their partners.

The majority of companies in Type I partnerships reluctantly agree with the statement that 'the partnership between their partners is based on the trust'. Despite of this, the suppliers believe that the governance structures of their partnerships are based on coercible power such as retailers' buyer power rather than trust. On the other hand, the retailers think that they have been somewhat managing to abstain from exercising power over their suppliers but believe that they have the legitimate power to influence them. This suggests significant perception asymmetry on this issue between retailers and their suppliers.

The partnerships in this category are not managed jointly by both participants. The participants of the supply chain partnerships in this category have the lowest degree of 1) formalised guidelines for developing, maintaining and monitoring, and 2) defined responsibility and roles for engaging in the supply chain partnership, in comparison with those in different categories. Moreover, there are 1) little or no participation by suppliers in the decision-making processes of their customers and 2) a lack of regular communication among partners on various operational and strategic issues. In addition, the structure of risk and benefit sharing from the business relationships are not well established in comparison with others; thus, potentially, this could degrade their partnerships' performance in the future.

In terms of relationship specific assets, both suppliers and retailers have a poor track records in terms of investing in IT and non-IT assets specifically for their partnerships. The participants of type I supply chain partnerships show the highest level of partner asymmetry regarding the value placed by their partners on keeping to commitments and willingness to change.

8.2 Developing Basic Supply Chain Partnership (Type II)

On the basis of the results from the cluster analysis, Type II partnership is named as 'Developing Basic Supply Chain Partnerships'. The supply chain partners who belong to Developing Basic Supply Chain Partnerships are in partnerships that are more collaborative than those from the previous category. The main difference is that partnerships in the 'Developing Basic Supply Chain Partnership' category possess a limited but nonetheless higher degree of IT and joint partnership management system than those of Type I. In addition to this, unlike the participants of the partnerships in the previous category, the participants in this category have strong and positive intentions to develop their partnerships further into more collaborative and beneficial partnerships. This suggests that the partnerships in this category are in the earlier stage of partnership development towards more highly collaborative relationships with the potential for growth.

An evolution toward more collaborative partnerships occurs when one or a combination of the following conditions are met. Firstly, if partners have a certain degree of satisfaction with a current inter-firm supply chain arrangement and positive expectations for the future, the partnerships will often evolve towards being more collaborative (Parkhe, 1991, 1993). Secondly, if newly developed strategic needs or other needs, which can be fulfilled by a closer partnership, emerge, then partners could commit themselves to the development of a more sophisticated form of partnership. Thirdly, if the participants of a supply chain relationship have sufficient infrastructure to support more sophisticated partnerships, then, they can agree with each other to develop their partnerships to a further stage.

The survey data support the proposition that partnerships in Type II are low collaborative partnerships but with high potential to evolve. The mean value of their responses to the question, 'my company is intending to establish a closer partnership with our partner' is significantly higher than the mean response from Type I, Stagnated Basic Supply Chain Partnerships, and this indicates that they have a strong willingness to develop their partnerships to a more advanced stage. Also, they have a significantly higher degree of infrastructure such as information systems and joint partnership management systems than Type I partnerships.

The majority of the companies in this category are supermarket chains and medium sized alternative retailers. One thing that came to the researcher's attention is that

there are two partnerships in this category which involve major large discount stores as customers. Their counterparts are, however, relatively medium sized manufacturers and the differences in their annual turnovers is considerable. These partnerships can be regarded as transaction-oriented partnerships with the customers, who have sufficient collaborative capacity; however, the development is stalled as both of the partners are content with the basic operational benefits from their partnerships and thus do not feel that it is necessary to expand their partnerships into the next stage.

As mentioned above, the major difference in IT compared to Type I supply chain partnerships is that the majority of both suppliers and retailers in Type II partnerships have some degree of IT infrastructure for external information sharing and the retailers (customers) in particular do possess some, albeit basic, capacity for sharing standardised or customised supply chain related information with their specific suppliers. However, the restricted capability for information exchange from the suppliers' side limits the exchange of standardised and customised information and the number of different types of information that can be exchanged. In addition, insufficient investment designed to improve information exchange with their specific partner is apparent in Type II supply chain partnerships as well. As with to Type I partnerships, this becomes more apparent from the suppliers' side. The companies in Type II' supply chain partnership show significantly higher interest and willingness to share information with their partners, but this is still below the average of all cases used for the analysis.

Unlike Type I, partnerships classed as Type II are managed jointly by both participants of the partnerships but in limited way. Both suppliers and customers have formalised guidelines for partnership management, responsibility and roles for engaging in supply chain partnership with the particular partners for basic SCM issues. However, both suppliers and customers think that the system of sharing risks and benefits is not functioning properly; this opinion is stronger among the suppliers. Also, the participation of suppliers in the decision-making processes of retailers and the existence of regular communication opportunities, although it does exist, is still very limited.

Other performance determinants used for cluster analysis such as trust, relationship specific assets, and partner asymmetry of the companies in Type II supply chain

partnership are not significantly different to those of the Type I supply chain partnerships.

In summary, the supply chain partners who belong to Type II are engaged in more collaborative partnerships than Type I partnerships, as they possess limited but higher degrees of IT and joint partnership management systems. However, they are still lacking in mutual trust and relationship specific asset investment specifically for their partnerships with their specific partners, which are essential for the successful functioning of a partnership.

8.3 Moderately Collaborative Supply Chain Partnership (Type III)

On the basis of the results from the cluster analysis, Type III partnership is named as 'Moderately Collaborative Supply Chain Partnership'. Companies belonging to the category of Moderately Collaborative Supply Chain Partnership (Type III) are engaged in more advanced partnerships than those in the previous two categories.

Overall, the supply chain partners belonging to Type III are engaged in moderately collaborative partnerships. These partnerships can be regarded as 'properly working partnerships' for the following reasons. Firstly, these partnerships are supported by IT infrastructure (especially IT connection for external information exchange) and joint partnership management systems at a sufficient level. Secondly, unlike the previous two categories, where customers are playing the dominant roles, these partnerships are based on 1) mutual trust, 2) better IT and JS from the suppliers' side, 3) participation of suppliers in the decision-making process, and 4) regular mutual communications. The partnerships in this category represent a more advanced and collaborative form of partnerships than those of Type I and Type II. In comparison with Type II partnerships, the main differences are 1) sufficient partnership infrastructure such as IT and JS from both sides and 2) more collaborative interaction elements such as mutual trust and a lower degree of partner asymmetry. The partnerships in this category are benefiting not only from sufficient operational improvement on their supply chains from their partnerships but also basic non-operational strategic improvements, such as improved marketing capability, customer service and new product development.

The majority of the participants in Moderately Collaborative Supply Chain Partnership are relatively large in their annual turnover, compared to those of Type I

and Type II. The customers are mainly large discount stores and some supermarket chains. Also, the suppliers are well known manufacturers with large annual turnovers. There are a few partnerships involving alternative retailers such as Internet and TV home shopping channels in this category; these are part of large retail networks which belong to well known Korean conglomerates such as SK and LG.

As mentioned above, the companies engaged in Type III partnerships have sufficient IT infrastructure for external information exchange. Both supplies and customers in these partnerships possess sufficient capacity for sharing standardised information with specific partners. However, the data show that only customised information with the specific partners is actually exchanged, with some difficulties. Despite the fact that both suppliers and customers in Type III partnerships do possess the ability to exchange standardised data with the specific partners, the exchange of standardised information is fairly limited. This phenomenon requires further research but at this stage, valid conclusions cannot be drawn from the existing data. However, due to the availability of sufficient IT capacity for information exchange, the partners exchange a greater variety of supply chain related information than Type I and II partnerships. Also, their evaluation of the quality of the information they are provided with is more positive and higher than the evaluation given by members of Type I and II partnerships. In addition, both parties of Type III partnerships are more eager to share more diversified types of information with their partners than those in Type I and II partnerships. This willingness to expand information becomes more apparent among customers of Type III partnerships, but the suppliers still remain less enthusiastic than the customers. However, the problem of insufficient IT investment still exits among Type III partnerships, despite the fact that the mean degree of IT investment targeted specifically towards a specific partner is slightly higher than those of Type I and II partnerships.

The governance structure of these partnerships is based on a high degree of non-coercible means such as trust. The majority of the companies within type III partnerships agree with the statement that 'the partnership between their partners' is based on trust. The retailers are confident that they successfully manage to abstain from using buyer power on their suppliers. On the other hand, suppliers have a neutral attitude to the claim by their customers. In addition, both the suppliers and retailers regard each other as a 'prime customer/suppliers'.

As mentioned above, various aspects of Type III partnerships are managed jointly by both participants of the partnerships. Both suppliers and customers have a certain degree of formalised guidelines for developing, maintaining and monitoring the partnership, and their responsibility and roles for engaging in the supply chain partnership are sufficiently defined. In addition, the suppliers in Type III supply chain partnership have broader opportunities to participate in the decision-making processes of their customers, and also have limited but regular communication opportunities for certain issues of SCM issues with their customers.

However, the lack of relationship specific assets also exists in Type III supply chain partnerships. Both the suppliers and retailers have poor track records in terms of investing in IT and non-IT specific assets to improve their partnerships' performance. Regarding partner asymmetry, both suppliers and customers consider that their partners have similar degrees of commitment and willingness to change.

8.4 Highly Collaborative Supply Chain Partnership (Type IV)

On the basis of the results from the cluster analysis, Type IV partnership is named as 'Highly Collaborative Supply Chain Partnership'. The partnerships in this category can be regarded as the most advanced supply chain partnerships. They have the highest degree of all the collaborative elements in all five areas. In other words, these partnerships are well supported by both IT and JS, and on the basis of this collaborative structure, there is plenty of mutual and collaborative interaction between partners for example, the partnerships in this category have the highest degree supplier participation in the decision making of customers and regular communication. These partnerships are distinctively different to the rest of the partnerships in this study in 1) level of IT capacity, 2) existence of partnership specific assets, and 3) mutuality.

Both suppliers and retailers in Type IV partnerships have the most sophisticated IT infrastructure for external information exchange with their partners. This is more apparent on the retailers' side, as the majority of the retailers in this category are well known, large, major discount stores with the reputation of valuing long-term partnerships with their suppliers. While the companies in Type III have problems with sharing standardised information with their partners, the retailers and suppliers in Type IV partnerships are actively sharing not only customised but also

standardised supply chain related information with their partners. As a consequence, 1) the variety of information exchanged, 2) the satisfaction of the partners with the information received and 3) willingness to share the information are the highest among the four types of partnerships identified in this research. Unlike the other types of partnerships, the participants in Type IV partnerships have a track record of IT investment, which is designated specifically for the partnerships and can increase performance of their partnerships. The existence of this IT investment implies that the degree of information exchange are sophisticated and large enough to justify the investment, and they have a certain degree of positive experience with previous information exchange. In addition, this probably explains the highest average score of Type IV partnerships on the items measuring the degree of IT among all partnership types.

The level of trust among the participants of these partnerships is not significantly different to that of Type III supply chain partnerships. However, the highest degree of the perception asymmetry is found among suppliers and customers of Type IV partnerships regarding the customers' abuse of their buying power. In a similar way to the customers in other categories, customers in Type IV partnerships are more confident that that they are abstaining from exercising buyer power than any other retailers in Types I, II, and III. On the other hand, Type IV suppliers are the most unhappy with their customers' abuse of their buyer power. The average score of the suppliers' disapproval of the abuse of buyer power is actually the lowest among all categories, despite the fact that the average scores for the other indicators of the level of trust of Type IV partnerships are the highest. One possible explanation for this is the timing of the survey. As mentioned in Chapter III, the survey was conducted before the Harvest Festival in Korea. Also, when the economic climate of recession is taken into consideration, along with the timing of the survey, it can be deduced that the CPG suppliers in Type IV partnerships were under heavy pressure from CPG retailers to provide them with discounts. The majority of the Type IV suppliers are large, well known suppliers, and the nature of their partnerships with their customers is very much one of inter-dependence. In other words, they are inter-locked with their retailers to a certain degree, due to the volume of trade and various assets committed to the partnerships. Therefore, the heavy pressure for discount from the retailers, as a result of the prevailing economic and circumstantial environments at the time of the

survey, can be viewed as 'abuse of buyer power' by the suppliers in Type IV relationships. However, this phenomenon requires further research but at this stage, valid conclusions cannot be drawn from the existing data.

As mentioned above, unlike the other three types of partnership in this research, the partnerships in Type IV had a significant amount of IT relationship specific investment with their partners. Also, both the suppliers and retailers have some track records in terms of investing in non-IT specific assets as well. Such investment is known to influence the performance of supply chain partnership by reducing transaction costs (Williamson 1975). However, investing on such assets requires a substantial amount of resource allocation and could give rise to hold-up situations (Williamson, 1975, Heide & Stamp, 1995, Artz, 1999, Houston & Johnson, 2000). For this reason, the existence of partnership specific assets implies that these partnerships and transactions are large and sophisticated enough to justify the risk of hold-up situations and resource requirements. The survey data support this proposition, as the majority of the partnerships in this category are formed between 1) large discount stores and 2) large CPG manufacturers with very well known brands, most of which are members of huge Korean conglomerates. In terms of transactions between them, the sum of the total annual revenue from both suppliers and customers of this group (the proxy measure) is the highest.

9 Managerial Implication: How to Make Partnerships Evolve?

The analysis of different types of supply chain partnerships sheds light on the evolution process of supply chain partnerships and provides valuable information to managers of CPG supply chain partnerships. Firstly, it reveals that there are certain patterns of development in all five collaborative elements, as partnerships evolve toward more collaborative forms. Secondly, it shows what circumstances and what kinds of conditions and efforts are required for evolution towards more collaborative partnerships.

9.1 Evolution from Type I to Type II Partnerships

Apart from 'Stagnated basic supply chain partnerships', all the other three types of partnerships can be regarded as partnerships with varying degree of potential for evolution into more collaborative partnerships. The main reason why the evolution

from Type I, Stagnated Basic Partnership towards Type II, Developing Basic Partnership, is not common is that the partners in this category do not have sufficient intent to develop the partnerships. The low level of intent to extend their partnerships to more collaborative forms can be explained by 1) the lack of awareness of the necessity of closer partnerships, and 2) the fact that motivations of these partnership can be served in a cost effective manner by low-level partnerships, and 3) low collaboration infrastructure such as IT, formalised guidelines and management systems.

9.2 Evolution from Type II to Type III Partnerships

Unlike Type I partnerships, the participants in the three other categories have positive intentions to develop their partnerships towards more collaborative forms. For this reason, the evolution from Type II to Type III and Type III to Type IV are more likely to happen than evolution from Type I to Type II. The evolution from Type II, Developing Basic Partnership to Type III, Moderately Collaborative Partnerships is based on the positive willingness and intention of both partners to develop their partnerships towards more collaborative forms in order to reap more benefits from their partnerships.

The most important conditions for enabling partnerships at Type II level to evolve towards a more collaborative Type III form of partnership is mutual trust. Trust can 1) decrease opportunistic behaviour, which can results in an increase of collaborative efficiency (Parkhe 1993), 2) reduce the uncertainty of risk involved in inter-firm partnerships (Child & Faulkner 1998, Whipple, Frankel & Anselmi 1999), and 3) encourage more effective reward and risk sharing system for collaborative inter-firm arrangements. Mutual trust is not only an important requirement itself for evolution towards Type III partnership, but also an important precondition for two other requirements: IT investment and improvement of joint partnership management systems.

Secondly, partners are required to improve their IT capacity significantly. Also, the asymmetry of IT capacity between suppliers and customers, which is common in Type I and Type II partnerships, should be rectified to a certain extent to evolve from Type II to Type III. However, rectifying the asymmetry of IT capacity between suppliers and customers requires substantial investment from suppliers, and for some

suppliers with low available resources, this can be a significant challenge. Also, such an increase in IT capacity requires a high level of certainty due to the amount of resource commitment, which is often a product of the trust between partners.

Thirdly, evolution to Type III requires a more sophisticated joint partnership management system and two additional elements 1) mutuality of decision-making processes and 2) fairness of risk/benefit sharing systems. As mentioned above, again mutual trust is an important pre-condition for effective reward and risk sharing systems within partnerships (Bowersox, 1990, Ellram, 1990).

9.3 Evolution from Type III to Type IV Partnerships

The survey suggested that, compared to the previous category (Type III), the overall IT and Joint Partnership Management System of Type IV partnerships are far more sophisticated and better functioning. Closer examination of the collaborative elements of Type IV revealed the existence of the high level of mutuality throughout most of the partnerships in Type IV. This mutuality is a unique trait of Type IV, Highly Collaborative Partnerships. Therefore, if partners are willing to advance their partnerships to the next stage, the mutuality of the following fields needs to be improved significantly.

First of all, the participants in Type III partnerships must improve the mutual aspects of their IT capacity. Improvement of mutual aspects of IT capacity here refers to 1) closing the gap in IT capacity between partners and 2) improving mutual IT capacity for more external information exchange. This phenomenon of IT capacity asymmetry was obvious in Type I and Type II partnerships. In terms of Type III partnerships, the IT capacity asymmetry was less obvious, but regarding the capacity of external information exchange, it was still the case that customers possessed more such capacity. This requirement of closing the gap for the evolution towards Type IV is more challenging than the similar requirement for the evolution towards Type III, because there is the least gap between the IT capacity of participants in Type IV partnerships (according to the survey results). Regarding the improvement of mutual IT capacity, the evidence from the survey has suggested that the external information exchange in Type III partnerships was mainly based on their own IT capacity. However, the evolution to Type IV needs mutual IT capacity in order to enable more sophisticated information exchange between partners. This requires not only

investment into their own general IT capacity but also IT investment specially designed for the partnerships with their specific partners. Such relationship specific investment incorporates another aspect of mutuality, which is 'the mutual commitment and involvement of suppliers and customers to investment into their partnerships', as investment for such assets by one party could possibly negatively impact the partnership outcome (Artz, 1999).

Secondly, the participants in Type III partnerships are also required to have a joint partnership management system' with strong mutuality. The mutuality in such joint partnership management systems can be observed throughout Type IV partnerships in the areas of 1) profit and risk sharing systems, and 2) decision-making systems for partnerships. In order to reach more advanced Type IV, partnership it is necessary to have a mutually satisfying partnership profit and risk sharing system. Overall, the evaluation of the fairness of this system by the suppliers of Type I, II and III partnerships was rather neutral. On the other hand, the survey indicated that both customers and suppliers were mutually satisfied by the fairness and efficiency of the profit and risk sharing systems of Type IV partnerships. Decision-making systems for partnerships should be improved as well. At this stage, the limited participation of suppliers in the decision-making processes of customers from Type III partnerships should be fully expanded, such that more strategic and operational-related SCM decision should be made mutually.

9.4 Types of Retailer and Evolution of Supply Chain Partnerships

One important point that should be noted is that the results suggest, in addition to the above conditions for the evolution, that the type of retailer is also an important exogenous condition that influences the possibility of partnership evolution.

According to the data used for this study, a large number of the retailers in Type II partnerships are either supermarket chains or alternative retailers, with the exception of two partnerships that consisted of one large discount store and two small suppliers. The majority of Type III partnerships had large discount store as their retail side partners, but three partnerships had either supermarket chains or alternative retailers as customers. Furthermore, all the retailers of Type IV were discount stores. This concentration of types of retailers into a particular type of partnership provides the following information regarding the pattern of supply chain partnership evolution.

The results of the cluster analysis suggest that if the retail side partner is a large discount store, there is a higher potential to evolve into more a collaborative supply chain partnership. On the other hand, if the retail side partner is a supermarket chain or an alternative retailer, then the evolution towards next stage might be more difficult. The majority of the partnerships with supermarket chains and alternative retailers as customers were Type II partnerships, and these partnerships were putting significant efforts into evolving their partnerships to the next level. However, only a small number of their partnerships had reached the category of Type III partnerships; this implies that evolution from Type II to Type III can be especially difficult. On the other hand, for large discount stores, almost all partnerships they belonged to were either Type III or Type IV.

In order to understand this limitation to evolution imposed by the type of retailer, more research needs to be carried out to investigate this issue more in detail, but the main reasons behind it might be the availability of resources for creation and maintenance of sophisticated IT and partnership management systems and trade volume that is too low to justify such investments.

v. Results II: Factors Influencing Success of Supply Chain Partnership

1 Introduction

Efforts to achieve the second research objective, which is the identification of the major determinants of the performance of a supply chain partnership and modelling of three performance dimensions, were made as follows. Firstly, as an initial step, the consistency of the new measures of supply chain partnership performance was tested by assessing the existence of significant correlations between existing measures. The tests for the existence individual relationships between each of two new performance measures, PEGOAL and PESCM, and the existing measure PECORP[39] were conducted by calculating Pearson's correlations. As a next step, simple regression analyses were conducted to test five hypotheses about the determinants of the performance of supply chain partnerships. Then, multiple regression analyses were conducted to determine which combination of factors predicted the partnerships' three dimensions of performance (PEGOAL, PECORP, and PESCM).

The results of these analyses are discussed in detail in this chapter. Then, the academic contribution (overcoming the previous research obstacles) of this research is discussed. Also, we propose a framework for achieving a successful supply chain partnership.

2 Testing Consistency of Performance Measures

Before the main analyses, the tests for the first two hypotheses regarding the consistency among two new measures, which were 1) contribution of partnership on SCM operational level and 2) extent of goal achievement, and the subjective measures suggested by Geringer & Herbert (1990), were conducted.

H_1: The new measure 'extent of goal achievement' is positively correlated with the existing measure 'enhancement of company's competitive positions'.

[39] PEGOAL: The first performance dimension, Extend of Goal Achievement, PECORP: The second performance dimension: Enhancement of Company's Competitive Position and PESCM: The third performance dimension, Contribution of SCM Operational Level.

H_2: The new measure 'contribution at SCM operational level' is positively correlated with the existing measure 'enhancement of company's competitive position'.

Pearson's correlations were calculated between the two new measures and the individual dimension of the conventional subjective measure. Then the outcome was verified by calculating other types of correlation: tau-b and Spearman correlations.

Existing Measures (Geringer & Herbert, 1990)	New Measures					
	Goal Achievement	Contribution at SCM Operational Level				
Subjective Measures	Evaluation	Lead-time	Flexibility	Cost	Forecast	Inventory
Sales Level	0.558(**)	0.492(**)	0.402(**)	0.431(**)	0.557(**)	0.554(**)
Profitability	0.352(**)	0.397(**)	0.342(**)	0.358(**)	0.420(**)	0.323(**)
Cost Control	0.473(**)	0.518(**)	0.463(**)	0.457(**)	0.476(**)	0.323(**)
Technology Development	0.480(**)	0.446(**)	0.431(**)	0.342(**)	0.498(**)	0.395(**)
Product Design	0.256(*)	0.383(**)	0.396(**)	0.235(*)	0.326(**)	0.281(*)
Knowledge and Learning	0.429(**)	0.421(**)	0.349(**)	0.249(*)	0.450(**)	0.361(**)
Quality Control	0.359(**)	0.434(**)	0.388(**)	0.304(**)	0.334(**)	0.404(**)
Marketing	0.552(**)	0.478(**)	0.453(**)	0.361(**)	0.449(**)	0.477(**)
Customer Service	0.426(**)	0.505(**)	0.439(**)	0.388(**)	0.474(**)	0.424(**)

Table V-1: Pearson's correlations between new measures 1) extent of goal achievement and 2) contribution in operational level, and subjective measures by Geringer & Herbert (1990), (N=74, *p<0.05, ** p<0.01, two-tail test)

The first new measure, 'Extent of Goal Achievement' evidenced significant correlation (at .01 or less) with all individual dimensions of the existing subjective measures of 'Enhancement of Company's Competitive Position' except for the dimension of product design (which was significant at .05). All correlations had the expected signs. The second new measure, 'Contribution on SCM Operational Level' was also correlated significantly with the majority of individual dimensions of the existing subjective measures at .01. The correlation coefficients of 1) cost control and product design, 2) cost control and knowledge transfer and learning, and 3) cost control and inventory were significant at .05.

With respect to H_1 and H_2, the result reported in Table V-1 supported both these hypotheses. From the results of the correlation analysis, it was evident that the two new subjective measures for the performance of supply chain partnerships had significant consistency with the existing subjective measure, 'enhancement of company's competitive positions'. Thus, we did not reject the H_1 and H_2. As the consistency of the new measures with the existing measures was statistically significant, the new measures were forwarded for the regression analyses.

3 Research Design of Multiple Regression Analyses

The regression analyses were based on the survey of seventy-four pairs of respondents collected from the participants of the Korean CPG industry.[40]

3.1 Research Objectives

The research objective of the multiple regression analysis was to identify the determinants of the performance of supply chain partnership. In addition to this, performance models were estimated by the multiple regression analyses, which would be the optimal models for the performance of supply chains, for the managerial purpose of achieving successful supply chain partnerships and predicting the performance of a supply chain partnership. Firstly, the five following hypotheses were tested by simple regression analyses with the focus on the individual relationships between five variables and three dimensions of the performance of a supply chain partnership[41].

H_3: A supply chain partnership with a higher degree of information technology and sharing between its partners will achieve better performance of partnership

H_4: A supply chain partnership with a higher degree of trust between its partners will achieve better performance of partnership

H_5: A supply chain partnership with a higher degree of partnership specific assets between its partners will achieve better performance of partnership

H_6: A supply chain partnership with a higher degree of joint partnership management structure of partnership between its partners will achieve better performance of partnership

H_7: A supply chain partnership with a lower degree of partner asymmetry between its partners will achieve better performance of partnership

Then, three performance models were estimated by the step-wise approach in order to determine which combination of factors predicted the performance of a partnership. Three regression models were developed: **Model 1** includes the first performance measure 'Extent of Goal Achievement' with five performance determinants, and **Model 2** and **Model 3** include 'Enhancement of Company's

[40] For detailed information regarding the data collection, please refer to the data collection section III.2.
[41] For detailed information on how the hypotheses were derived, please refer to section II.4.4.4.

Competitive Positions' (existing measure) and 'Contribution at SCM Operational Level' respectively. For the model estimation, two control variables, which were 1) the difference of the revenue between the supplier and the retailer and 2) type of retailers in supply chain, were included.

3.2 Selection of Variables

Three dependent variables (performance measures), 1) extent of goal achievement, 2) 'enhancement of company's competitive positions' and 3) contribution on SCM operational level, were to be predicted by independent variables representing five determinants of supply chain partnership performance. The following five variables were included as independent variables.

X_1: Use of Information Technology

X_2: Trust

X_3: Joint Partnership Management System

X_4: Partnership Specific Assets

X_5: Partner Asymmetry

The relationships among the five independent variables (plus two control variables) and the three dependent variables were assumed to be statistical, not functional, because they involved many perceptual measures and may have had levels of measurement error.

3.3 Individual Relation of Factors on Partnership Performance

As an initial step in the multiple regression analyses, the correlations for the independent variables and the dependent variables were calculated; see Table V-2. In general, there were significant correlations at .01 between the three performance measures and the other independent variables. Each of the significant correlations had the expected sign. The correlation between 'relationship specific asset' and 'goal achievement' (0.248) was significant at .05. As Geringer & Hebert (1990) suggested, the outcome was verified by calculating tau-b and Spearman correlations. The outcomes from two additional analyses confirmed the initial result. Thus, individually, all variables had significant correlations with the performance of supply chain partnerships.

	1	2	3	4	5	6	7	8	9
1. Goal Achievement	1	.557(**)	.601(**)	.555(**)	.624(**)	.610(**)	.248(*)	.523(**)	-.249(*)
	.	.000	.000	.000	.000	.000	.016	.000	.016
2. Enhancement of Position	.557(**)	1	.577(**)	.481(**)	.515(**)	.403(**)	.433(**)	.366(**)	-.047
	.000	.	.000	.000	.000	.000	.000	.001	.344
3. Contribution SCM Level	.601(**)	.577(**)	1	.548(**)	.518(**)	.485(**)	.270(**)	.526(**)	-.258(*)
	.000	.000	.	.000	.000	.000	.010	.000	.013
4. IT	.555(**)	.481(**)	.548(**)	1	.742(**)	.526(**)	.388(**)	.652(**)	-.489(**)
	.000	.000	.000	.	.000	.000	.000	.000	.000
5. Joint SCP Management	.624(**)	.515(**)	.518(**)	.742(**)	1	.665(**)	.357(**)	.714(**)	-.236(*)
	.000	.000	.000	.000	.	.000	.001	.000	.022
6. Trust	.610(**)	.403(**)	.485(**)	.526(**)	.665(**)	1	.164	.650(**)	-.389(**)
	.000	.000	.000	.000	.000	.	.081	.000	.000
7. Relationship Specific Asset	.248(*)	.433(**)	.270(**)	.388(**)	.357(**)	.164	1	.219(*)	.049
	.016	.000	.010	.000	.001	.081	.	.030	.339
8. Partner Asymmetry	.523(**)	.366(**)	.526(**)	.652(**)	.714(**)	.650(**)	.219(*)	1	-.247(*)
	.000	.001	.000	.000	.000	.000	.030	.	.017
9. Difference in Revenue	-.249(*)	-.047	-.258(*)	-.489(**)	-.236(*)	-.389(**)	.049	-.247(*)	1
	.016	.344	.013	.000	.022	.000	.339	.017	.

Table V-2: Pearson's correlations, (N=74, *p<0.05, ** p<0.01, one-tail test)

3.4 Sample Size

The first concern to be addressed before the main analysis is the level of relationship that can be detected reliably with the proposed regression analysis. The sample size of seventy-four, with five potential independent variables, can detect relationships with R^2 values of approximately 23% at a power of 0.80 with a significance level of .01 (Cohen 1988). On the basis of the above, the proposed regression analyses were considered sufficient to identify 1) statistically significant relationships and 2) managerial significance with the sample size of seventy-four. The sample of seventy-four observations also almost meets the guideline suggested by Stevens (1991), which is a nominal number of fifteen data points per predictor.

3.5 Control Variables

In this research, three control variables were used: 1) Difference of Annual Revenue, 2) Types of Retailer I, and 3) Types of Retailer II. The control variables 'Type I' and 'Type II' were indicator coded for three different types of retailers in the sample, which were 1) large discount store, 2) supermarket and 3) alternative retailers such as Internet and TV Home Shopping Channels. Separate analyses to test the influence of these control variables on the three dependent variables (PEGOAL, PECORP, and PESCM) were conducted. In terms of the combination effect of three control

variables on 'extent of goal achievement', the results indicated that the combination of variables was not significant (F=0.981, R^2=0.04, p=0,407). Regarding 'enhancement of company's competitive position', the results suggested that the combination of the control variables was not significant (F=1.510, R^2=0.061, p=0.219). On the other hand, the test on 'contribution at SCM operational level', the combination of variable was significant (F=5.282, R^2=0.185, p=0.002). The control variable Type II, which referred to the type of retailers in the sample, was significant at .05. For this reason, the control variables for the type of the retailer, Type I and Type II, were included for the estimation process of Model three.

4 Pre-test for Assumptions in Multiple Regression Analyses

The three assumptions to be addressed for the individual variables before the main analyses were 1) linearity, 2) constant variable, and 3) normality.

As an initial step towards assessing the linearity of variables, scatter plots were plotted for each of five performance determinants of supply chain partnership on three performance measures (Appendix 2). The plots did not indicate any non-linear relationship between the dependent variables and the independent variables.

Secondly, residual plots between each of the independent variables and dependent variables were plotted for visual inspection for the violation of the assumption of homoscedasicity (Appendix 2). Examination of these fifteen plots suggested that the points were all evenly and randomly dispersed throughout each plot. Thus, it could be concluded that no evident heteroscedasity existed in any of the individual variables.

Thirdly, tests of normality for the all the independent variables were conducted. Kolomogorov-Smirnov and Shapiro-Wilk test statistics were calculated. The outcome of the K-S tests suggests that there was one possible non-normal distribution, which was trust (TR).

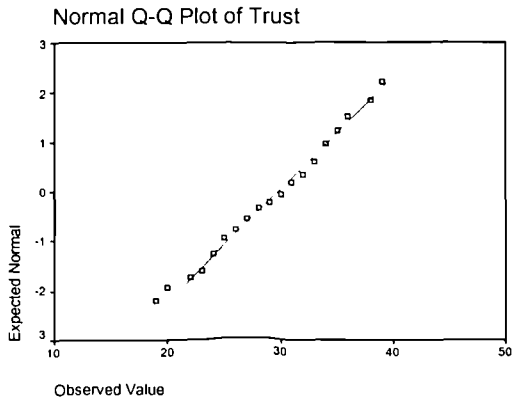
	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
IT	.062	74	.200(*)	.978	74	.216
RA	.094	74	.099	.971	74	.090
PA	.098	74	.076	.979	74	.260
TR	.107	74	.036	.981	74	.311
JS	.077	74	.200(*)	.969	74	.069

Table V-3: Kolmogorov-Smimov and Shapiro-Wilk normality tests for all variables

However, the result of the S-W tests suggested that the variable TR, identified as non-normal distributions by K-S, was distributed normally at .05. Further assessment by visual inspection of Normal Q-Q plot for TR was carried out to make a decision about the transformation of non-normally distributed variable. As can be seen from Graph V-1, the deviation of TR from the normal distribution (Trust: skewness, -0.223, kurtosis, -0.445) was not serious. Also, Field (2000) suggested that the S-W test performs significantly better than K-S on a small sample size, which was the case in this analysis. Thus, TR was not transformed.

Variables		Statistic	Std. Error
IT	Skewness	.096	.279
	Kurtosis	-.817	.552
RA	Skewness	.381	.279
	Kurtosis	-.207	.552
PA	Skewness	-.127	.279
	Kurtosis	-.589	.552
TR	Skewness	-.223	.279
	Kurtosis	-.445	.552
JS	Skewness	.180	.279
	Kurtosis	-.927	.552

Table V-4: Descriptive statistics (skewness and kurtosis) for all variables



Graph V-1: Normal Q-Q plot for 'trust'

5 Hypotheses Tests, Estimating the Regression Models and Assessing Overall Model Fit

Before the process of estimating the performance models, the five hypotheses regarding the determinants of supply chain partnership performance were tested. Then, the processes of 1) evaluating the assumptions related to the regression analyses and 2) identifying outliers and influential observations were carried out. Then, the final two performance models regarding the two dimensions of the performance of a supply chain partnership (PEGOAL and PECORP) were re-estimated. Upon completion of the final estimations, the degree of multicollinearity was assessed.

5.1 Testing Hypotheses

In total, fifteen single regression analyses were run and the results were presented in Table V-5. As can be seen from the table, relationship specific assets did not significantly influence the SCM dimension of the performance of a supply chain partnership. Apart from this, all other influences of the five performance determinants on the three dimensions of the partnership were significant. On the basis of these results, we do not reject H_3 (Significant Contribution of IT to SCP Performance), H_4 (Significant Contribution of Trust to SCP Performance), H_6 (Significant Contribution of Joint Partnership Management System to SCP Performance), and H_7 (Significant Contribution of Partner Asymmetry to SCP Performance). However, hypothesis 5, which is based on the argument that a partnership with higher degree of relationship specific assets will achieve better performance, should be accepted with a caution.

		R^2	Adj. R^2	F	Sig	Beta	t	Sig
IT	PEGOAL	.147	.135	12.433	.001	.384**	3.526	.001
	PECORP	.248	.238	23.798	.000	.498**	4.878	.000
	PESCM	.300	.291	30.928	.000	.548**	5.561	.000
JS	PEGOAL	.235	.224	22.124	.000	.485**	4.704	.000
	PECORP	.290	.280	29.429	.000	.539**	5.425	.000
	PESCM	.269	.259	26.464	.000	.518**	5.144	.000
TR	PEGOAL	.268	.258	26.410	.000	.518**	5.139	.000
	PECORP	.177	.166	15.518	.000	.421**	3.939	.000
	PESCM	.236	.225	22.214	.000	.486**	4.713	.000
RA	PEGOAL	.066	.053	5.102	.027	.257*	2.259	.027
	PECORP	.190	.179	16.865	.000	.426**	4.107	.000
	PESCM	.047	.033	3.519	.065	.216	1.876	.065
PA	PEGOAL	.182	.170	16.005	.000	.426**	4.001	.000
	PECORP	.150	.138	12.671	.001	.387**	3.560	.001
	PESCM	.242	.232	23.003	.000	.492**	4.796	.000

Table V-5: Results of 15 individual single regression analyses, (*p<0.05, ** p<0.01)

5.2 Stepwise Estimation of Three Regression Models

Upon completion of the hypothesis tests, the stepwise process was conducted in order to estimate three models of the performance of supply chain partnerships. During the stepwise estimation, SPSS uses the tolerance criterion to select variables to be entered in the equation, regardless of the entry method specified. Also, a variable is not entered, if it would cause the tolerance of another variable already in the model to drop below the tolerance criterion (SPSS base 10.0 user's guide). The tolerance level was set at 0.0001 for the estimation, which is the default value set by SPSS.

5.2.1 Model Estimation of Extent of Goal Achievement

The first model consisted of the first performance measure 'Extent of Goal Achievement' and the five theoretical determinants of partnership performance (IT, TR, JS, RA, and PA). The three control variables, Type I, Type II and Diff were not included as the outcome from the earlier tests indicated that the combination effect of these variables on PEGOAL was not significant.

M	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.624	.389	.381	.83724	.389	45.885	1	72	.000
2	.677	.458	.443	.79433	.069	8.990	1	71	.004

ANOVA		Sum of Square	df	Mean Square	F Ratio
1	Regression	32.164	1	32.164	45.885
	Residual	50.470	72	.701	
2	Regression	37.836	2	18.918	29.983
	Residual	44.798	71	.631	

		Variables in Equation			Not in Equation		
		Coefficient	Std Error of Coefficient	Beta	Partial t Value	Partial Correlation	t Value
1	Constant	.199	.618				
	JS	.106	.016	.624**	6.774		
	TR					.335	2.998
	IT					.176	1.507
	PA					.141	1.201
	RA					.035	.298
2	Constant	-.810	.676				
	JS	.067	.020	.391**	3.342		
	TR	.086	.029	.351**	2.998		
	IT					.164	1.490
	PA					.032	.629
	RA					.075	.270

Table V-6: Summary of regression models of PEGOAL, (N=74, *p<0.05, ** p<0.01)

The first variable to be entered was JS, as it had the highest correlation (r=0.624) with the dependent variable PEGOAL. After this, JS was retained, as it did not meet

the exit criteria. Then, TR was entered as it had the highest semi-partial correlation (r=0.335) with PEGOAL, and was retained. The first model with JS had multiple R and R^2 values of 0.624 and 0.389 respectively. Adding TR increased multiple R and R^2 values by 8.5% and 17.7%, to 0.677 and 0.458. The p-values suggested that JS and TR were significant at .01; thus neither of them was dropped (Table V-6).

5.2.2 Model Estimation of Enhancement of Company's Competitive Positions

The second model to be estimated consisted of the second performance measure 'enhancement of company's competitive positions' and five determinants of partnership performance (IT, TR, JS, RA, and PA). Again, the control variables were not included, as the early results indicated that the combination effect of these variables on PECORP was not significant.

M	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.515	.265	.255	10.81803	.265	25.928	1	72	.000
2	.580	.336	.317	10.35301	.071	7.9670	1	71	.000

	ANOVA	Sum of Square	df	Mean Square	F Ratio
1	Regression	3034.342	1	3034.342	25.928
	Residual	8426.144	72	117.030	
2	Regression	3850.369	2	1925.184	17.961
	Residual	7610.118	71	107.185	

		Variables in Equation			Not in Equation		
		Coefficient	Std Error of Coefficient	Beta	Partial t Value	Partial Correlation	t Value
1	Constant	47.304	7.991				
	JS	1.034	.203	.515**	5.092		
	IT					.173	.450
	RA					.311	.873
	PA					-.003	.490
	TR					.095	.558
2	Constant	46.132	7.659				
	JS	.829	.208	.413**	4.315		
	RA	.933	.338	.286*	2.759		
	IT					.119	.432
	PA					.015	.488
	TR					.135	.552

Table V-7: Summary of regression models of PECORP, (N=74, *p<0.05, ** p<0.01)

The first variable to be entered was JS, as it had the highest correlation (r=0.515) with the dependent variable PECORP, and was retained. Then, RA was entered as it had the highest semi-partial correlation (r=0.311) with PECORP, and was retained. The first model with JS had multiple R and R^2 values of 0.515 and 0.265 respectively. Adding RA increased multiple R and R^2 value by 12.6% and 26.7% to 0.580 and 0.336. The coefficients of JS and RA were significant at .01 and .05

respectively; thus, neither of them was dropped (Table V-7).

5.2.3 Model Estimation of Contribution on SCM Operational Level

The third model to be estimated consisted of the third performance measure 'Contribution on SCM Operational Level' and IT, TR, JS, RA, and PA. In addition to these, the two control variables, Type I and Type II, were included, as the result of the earlier test suggested that the combination effect of the type of retailers on PESCM was significant at .05.

M	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.548	.301	.291	7.56351	.301	30.933	1	72	.000
2	.595	.354	.336	7.31828	.035	11.495	1	71	.000
3	.626	.392	.366	7.14990	.030	4.412	1	70	.000

	ANOVA	Sum of Square	df	Mean Square	F Ratio
1	Regression	1769.601	1	1769.601	30.933
	Residual	4118.885	72	57.207	
2	Regression	2085.920	2	1042.960	19.474
	Residual	3802.566	71	53.557	
3	Regression	2310.011	3	770.004	15.062
	Residual	3578.47	70	51.121	

		Variables in Equation			Not in Equation		
		Coefficient	Std Error of Coefficient	Beta	Partial t Value	Partial Correlation	t Value
1	Constant	26.886	4.691				
	IT	.537	.097	.548**	5.648		
	JS					.198	.450
	RA					.075	.849
	PA					.265	.574
	TR					.277	.723
	Type I					.049	.929
	Type II					.267	.999
2	Constant	16.827	6.143				
	IT	.397	.110	.405**	3.611		
	TR	.561	.231	.273*	2.430		
	JS					.076	.345
	RA					.093	.847
	PA					.158	.444
	Type I					-.009	.889
	Type II					.243	.983
3	Constant	13.756	6.178				
	IT	.406	.107	.414**	.000		
	TR	.501	.227	.243*	.031		
	Type II	5.134	2.452	.197*	.040		
	JS					.042	.338
	RA					.064	.833
	PA					.157	.444
	Type I					.127	.682

Table V-8: Summary of regression models of PESCM, (N=74, *p<0.05, ** p<0.01)

The first variable to be entered was IT (correlation at r=0.548 with PESCM) and was retained. Then, TR was entered (semi-partial correlation at r=0.277 with PESCM)

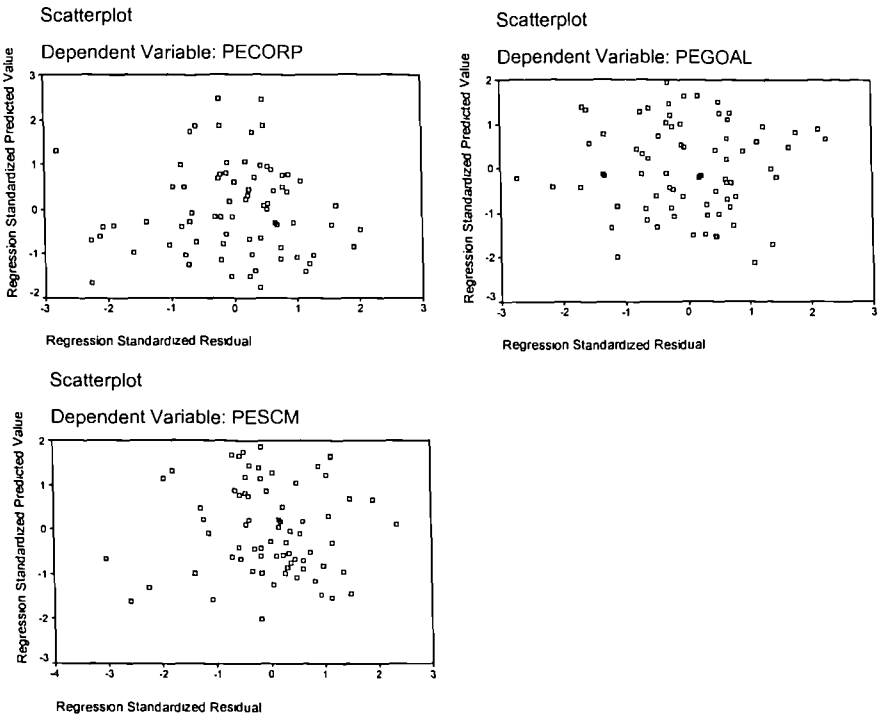
and retained. Thirdly, Type II was entered (semi-partial correlation at r=0.243 with PESCM) and retained. The first model with IT had multiple R and R^2 values of 0.548 and 0.291 respectively. Adding the second variable, TR, increased multiple R and R^2 values by 8.6% and 21.6%, to 0.595 and 0.354. Addition of the third variable, TYPE II, increased multiple R and R^2 values by 6.9% and 14.4%, to 0.636 and 0.405. The p-values suggest that IT were significant at .01 and TR and TYPE II were significant at .05. Therefore, neither of these variables was dropped (Table V-8).

5.3 Evaluating the Variate for the Assumptions of Regression Analyses

Upon completion of the estimation of these three models, the results suggested that all there models were statistically significant. Thus, two issues, 1) meeting the assumptions underlying regression, and 2) identifying the influential data points, needed to be addressed. The standardised residuals were plotted against standardised predicted value to examine any possible violation of the regression assumptions.

5.3.1 Linearity

The assumption of linearity was assessed through residual plots and partial correlation plots. The first assessment through residual plots was conducted for the purpose of assessing the combined effect of all the variables. None of the residual plots in Graph V-2 exhibited any consistent curvilinear patterns. This suggested that there was no non-linear relationship in the models. However, as this assessment did not guarantee the linearity of the individual dependent variable, the second assessment of linearity through partial correlation plots needed to be carried out. This assessment was completed in stage three of the analyses and the results indicated that there was no violation of linearity among individual variables.



Graph V-2: Residual plots of three models, PEGOAL, PECORP and PESCM

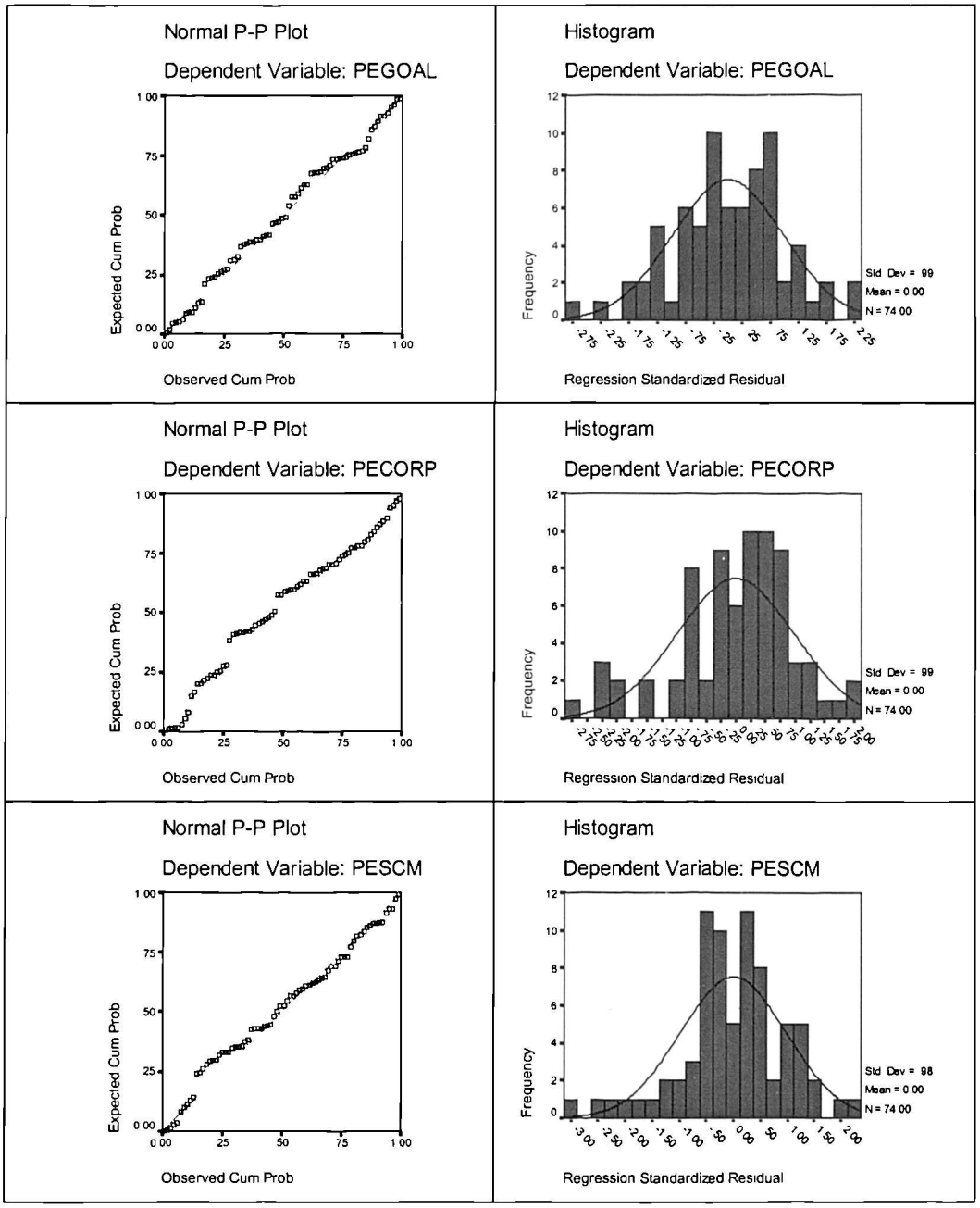
5.3.2 Homoscedasticity

The assumption of homoscedasticity was assessed with the residual plots; see Graph V-2. The plots suggested that the residuals of three models fell randomly, with relatively equal dispersions about zero and no strong tendency to be either greater or less than zero. This finding indicated that the assumption of homoscedasticity could be upheld in the multivariate case. The assessment of the individual variables was conducted in stage three and the results again suggested homoscedasticity at the univariate level.

5.3.3 Independence of the Residuals

In order to examine the independence of the residuals, Durbin-Watson Statistics were carried out to assess possible violations of this assumption. The test criteria for 'Durbin-Watson Statistic' for the sample of seventy-four observations and 5+ variables to accept the null hypothesis is 1.77 - 2.23. Durbin-Watson Statistics for the three models were 1.880 (I), 1.820 (II) and 1.540 (III). Model three had a Durbin-Watson Statistic lower than the criteria for accepting the null hypothesis but higher than 1.49 for rejecting it for positive autocorrelation. Field (2000) suggested that a level between 1 - 3 is an acceptable level from which to conclude that there is no

obvious autocorrelation. In addition, visual inspection of the residual plots with the case numbers and individual variables did not reveal any pattern emerging.



Graph V-3: Normal P-P plots and histograms of three models

5.3.4 Normality

In order to assess the normality of the distribution of error terms of the variate, three normal probability plots and histograms were plotted for visual inspection. As shown in Graph V-3, the values fell along the diagonals with no substantial or systematic departures. Also, inspection of the three histograms suggested that these distributions had roughly bell-shaped curves, which indicated normal distribution.

5.3.5 Identifying Outliers as Influential Observations[42]

The four-step approach was taken in order to identify possible influential observations.

5.3.5.1 Model I: Extent of Goal Achievement

Step 1: Examining Residuals

Studentised residuals are the most common form of residuals used to identify outliers. In total four observations (17, 48, 54, and 57) fall outside of 1.96 with a 95% confidence interval. However, outliers are not necessarily influential points; nor are all influential points outliers (Hair *et al.*, 1998). Thus, further diagnosis is required to estimate the influence of these single observations on the results.

Case Number	Std. Residual	PEGOAL	Predicted Value	Residual
17	-2.164	2.33	4.0524	-1.7191
48	-2.741	2.00	4.1770	-2.1770
54	2.249	6.60	4.8135	1.7865
57	2.129	6.67	4.9758	1.6909

Table V-9: Casewise diagnostics for Model I PEGOAL

Step 2: Identifying Leverage Points

Leverage points were calculated by the formula $(2(k + 1)/n)$ suggested by Hoaglin & Welsch (1978). These researchers have suggested that this value can be used as a cut-off point for identifying cases having undue influence. The leverage point for Model I PEGOAL was 0.1622. Under this criterion, none of the cases was considered to be exerting undue influence.

Step 3: Single-Case Diagnostics

In order to identify the impact on the estimated regression coefficient, DFBETA values were calculated for JS and TR. The threshold was calculated with $\pm 2/\sqrt{n}$, 0.2324. Four cases, 24, 26, 40 and 57 were identified as affecting a single coefficient and cases 48, 49 and 60 were identified as affecting multiple coefficients. Case 49 had the greatest impact on the interceptor, and case 48 has the greatest impact on both JS and TR.

Then, three measures, Cook's distance, COVRATIO and SDFFIT, which are known to consider all coefficient simultaneously, were used for further diagnoses. Firstly,

[42] Please refer to Appendix 2 for the detailed results

the threshold for Cook's distance was calculated. Weisberg (1985) recommends using a rough cut-off of 1.00, but a more conservative threshold, calculated by $4/(n-k-1)$, was used, which was 0.0588. Cook's distance identified three cases (48, 57, and 60) as influential cases. Secondly, the threshold of COVRATIO was calculated by use of $1 \pm 3\ p$ / n, which gave values of 1.243 and 0.757. None of the cases were identified as either contributing positively towards or decreasing the efficiency of the estimation process. Thirdly, the cut-off point for SDFFIT was calculated by $2\sqrt{(k+1)/(n-k-1)}$, giving a value of 0.5940. Case 48 was identified as an influencing case.

Step 4: Selecting Influential Cases

Diagnostic Measure	Calculated Threshold	Observation Exceeding Threshold
Residuals		
Standardised	± 1.96	17, **48**, 54, 75
Studentised	± 1.96	17, **48**, 54, 75
Studentised Deleted	± 1.96	17, **48**, 54, 75
Leverage		
Hat Values (Small Sample)	0.1622	None
Hat Values (L/M Sample)	0.2432	None
Mahalanobis Distance	None	8, 18, 26, 36, **48**, 49, **60**, 63, 71 and 73 (Top ten observations)
Single-case Measures		
SDFBETA	0.2324	C: 24, 26,**48**, 49, **60**
		JS: 40, **48**, 57, **60**
		TR: **48**, 49, **60**
Cook's Distance	0.0588	**48**, 57, **60**
COVRATIO	1.243 and 0.757	None
SDFFIT	0.5940	**48**

Table V-10: Summary of diagnostic tests for influential observations for Model I PEGOAL

Case 48 was identified as the only possible outlier or influencing case by 1) Casewise diagnostics, 2) DFBETA, 3) Cook's distance and 4) SDFFIT (Table V-10). Thus, it was concluded that case 48 was the case with the most impact on improving the regression equation.

5.3.5.2 Model II: Enhancement of Company's Competitive Positions

The same four-step diagnosis used for Model II was conducted and the results are presented in Table V-11. Case 73 was identified as a possible outlier or influencing case by 1) Casewise diagnostics, 2) Mahalanobis, 3) DFBETA, 4) Cook's distance and 5) SDFFIT. Also, case 74 was identified as a possible outlier or influencing case, by 1) Casewise diagnostics, 2) COVRATIO, 3) DFBETA, 4) Cook's distance, and 5) SDFFIT. Thus, it was concluded that cases 73 and 74 could be regarded to be the cases with the most impact on improving the regression equation.

Diagnostic Measure	Calculated Threshold	Observation Exceeding Threshold
Residuals		
Standardised	± 1.96	6, 68, **73, 74**
Studentised	± 1.96	6, 68, **73, 74**
Studentised Deleted	± 1.96	6, 68, **73, 74**
Leverage		
Hat Values (Small Sample)	0.1622	None
Hat Values (L/M Sample)	0.2432	None
Mahalanobis Distance	None	21, 24, 34, 35, 37, 42, 43, 53, 63, **73** (Top ten observations)
Single-case Measures		
SDFBETA	0.2324	C: 14, 23, 52, **73, 74**
		JS: 23, 24, 52, **59**, 63, **73, 74**
		RA: 6, 14, 52, **59**, 62, 63, 65, **73**
Cook's Distance	0.0588	14, 52, **59, 73, 74**
COVRATIO	1.243 and 0.757	**74**
SDFFIT	0.5940	**73, 74**

Table V-11: Summary of diagnostic tests for influential observations for Model II PECORP

5.3.5.3 Model III: Contribution on SCM Operational Level

The same four-step diagnosis used for Model II was conducted and the results are presented in Table V-12. None of the cases were consistently identified as outliers or influential cases by the above measures. Thus, it was concluded that there was no influential case for Model III.

Diagnostic Measure	Calculated Threshold	Observation Exceeding Threshold
Residuals		
Standardised	± 1.96	10, 59, 54, 62
Studentised	± 1.96	10, 59, 54, 62
Studentised Deleted	± 1.96	10, 59, 54, 62
Leverage		
Hat Values (Small Sample)	0.1622	None
Hat Values (L/M Sample)	0.2432	None
Mahalanobis Distance	None	1, 2, 3, 4, 9, 15, 44, 46, 48, 49 (Top ten observations)
Single-case Measures		
SDFBETA	0.2324	C: 14, 26, 66
		IT: 10, 14, 39, 57
		TR: 26
		Type II: 3, 45, 46, 47
Cook's Distance	0.0588	14
COVRATIO	1.243 and 0.757	None
SDFFIT	0.5940	None

Table V-12: Summary of diagnostic tests for influential observations for Model II PESCM

5.4 Final Models after Eliminating Influential Observations

After eliminating the influential observations for Model I PEGOAL and Model II PECORP, final regression models were re-estimated. The final regression for Model I PEGOAL showed substantial improvement in R^2 and standard error. The R^2 for Model I improved by 6.55% from 0.458 to 0.488 and the standard error decreased by 5.47% from 0.794 to 0.751. The statistical significance of JS improved, but that of

TR dropped marginally.

Final Model I PEGOAL	R		R Square		Adjusted R Square		Std. Error of the Estimate
	.699		.488		.473		.7509
ANOVA	Sum of Square		df		Mean Square		F Ratio
Regression	35.136		1		35.136		59.44
Residual	41.965		71		.591		
	Variables in Equation				Not in Equation		
	Coefficient	Std Error of Coefficient	Beta		Partial t Value	Partial Correlation	t Value
Constant	-.641	.642					
JS	.083	.020	.503**		4.243		
TR	.059	.028	.249*		2.104		
IT						.188	1.587
PA						.082	.681
RA						.076	.629

Table V-13: Summary of regression final Model I of PEGOAL, (N=73, *p<0.05, ** p<0.01)

The final regression for Model II PECORP showed substantial improvement in R^2 and standard error as well. Especially, the R^2 improved by 26.1% from 0.336 to 0.424 and standard error decreased by 8.57% from 10.35301 to 9.53565. The statistical significance of JS remained the same but that of RA dropped marginally.

Final Model II PECORP	R		R Square		Adjusted R Square		Std. Error of the Estimate
	.651		.424		.408		9.53565
ANOVA	Sum of Square		df		Mean Square		F Ratio
Regression	4623.576		2		2311.788		25.424
Residual	6274.077		69		90.929		
	Variables in Equation				Not in Equation		
	Coefficient	Std Error of Coefficient	Beta		Partial t Value	Partial Correlation	t Value
Constant	39.136	7.302					
JS	1.047	.200	.515**		5.223		
RA	.797	.315	.249*		2.529		
IT						.067	.424
PA						.061	.517
TR						.075	.533

Table V-14: Summary of regression final Model II of PECORP, (N=73, *p<0.05, ** p<0.01)

5.5 Measuring the Degree and Impact of Multicollinearity

The existence of strong multicollinearity can distort results substantially or decrease the generalisability of the results by making them unstable. Two measures, 1) tolerance and VIF values and 2) combination of condition index and variance proportions, were taken in order to diagnose the possible existence of strong multicollinerarity among independent variables.

5.5.1 Tolerance and VIF Diagnosis

Table V-16 shows tolerance and VIF values. VIF value exceeding 10 and tolerance value lower than 0.2 can cause concern (Myers, 1990 and Menard, 1995). The results

suggested that none of the statistics indicated the existence of strong multicollinearity.

		Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
MI	JS	.083	.020	.503	4.243	.000	.521	1.919
	TR	.059	.028	.249	2.104	.039	.521	1.919
MII	JS	.819	.210	.409	3.910	.000	.878	1.420
	RA	.925	.340	.285	2.723	.008	.878	1.420
MIII	IT	.406	.107	.414	3.778	.000	.722	1.385
	TR	.501	.227	.243	2.201	.031	.712	1.405
	TYPE II	5.134	2.452	.197	2.094	.040	.983	1.017

Table V-15: Tolerance and VIF statistics of independent variables of three models

5.5.2 Combination Approach: Checking Condition Index and Variance Proportions

Hair *et al.* (1998) suggested a two-part process for detecting the existence of strong multicollinearity, which was firstly to identify all indices above 30, and then identify portions of variance greater than 0.90 associated with the variables of these indices. The results are presented in Table V-16. None of the condition indices was greater than the threshold of 30.

Dimension (PEGOAL)	Eigenvalue	Condition Index	Variance Proportions		
			(Constant)	JS	TR
1	2.980	1.000	.00	.00	.00
2	.013	15.073	.91	.30	.05
3	.007	21.027	.09	.69	.95
Dimension (PECORP)	**Eigenvalue**	**Condition Index**	**Variance Proportions**		
			(Constant)	JS	RA
1	2.906	1.000	.00	.00	.01
2	.083	5.918	.06	.03	.94
3	.011	15.956	.94	.97	.05
Dimension (PESCM)	**Eigenvalue**	**Condition Index**	**Variance Proportions**			
			(Constant)	IT	TR	TYPEII
1	3.866	1.000	.00	.00	.00	.01
2	.107	6.017	.01	.03	.01	.94
3	.017	14.905	.39	.83	.04	.05
4	.010	19.983	.60	.14	.95	.00

Table V-16: Collinearity diagnostics (condition indices and variance proportions)

On the basis of the above diagnostics, it was concluded that no strong mutilcollinearity existed in the models estimated.

6 Interpretation of the Results

After the completion of the hypotheses tests of the individual relationship specifications between the factors and the three performance dimensions, the specification of the regression variate and the diagnostic test that confirmed the appropriateness of the results, the final regression models were re-estimated.

On the basis of the results, firstly, the significance of the impact of each individual variable on the three dimensions of supply chain partnership performance was evaluated. Then, we interpreted the regression variate by evaluating the prediction power of each determinant on the three dependent variables (three dimensions of the performance of a supply chain partnership). As a final step, we suggested the three performance models.

6.1 Determinants of Supply Chain Partnership Performance

6.1.1 Information Technology

Impact of IT on Partnership Performance as an Individual Variable

The result of the regression analyses to test H_3, which was based on the argument that a supply chain partnership with a higher degree of IT will have higher degree of partnership performance, suggested that individually, IT was an important determinant, positively influencing all three dimensions of the performance of a supply chain partnership as an individual variable (Table V-5). The result from this research is similar to the findings of previous research regarding the impact of IT systems on the performance of collaborative inter-firm arrangements. However, unlike previous research, which used a few measures in a broad assessment of the impact of IT on the performance of collaborative inter-firm arrangements, in this study three distinctive dimensions of performance were included to investigate the impact of IT on performance. Thus, a more detailed picture of how IT influences the three dimensions of the performance of a partnership individually was provided by this research.

Impact of IT in Predicting Partnership Performance through Three Models

According the estimated models, the impact of IT was particularly strong on one dimension of performance, which is the 'contribution at SCM level' in conjunction with 'Trust'. As mentioned, the construct IT in this research consisted of three

indicators, 1) IT capacity, 2) willingness to share information and 3) diversity and quality of information exchanged. From the IT capacity point of view, the findings of this research are consistent with the argument by Bako (1991) that improved IT (information links) can increase the capacity and decrease the response time of inter-organisational communication, which leads to better co-ordination, the outcome of which is improvement at the SCM operational level, such as inventory management. In addition, from the perspective of the quality and diversity of information, the outcome is similar to the empirical findings of Whipple, Frankel, & Anselmi (1999) that the quality and diversity of information exchange is an important factor for the success of a partnership.

On the other hand, the results indicated that the IT capacity of the partners of supply chain partnerships did not contribute significantly in terms of predicting the other two dimensions of supply chain partnership performance, 'enhancement of company's competitive positions' and 'extent of goal achievements' thorough the two performance models. Previous research has suggested that the increase in IT capacity and information exchange will enable the successful outcome of a supply chain partnership by reducing 1) co-ordination costs (Gurbaxani & Whang, 1991 and Clemons, Reddi & Row, 1993), 2) transactional risk (Clemons, Reddi & Row, 1993) and 3) uncertainty related to insufficient information and information processing capacity. As can be seen above, the results of this research suggested that improved IT and information exchange enabled partnerships to experience more benefits from their SCM operations. However, more research is required to find out why IT is not a significant factor in predicting the two other dimensions of performance.

6.1.2 Trust

Impact of Trust on Partnership Performance as an Individual Variable

Evidence relating to H_4, which is based on the argument that a partnership with a higher degree of trust will achieve better performance, suggested that the independent variable 'Trust' was identified by the analyses as a significant determinant which positively influenced all three supply chain partnership dimensions as an individual variable (Table V-5).

The results of this research are similar to those of Parkhe (1993), who tested the link between the level of trust and the performance of collaborative inter-firm

arrangements (measured by fulfilment of strategic need of forming) by examining the degree of opportunistic behaviour and monitoring costs. More specifically in supply chain partnership, the results confirmed the significant role of trust in partnership performance found by Zaheer, McEvily & Perrone (1998) in an electrical components supply chain, and in a motor supply chain by Dyer (1996). This suggests that trust could be another important factor in the performance of partnerships in CPG supply chain.

Impact of Trust in Predicting Partnership Performance through Three Models

In terms of predicting the three dimensions of the performance of a supply chain partnership through the three estimated models, 'Trust' was a significant factor in predicting two performance dimensions, 1) 'extent of goal achievement' in conjunction with JS (Table V-13) and 2) 'contribution at SCM operational level dimension' with IT (Table V-8).

However, the influence of trust was not significant in predicting the third performance dimension of 'enhancement of company's competitive position'. One possible explanation, from a transaction cost theory perspective, is that the supply chain partnership-related uncertainty, which trust can reduce, is mainly an SCM operation related risk. Parkhe (1993, 1998) argued that the role of trust among partners is in reducing transaction related complex and uncertain realities far more quickly and economically than prediction, authority or bargaining (Powell, 1990), and it thus improves partnership performance. The uncertainty related to collaborative inter-firm arrangements can come in many different forms depending on the types and purposes of such arrangements. However, the uncertainty in supply chain partnerships is specifically related to operational aspects of SCM, such as volume uncertainty (Heide & Stump, 1995), and therefore increasing the level of trust can lead to a major improvement in the contribution of a partnership at the SCM operational level of partnership performance. Also, the present results indicate that trust has a significant impact on another dimension of the performance, 'extent of goal achievement'. This can be explained in the same way, as many of the participants of the survey identified at least one of their goals of forming/remaining in partnerships as SCM operation related goals.

6.1.3 Relationship Specific Assets

Impact of Relationship Specific Assets on Partnership Performance as an Individual Variable

The result in Table V-6 indicated that 'Relationship Specific Assets' is an individual determinant which significantly influences two dimensions of the performance measure, which are 'extent of goal achievement' and 'enhancement of the companies' competitive positions'. However, the individual influence of RA was not significant on the performance dimension 'contribution at SCM level'.

Impact of Relationship Specific Assets in Predicting Partnership Performance through Three Models

In terms of predicting three dimensions of performance of supply chain partnership with three models, RA has significant power to predict the performance dimension, 'enhancement of the companies' competitive positions' in conjunction with JS (Table V-13).

From a transaction cost economy point of view, the impact of partnership specific assets could give rise to a hold-up situation (Williamson, 1975, Heide & Stump, 1995, Houston & Johnson, 2000, Artz, 1999). For example, the empirical study of Heide & Stump (1995) showed that investment into relation specific assets without a safegaurd by buyers could negatively impact the performance of the supplier-buyer partnership, as suppliers could behave in an opportunistic way. On the other hand, Dyer & Ouchi (1993) found thorough their empirical study of the Japanese motor industry that in Japanese-style partnerships, relation specific assets could improve certain dimensions of partnership performance. Whipple, Frankel, & Anselmi (1999) concluded that partnership specific assets positively affect the performance of collaborative inter-firm relationships when the improvement in efficiency and effectiveness gained through such specialised assets surpasses the cost of maintaining the existence of such assets, whose salvage value outside of such relationship is minimal.

The result from this research confirmed those of the previous empirical studies, in that the existence of relationship specific assets was a significant predictor of the performance of a partnership. Relationship specific assets between suppliers and customers in CPG supply chains traditionally exist in the form of OEM production

lines, logistics equipment etc. During the process of data collection, it came to the researcher's attention that a substantial amount of partnership specific investment made between suppliers and customers in CPG partnerships nowadays was focused around improving external and internal IT capacity. Compared to the traditional forms of relationship specific asset, setting up and maintaining this kind of IT asset in CPG would generate less cost as a result of 1) price of IT equipment and solutions continuing to drop, and 2) affordable Internet-based EDI applications. Also, such IT assets have additional value outside of their relationship-specific application, due to their flexibility to be reconfigured and used for other purposes; thus, when a decision about investment into a partnership is made, the partners are less exposed to the danger of opportunistic behaviour on the part of their counterparts.

With the result of this research and the available data, it is difficult to answer why this factor's influence on supply chain partnership performance was limited only to the one performance dimension of 'enhancement of the companies' competitive positions'. The limited influence of RA requires more detailed research in the future.

6.1.4 Joint Partnership Management System

Impact of Joint Partnership Management System on Partnership Performance as an Individual Variable

The independent variable 'Joint Partnership Management System' was identified as a factor that significantly and positively influenced all three dimensions of supply chain partnership performance. This result is similar to those of Kogut & Zander (1996) and Whipple, Frankel, & Anselmi (1999), who found that well structured/defined and fair partnership management structures influence the performance of supply chain partnership positively (Table V-6).

Impact of Joint Partnership Management System in Predicting Partnership Performance through Three Models

In terms of predicting three dimensions of performance of supply chain partnership with the three models, JS was found to have significant power to predict two performance dimensions, 1) 'extent of goal achievement' in conjunction with TR (Table V-13) and 2) 'enhancement of the companies' competitive positions' in conjunction with RA (Table V-14).

However, JS did not have significant power to predict the performance dimension 'contribution at SCM operational level'. From our data, it became clear that the impact of JS is more profound and longer-term oriented, rather than being associated with short-term operational level benefits. The impact of JS was to create little immediate revenue related return, but more future oriented returns. Similar conclusions can be found in the previous literature. According to the literature, a well defined 'joint partnership management system', refers to a system with 1) well-defined structure for developing, maintaining and monitoring the partnership, including role specificity 2) open joint decision making system, and 3) fair risk and benefit sharing system (Bowersox, Closs & Stank, 1999). A well-established 'joint partnership management system' influences the performance of a supply chain partnership positively by 1) providing a system of control and monitoring in the absence of a control and monitoring system from equity ownership, 2) reducing the bounded rationality and 3) reducing uncertainty related to partnership activities. From the above, it is clear that the benefits of having a well-established JS lie in its provision of a firm foundation and channels for a more long-term oriented, sustainable partnership. This could be an explanation for the finding that the prediction power of JS is not significant on 'the contribution at SCM operational level'.

However, this result should be taken with some caution, and requires more research to investigate the precise reason why the impact of the well structured joint partnership management system was not significant on the operational dimension of the supply chain partnership performance.

6.1.5 Partner Asymmetry

Impact of Partner Asymmetry on Partnership Performance as an Individual Variable

The results in Table V-6 suggested that as an individual variable, the independent variable 'Partner asymmetry' was a significant factor influencing all three performance dimensions.

Impact of Joint Partnership Management System in Predicting Partnership Performance through Three Models

However, the results of the regression analyses indicated that 'partner asymmetry'

was not a significant predictor of any of the measures of the performance of supply chain partnerships. This result was similar to those of Ellram (1995) and Saxton (1997), who found that the partner asymmetry within corporate culture was not a significant factor influencing the success of supply chain partnerships.

This could be explained as follows. Firstly, all supply chain partnerships in this study are formed between partners in Korea; while the majority of CPG supply chains have some overseas suppliers. Thus, partnerships with overseas suppliers are not included for this research, which reduces the chance of partnerships being exposed to inefficiency caused by other types of partner asymmetry such national and societal differences. Secondly, the majority of partner asymmetry in supply chain partnerships is in the form of non-complementary differences at the micro level: variations in management style and organisational structure of the firms are the main source of the difference. This diversity can be minimised by unitary management processes and structures (Parkhe, 1991). For this reason, regarding CPG supply chain partnerships, where the decision-making processes within partnerships are often led by customers, the inefficiency created by these micro level differences does not significantly reduce the performance of supply chain partnerships.

6.2 Three Models of SCP Performance

The following prediction models were estimated by three multiple regression analyses (Table V-17). These models can be regarded as the 'best models' of the three dimensions of supply chain partnership performance, as the estimated equations of the combination of independent variables are the best way to predict the performance dimensions.

	R^2	Sig. Factors	B Coefficients	Prediction Equations
Model I (PEGOAL)	.488	JS**, TR*	.503, .249	PEGOAL = -0.641 + 0.083JS + 0.059TR
Model II (PECORP)	.424	JS**, RA*	.515, .249	PECORP = 39.136 + 1.047JS + 0.797RA
Model III (PESCM)	.366	IT**, TR*, Type II*	.414, .243, .197	PESCM = 13.756 + 0.406IT + 0.501TR + 5.134Type II

Table V-17: Summary of three models, (*p<0.05, ** p<0.01)

6.2.1 Model I: Extent of Goal Achievement

Two independent variables, 'joint partnership management system' and 'trust', were identified as significant determinants of the degree of the goal achievement at .01 and .05 respectively. The standardised regression coefficients of JS and TR were

0.503 and 0.249. These suggested that JS was the single most influential determinant of the performance measure 'Extent of Goal Achievement'. TR was notably in lower in importance.

6.2.2 Model II: Enhancement of Company's Competitive Positions

'Joint partnership management system' was again identified by the results as the single most important factor for the performance measure 'enhancement of company's competitive positions', (at .01 and β=0.515). The other determinant identified was 'relationship specific assets', at .05. The standardised regression coefficient of 'RA' was 0.249 and was less influential than JS on PECORP.

6.2.3 Model III: Contribution on SCM Operational Level

'Information technology' was identified by the results as the single most influential determinant for the performance measure (at .01 and β= 0.414). As a second determinant, 'trust' was identified at .05, but its effect on PESCM was less influential than that of IT. As mentioned above, separate analyses to test for the influence of control variables on the three dependent variables were conducted earlier and the results indicated that the type of retailer was significant at .05 and β= .243. Thus, two indicator coded variables, 'Type I' and 'Type II' were included. The result suggested that Type II was significant at .05 with β= 0.197. This can be interpreted as indicating that the supply chain partnerships with large discount stores as customers performed better than the other forms of retailers on the performance measure PESCM.

7 Academic Contribution and Managerial Implication

The area of supply chain partnerships has been in the spotlight for some time. A considerable amount of effort has been made in various practitioners' journals to find ways to improve the performance of supply chain partnerships, and this provides a vivid picture of supply chain partnership from the field. However, these works have often been carried out without strong theoretical foundations, with a focus on limited numbers of individual factors rather than including as many as relevant factors as possible. In addition, the supply chain performance measures have often been used as proxy measures for the performance of supply chain partnerships without clear justifications or modifications, which could misconstrue the true picture of the

contribution of supply chain partnership to the different aspects of partners' companies. Also, from a methodological point of view, throughout the data collection procedures, the importance and the impact of the perception asymmetry of partners on various aspects of supply chain partnership has often been ignored in previous studies, and the data have been collected from one side of the partnership only due to methodological difficulties. In the present research, efforts have been made to correct the above-mentioned limitations. In this section, the academic contribution and managerial implication and the limitation of this research are discussed.

7.1 Academic Contribution: Overcoming the Limits of Past Research

This research has made the major contribution of overcoming the limits of the past research by achieving, 1) the development of two new performance measures, 2) overcoming the perception asymmetry, and 3) integration of two different research perspectives.

Firstly, two new measures, 1) extent of goal achievement and 2) contribution at SCM operational level, were developed in an attempt to produce a more extensive measurement scheme for supply chain partnership performance, based on the scheme for classifying alternate approaches for measuring business performance developed by Venkatraman & Ramanujam (1986), and incorporating the idea of multi-dimensionality of the performance measurement put forward by Kale, Dyer & Singh (2001). As a result, the performance of supply chain partnerships can be measured by tailor-made measures and the gap left by the absence of objective measure can be filled to some degree. In addition to this, using two new measures such as 'contribution at SCM operational level' enables us to reflect the unique dimension of performance of supply chain partnerships. The consistency of the new measures was ensured by checking the significance and direction of the correlations between two new measures and nine dimensions of the existing subjective partnership performance measure by Geringer & Herbert (1990).

Secondly, the results of this research can be considered to be less biased by perception asymmetry, as the data for this research were collected from both participants of supply chain partnerships and then averaged. The perception asymmetry on performance measures and their determinants was thus removed

during the process of data collection by posing questions to both participants of partnerships. During the initial data screening and MANOVA test[43], the differences in perception of the various aspects of supply chain partnerships between suppliers and customers were obvious in our data set. The mean value was calculated from the responses of suppliers and customers, and this enabled us to investigate the subject of partnership performance with less perception asymmetry bias, which is common in the majority of alliance related research, where data is collected from one side only.

Thirdly, this research approached the issue of the performance of supply chain partnership from an integrated perspective. Traditionally, the issues related to the performance of collaborative inter-firm arrangements have been viewed from two different perspectives, 1) the physical characteristics of partnerships such as relationship specific assets, and 2) complementary assets of a partner, and IT and the interactive nature of partnership between organisations such as trust and partner asymmetry (Gulati 1998, Saxton 1997). However, little effort has been made to integrate these views. In order to overcome this limitation, the selection of the determinants of partnership performance was made with a view to integrating the two distinctive approaches from past research into the performance of partnerships. Investigating partnership performance and its determinants from this integrated perspective enabled us to include both the collaborative inter-actions and the system and the structure of partnerships in our models.

7.2 Managerial Implication: How to Achieve a Successful Supply Chain Partnership

Improving the performance of the partnership with one's supplier/customer is an important task. Often, the desire to improve the performance of a partnership remains nothing more than just a desire, since participants are not aware of the different dimensions of the performance of partnerships.

An effort to improve the performance of a supply chain partnership without being aware of the three performance dimensions could not be guaranteed to bring the expected improvement, and at the same time, it might require a large amount of resource expenditure. We would like to propose a systematic approach to improving the performance of supply chain partnerships on the basis of the result of this

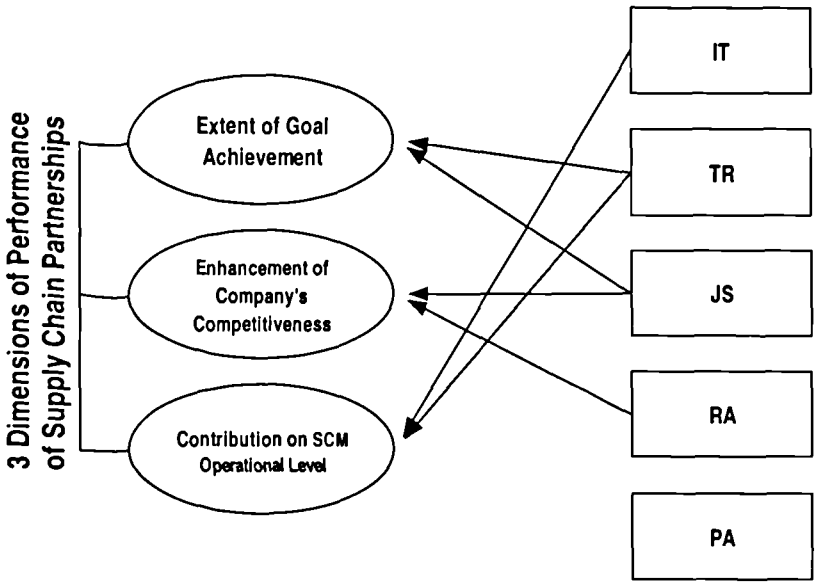
[43] Please refer to Chapter VI for the detailed results of the MANOVA for testing the existence of perception asymmetry on the characteristics and the performance of supply chain partnerships.

research.

As an initial step in such an effort, boundary spanning personnel should approach the performance of partnership in a rather different way. Instead of looking the performance of the partnership as a single vague, broad concept, it is necessary to see the performance of the partnership in the form of smaller and more manageable chunks in order to facilitate efforts to improve the performance by focusing available resources on the targeted dimensions.

In this study, the performance of supply chain partnerships was divided into three performance dimensions: 1) the extent of goal achievement, 2) the enhancement of company's competitive positions, and 3) the contribution at the SCM operational level. The first dimension refers to the degree of the achievement of the participants within a supply chain partnership of the goals of forming/maintaining their partnership. The second dimension refers to how much supply chain partnerships contribute the participants' companies in terms of enhancing their competitive positions, as measured by nine indicators. The final dimension is about how much the supply chain partnerships help them to improve the operational aspects of SCM.[44] Therefore, when we refer to a successful supply chain partnership or a well-performing partnership, any or all of the following three aspects can be expected: 1) the participants think that the degree of goal achievement in terms of forming and maintaining the partnership is satisfactory, 2) they believe that the partnership enhances their competitive positions, and 3) their SCM operations are greatly facilitated by the partnership. One important point to be underlined is that the definition of a well-performing or successful supply chain partnership varies depending on the situation. For example, if a supply chain partnership was formed for the sole purpose of increasing the brand image of a certain product on top of the existing business relationship, then as long as there are high scores in the first and second dimensions, we can regard this partnership as well-performing or successful.

The results of this research have suggested the each dimension of a successful supply chain partnership is determined by various factors (Figure V-1). Thus, in order to improve a certain dimension of the supply chain partnerships, participants ought to focus on improving certain attributes of their partnership, either solely or jointly with their partners.



Dimension I: Extent of Goal Achievement
Critical Determinants
1. Well-established and functioning 'joint partnership management system'.
2. Strong mutual trust among partners

Dimension II: Enhancement of Company's Competitive Positions
Critical Determinants
1. Well-established and functioning 'joint partnership management system'.
2. Sufficient level of investment dedicated to their partnerships

Dimension III: Contribution on SCM Operational Level
Critical Determinants
1. High degree of internal and external IT capacity and information exchange
2. Strong mutual trust among partners

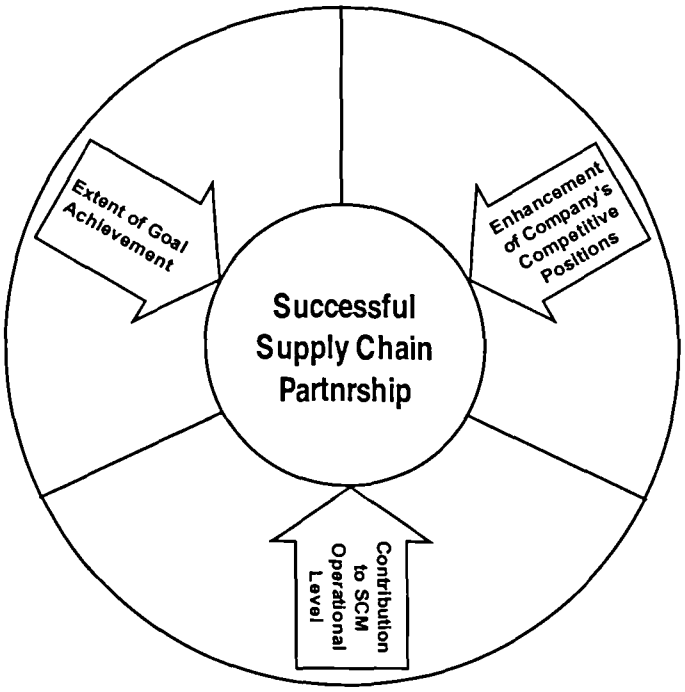


Figure V-1: Three individual dimensions of the performance of supply chain partnership

[44] Please refer to section III.2.4.2 for detailed information on how these three dimensions were measured.

Efforts to improve the performance of supply chain partnerships should be made in a more organised manner. Firstly, the process of identifying the need for improvement of any of the three dimensions should be carried out. For example, a number of suppliers in this study identified their main objective for maintaining a partnership as increasing the brand awareness of their products. However, on the other hand, as such objectives are mainly associate with benefits for suppliers; customers within the same partnership might have very different motivations such as low price procurement via partnership. In this case, this process can be carried out alone. If the objectives of a partnership are closely shared between the supplier and customer, then this process can be done in co-operation with their partners. Upon completion of the first step, the next stage is to identify the requirements for improving the dimensions of partnership performance that they wish to improve. For example, if partners wish their partnerships to be more beneficial towards the operational aspect of their SCM, they should focus their efforts on checking which aspects of IT capability and information exchange and the level of mutual trust should be improved. This process often requires close involvement with their counterparts in order to obtain a clear picture of various inter-firm aspects of the partnership. Subsequently, as a final step, a detailed action plan should be drawn up to improve the areas identified in step 2. Such plans should be drawn up in collaboration with their partners.

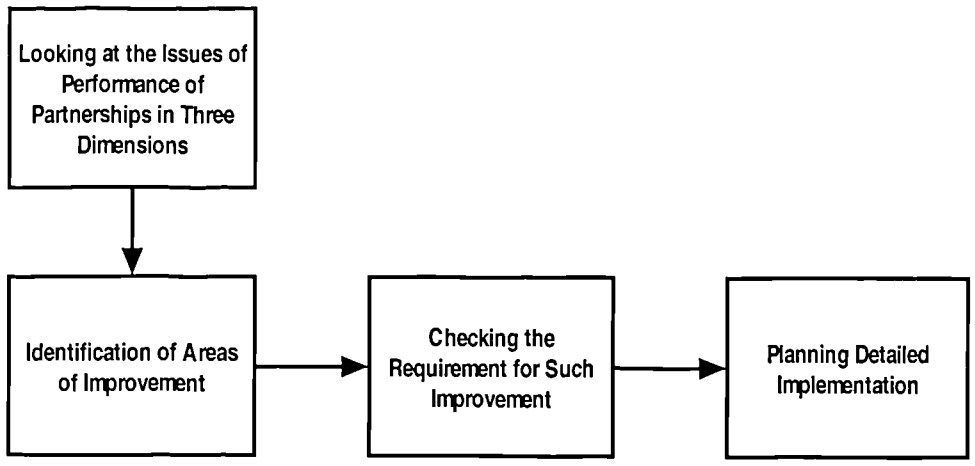


Figure V-2: Process of improving performance of supply chain

One point that should be underlined is that when the impact of each factor is assessed

individually[45], then the influence of all five factors is significant on the three dimensions of the performance, apart from that of relationship specific assets on the performance dimension 'contribution at an SCM operational level'. However, this should not be taken as it is, for the reason that this individual influence becomes significant only when all other factors are held constant. Also, increasing only one factor is not necessarily the best way to improve the performance of the performance of a supply chain partnership. It should be emphasised that focusing on the critical determinants can deliver the optimal and the most efficient results in terms of improving the performance of a supply chain partnership.

[45] Please refer to section V.5.1 for more information.

VI. Results III: Perception Asymmetry among Partners of Supply Chain Partnership and its Association with Performance

1 Introduction

The third research objective of this thesis was firstly to identify the existence of perception asymmetry between customers and suppliers on the various aspects of a supply chain partnership and secondly, to assess whether there exists a significant negative correlation between the magnitude of the perception asymmetry and the performance of supply chain partnerships. In order to achieve the third research objective, two separate analyses, MANOVA and Pearson's correlation were employed. MANOVA was used to check the existence of significant perception asymmetry among partners and Pearson's correlation was employed to assess the direction and degree of the association between the magnitude of perception asymmetry and performance.

In chapter six, the results of the above analyses are presented along with the academic contributions of this research. Due to the lack of the research interest in this area, very few studies of this type have been carried out, and therefore, this research has a strong exploratory nature.

As with the previous two analyses, cluster analysis and multiple regression analyses, the six-stage approach to multivariate model building suggested by Hair *et al.* (1999) was used for the purpose of assuring quality results from a systematic approach.

2 Research Objectives and Selection of Dependent Variables

2.1 Research Objectives

The existence of perception asymmetry on the status and performance of supply chain partnerships among supply chain partners are implicitly assumed by academics and practitioners, although the impact of the perception asymmetry on the supply chain partnership performance has not yet been extensively studied. In this research, using the survey data collected from companies in Korean CPG supply chains[46], two separate MANOVA analyses were performed to detect the existence of significant

[46] For detailed information regarding the data collection, please refer to section III.2.

perception asymmetry between partners on the status of supply chain partnerships they belonged to and their performance. Furthermore, the strength and the direction of the relationship between the partners' perception asymmetry on the status of supply chain partnerships and the performance of these partnerships were tested using Pearson's correlation.

Four major hypotheses were tested here. Firstly, the following two hypotheses regarding the existence of the perception asymmetry between suppliers and customers of supply chain partnerships were tested.

H_8: There is a significant difference between the perceptions of a supplier and a customer on the status of the supply chain partnership they belong to.

H_9: There is a significant difference between the perceptions of a supplier and a customer on the performance of the supply chain partnership they belong to.

Then, the third and fourth hypotheses, which are that the degree of the difference of the perceptions of partners of a supply chain partnership on 1) the status of their partnership and 2) the performance of their partnership are negatively correlated with three measures of partnership performance, were tested using Pearson's correlations.

H_{10}: The degree of perception asymmetry on the status of the supply chain partnership is negatively correlated with the performance of the supply chain partnership.

H_{11}: The degree of perception asymmetry on the performance of the supply chain partnership is negatively correlated with the performance of supply chain partnership.

2.2 Selection of Dependent Variables

Five dependent variables for the status of supply chain partnership, which were 1) information technology, 2) trust, 3) joint partnership management system, 4) partnership specific assets, and 5) partner asymmetry, were used to test the hypothesis eight. For hypothesis nine, three performance measures, 1) extent of goal achievement, 2) contribution on corporate level, and 3) contribution on SCM operational level were selected as dependent variables. The non-metric variable of 'customer' and 'supplier' was used as a grouping variable.

Status of SCPs	Indicators
Information Exchange	a) Capacity of external information sharing in general
	b) Capacity of information exchange of 1) standardised and 2) customised information exchange with its specific partner
	c) Willingness to share 1) operational and 2) strategic SCM information with its specific partner
Trust	a) Level of trust towards its specific partner
	b) Abuse of customers' buyer power
	c) Prime customer/supplier
Joint Partnership Management	a) Existence of formalised guidelines for supply chain partnership management
	b) Existence of well defined roles and responsibility for engaging partnerships
	c) Opportunity for suppliers' participation in the decision-making process of their customers
	d) Existence of benefit and risk sharing system
Relationship Specific Asset	a) Existence of IT investment for the partnership with the specific partner
	b) Existence of Non-IT investment for the partnership with the specific partner
Partner Asymmetry	a) Degree of partner asymmetry with the specific partners in 'willingness to change'
	b) Degree of partner asymmetry with the specific partners in 'keeping commitments'
Performance of SCPs	
Extent of Goal Achievement	Three major reasons for forming/ maintaining their supply chain partnerships and their evaluation
Enhancement of Company's Competitive Positions	a) Profit level
	b) Cost control
	c) Technology development
	d) New product development
	e) Knowledge transfer
	f) Manufacturing and quality control
	g) Marketing activities
	h) Sales level
	i) Customer service
Contribution in Operational level	a) Forecasting accuracy
	b) Inventory level
	c) Lead time
	d) Supply chain responsiveness
	e) SCM cost reduction

Table VI-1: Measures used for status and performance of supply chain partnership

3 Research Design of MANOVA (Sample Size)

The primary concern when performing a two-group MANOVA is the sample size requirement for each cell. Hair *et al.* (1998) suggested, as a the rule of thumb for the recommended sample size, that the sample size should be greater than 20 observations for each cell and the minimum sample size, that is the observation in each cell, should be greater than the number of dependent variables. The sample size for this study is 148, made up of 74 contributions each from the supplier group and the customer group. This sample size exceeds the minimum sample size suggested by Hair *et al.* (1998). In addition to this, power analyses for MANOVA were carried out by using Gpower[47] to calculate the power level by the given sample size (n=74 per

[47] Gpower is a freeware software application developed by Heinrich-Heine-Universität, Düsseldorf.

group), medium effect size, α level (0.05), the number of dependent variables (5 and 3) and the classes within the grouping variable (2). The outcomes (power = 0.9999, 0.9991) suggested that the sample size was adequate to provide the recommended power of .80 for at least medium effect size.

4 Assumptions in MANOVA

Hair *et al.* (1998) and Stevens (2001) suggest three assumptions for valid results, which are that 1) the observations must be independent, 2) the variance-covariance matrices must be equal for all treatment groups, and 3) the set of p-dependent variables must follow a multivariate normal distribution. In addition, the possible existence of linearity, multicollinearty and outliers should be examined.

4.1 Identifying Outliers

Two separate outlier detection processes were carried out for the two MANOVA analyses, 1) the perception asymmetry on the status of supply chain partnerships and 2) the perception asymmetry on the of performance supply chain partnerships.

Three Step Approach for Detecting Outliers for MANOVA of the Perception Difference on the Status of the Supply Chain Partnerships (IT, TR, JS, PA, and RA)			
	Univariate Outliers Cases (Z Scores Exceeding 2.5)	Bivariate Outliers Cases (90% Confidence Interval Ellipse)	Multivariate Outliers Cases (Mahalanobis D^2)
IT	None	6, 14, 37, 39, 61, 87, 98, 99, 126, 133, 136, 144	144, 123
JS	None	6, 13, 14, 65, 96, 97, 98, 125, 126, 136, 144	
PA	14	6, 10, 46, 74, 88, 123, 125, 126, 133, 136, 144, 147	
RA	10, 123, 144, 147	6, 34, 39, 71, 123, 126, 133, 148	
TR	123	4, 6, 39, 69, 71, 98,122, 123, 125, 126, 133, 134, 136, 139	
Three Step Approach for Detecting Outliers for MANOVA of the Perception Difference on the Performance of Supply Chain Partnership (PEGOAL, PECORP, and PESCM)			
	Univariate Outliers Cases (Z Scores Exceeding 2.5)	Bivariate Outliers Cases (90% Confidence Interval Ellipse)	Multivariate Outliers Cases (Mahalanobis D^2)
PEGOAL	122, 136	6, 14, 16, 38, 61, 87, 99, 122, 136, 144	122
PECORP	6, 126, 136	6, 10, 46, 74, 88, 123, 125, 126, 133, 136, 144, 147	
PESCM	10, 13, 14, 25, 136	6, 10, 13, 14, 37, 39, 46, 61, 99, 125, 136, 144	

Table VI-2: List of outliers for two MANOVA analyses

For the first data set, relating to the status of supply chain partnerships, the results of the above three diagnostic tests suggested that observations 6, 13, 14, 123, 126, 136, and 144 appeared to be possible outliers. They repeatedly appeared as outliers in

different stage of the analyses; for that reason, these cases were regarded as true aberrant observations, which were not representative of the general population. Therefore these observations were excluded from further analysis. For the second data set, relating to supply chain partnership performance, observations 6, 122, and 136 repeatedly appeared during the examination to detect univariate, bivariate and multivariate outliers. Thus, they were excluded from the second MANOVA analysis.

4.2 Assumption of the Independence of Observations

Hair *et al.* (1998) argued that violation of the assumption of the independence of observations is the most serious for the valid outcome of analysis. However, as Field (2000) suggested, the violation of this assumption is serious only when performing a univariate repeated measures ANOVA. In the individual univariate tests produced by MANOVA, which produce F-values that are the squares of the t-values accompanying parameter estimates, each uses a separate error term, and thus does not require the sphericity assumption to be met. Therefore, the assessment of this assumption was omitted.

4.3 Assumption of the Equal Variance-Covariance Matrices among all Groups

The test for the homogeneity of the variance-covariance matrices among supplier and customer groups for the two data sets was conducted in two steps. Firstly, Levene's Test of Equality of Error Variance was used to assess the univariate homogeneity of variance across suppliers and customer groups. The results of Levene's test are presented in Table VI-3. The results suggested that there was a violation of the assumption of homogeneity in the dependent measures TR and PEGOAL.

MANOVA 1	F	df1	df2	Sig.
IT	.618	1	137	.433
TR	11.728	1	137	.001
JS	.176	1	137	.676
RA	.000	1	137	.984
PA	.717	1	137	.399
MANOVA 2	**F**	**df1**	**df2**	**Sig.**
PEGOAL	16.951	1	133	.000
PECORP	1.942	1	133	.166
PESCM	3.512	1	133	.063

Table VI-3: Levene's test of equality of error variances for data set I and II

The next step was to assess the dependent variables collectively by testing the

equality of the entire variance-covariance matrices between the groups. The Box M test was used for this purpose with a significance level of .01. The results of the Box M test are presented in Table VI-4. The results suggest that the null hypothesis, that the error variance of the dependent variable is equal across groups for the status of supply chain partnership, could not be rejected. However, the statistic for the second data set of supply chain performance was significant, indicating a possible violation of the assumption of homogeneity.

	Perception Asymmetry on the Status of Supply Chain Partnerships	Perception Asymmetry on the SCP Performance
Box's M	29.968	27.153
F	1.920	4.415
df1	15	6
df2	75535.463	126245.140
Sig.	.017	.000

Table VI-4: The results of Box's M tests for data set I and II

Hair *et al.* (1998) and Field (2000) suggested that the Box test is very sensitive to the multivariate non-normality of dependent variables. In order to decrease the level of heterogeneous covariance by improving multivariate normality of the dependent variables, various transformation of dependent variables were conducted, but this did not yield significant improvements. Thus, random deletion, suggested by Field (2000), of five cases in the supply group to yield equal cell sizes (65 in each cell) between supplier and customer groups was conducted, as Hotelling's T^2 is robust in the two-group situation when the sample size is equal (Hakstian, Roed, & Lind, 1979). However, such random deletion could result in decreasing the statistical power of MANOVA analysis. Thus, additional power analysis for MANOVA were carried out, again using Gpower to calculate the power level for the decreased sample size of 65 per group, to ensure that there was no drastic decrease. The power calculated was 0.9990, and this suggested that the decrease in the sample size as a result of the deletion of cases had not decreased the power below the recommended power of .80 for at least medium effect size.

4.4 Assumption of Multivariate Normality

Hair *et al.* (1998) suggested that there is no direct test for multivariate normality. Instead, univariate normality tests were conducted for the status of supply chain partnerships and the performance of a supply chain partnership. The reason behind this was that even though univariate normality is not a guarantee of multivariate

normality, if all variables meet this requirement, then the effect of the violation of this assumption is minimal. Along with the visual inspection of histograms and Normal Q-Q plots of each variable, Kolomogorov-Smirnov and Shapiro-Wilk test statistics were calculated. The results of the K-S test suggested that all seven variables, except for IT, had possible abnormal distributions. The S-W test results suggested that the previous five variables 1) RA, 2) PA, 3) TR, 4) JS, and 5) PESCM were identified as non-normal distributions.

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
IT	.064	139	.200(*)	.989	139	.377
RA	.232	139	.000	.884	139	.000
PA	.103	139	.001	.947	139	.000
TR	.141	139	.000	.963	139	.001
JS	.097	139	.003	.967	139	.002
PEGOAL	.091	130	.011	.980	130	.051
PECORP	.080	130	.042	.981	130	.067
PESCM	.083	130	.027	.943	130	.000

Table VI-5: Kolmogorov-Smirnov and Shapiro-Wilk normality tests for all variables

Visual inspections of Normal Q-Q plots and histograms were carried out to make a final decision and the results indicated the distribution of RA was heavily positively skewed and the other two variables, PA and PESCM, were heavily negatively skewed. Thus, transformation of these variables, log transformation for RA and square transformation for PA and PESCM, were conducted. As a result, there was an improvement in the skewness for the three variables, RA (.492 => .207), PA (-.452 => .143) and PESCM (-.750 => .038), but normality of their distributions could not be achieved. Field (2000) argued that violation of this assumption can create problems when applying the Box test, but in our case, the Box test for the first data set was not significant and the second data set had the same number of observations in both groups. In addition, the impact of the violation of this assumption is minimal with a large sample size (148 in this research) and with the moderate sample size, the violation can be accommodated as long as the difference is due to skewness and not outliers. For this study, as a first step of this analysis, seven outliers were eliminated from the first data set and three from the second, and from the visual inspection of the histograms, it was evident that skewness was causing the non-normal distribution. Thus, it was clear that non-normal distribution in the data set was caused by the skewness but not by the existence of outliers. Thus, the effect of the minor violation of the assumption of multivariate normal distribution for this study was

expected to be minimal.

5 Estimation of the MANOVA Models, Assessing Overall Fit, and Testing Hypotheses

Two MANOVA models for testing perception asymmetry regarding the performance of partnerships and respondents' views on the status of the partnerships between supply chain partners were estimated. The overall fits of these two MANOVA models were assessed in two separate steps. Firstly, Hotelling's T^2 was used to test the significance of the models estimated, as it is a specialised test to assess the statistical significance of the difference in the means of two or more variables between two groups (Hair *et al.*, 1998). The significance level for Hotelling's T^2 was specified at .05, which is the maximum allowable Type I error.

$$T^2_{crit} = \frac{p(N_1 + N_2 - 2)}{N_1 + N_2 - p - 1} \times F_{crit}$$

Equation VI-1: Equation of Hotelling-Lawley trace, (Source: Field, A., Discovering statistics, using SPSS for Windows, 2003)

In addition to this, other statistics, Pillai's Trance, Wilks' Lambda, and Roy's Largest, were used to assess the overall fit of two models.

5.1 Model I: Perception Asymmetry among Suppliers and Customers on Status of Supply Chain Partnerships

Four multivariate model statistics of MANOVA I (the perception asymmetry among the partners on the status of supply chain partnerships) are presented in Table VI-6. Hotelling's T^2 (p = 0.042) reached the criterion for significance at .05, and all other three statistics reached this level as well. On the basis of the result of this MANOVA, we can accept hypothesis 8, which was based on the argument that 'suppliers and customers perceived the status of supply chain partnerships differently.'

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.985	1728.347	5.000	133.000	.000
	Wilks' Lambda	.015	1728.347	5.000	133.000	.000
	Hotelling's Trace	64.975	1728.347	5.000	133.000	.000
	Roy's Largest Root	64.975	1728.347	5.000	133.000	.000
Type of SCP Participants	Pillai's Trace	.082	2.378	5.000	133.000	.042
	Wilks' Lambda	.918	2.378	5.000	133.000	.042
	Hotelling's Trace	.089	2.378	5.000	133.000	.042
	Roy's Largest Root	.089	2.378	5.000	133.000	.042

Table VI-6: Multivariate tests for Model I: Percpetual difference among partners on the status of supply chain partnership

5.2 Model II: Perception Asymmetry among Suppliers and Customers on Supply Chain Partnership Performance

All statistics reached the criterion for significance at .01. The evidence relating to H_9, which was based on the argument that 'suppliers and customers perceived the performance of a supply chain partnership differently,' is presented in Table VI-7. The four multivariate model statistics of MANOVA II (the perception asymmetry among the partners of a supply chain partnership on its performance) are presented in Table VI-7. With this result, we accept hypothesis 9.

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.967	1222.780	3.000	126.000	.000
	Wilks' Lambda	.033	1222.780	3.000	126.000	.000
	Hotelling's Trace	29.114	1222.780	3.000	126.000	.000
	Roy's Largest Root	29.114	1222.780	3.000	126.000	.000
Type of SCP Participants	Pillai's Trace	.126	6.073	3.000	126.000	.001
	Wilks' Lambda	.874	6.073	3.000	126.000	.001
	Hotelling's Trace	.145	6.073	3.000	126.000	.001
	Roy's Largest Root	.145	6.073	3.000	126.000	.001

Table VI-7: Multivariate tests for Model II: Percpetual difference among partners of supply chain partnership on its performance

6 Interpretation of the MANOVA Results

Once the significance tests of the multivariate analyses confirms the presence of group difference on the dependent variates, a set of follow-up analyses needs to be performed to assess where the significant difference on variates originates. Upon completion of the estimation of two significant MANOVA models and the hypotheses tests, separate ANOVAs on each of the dependent variables were performed to assess which individual variables were contributing to the difference. Caution should be taken when running a series of ANOVAs over the same dependent variables, as it could inflate Type I errors (Hair *et al.*, 1999, and Field, 2000). However, the following ANOVAs are protected against inflated Type I error by the previous MANOVA, because if the initial result of the MANOVA is not significant, then any significance statistics from the following ANOVAs can be regarded as Type I errors (Bock, 1975).

6.1 Model I: Perception Asymmetry among Suppliers and Customers on the Status of Supply Chain Partnerships

The results of the follow-up analysis of separate ANOVAs on IT, TR, JS, PA, and RA are presented in Table VI-8. The results of the follow-up analysis suggested that there

were significant differences between the suppliers and customers in terms of perceiving the level of joint partnership management system and trust.

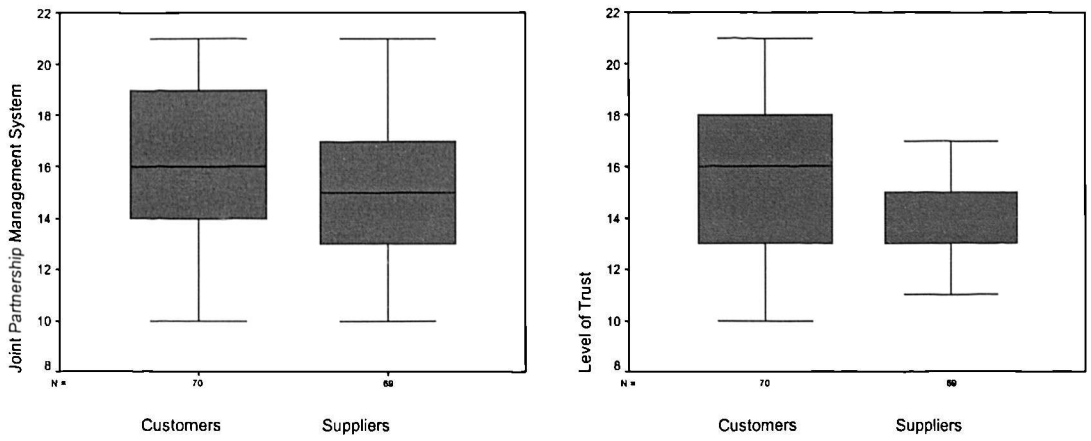
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Type SCP Participants	RAT	.188	1	.188	.482	.489
	PAT	5859.360	1	5859.360	2.622	.108
	IT	33.271	1	33.271	2.602	.109
	TR	80.597	1	80.597	11.200	.001
	JS	39.720	1	39.720	4.709	.032

Table VI-8: The follow-up analysis of separate ANOVAs for MANOVA I on IT, TR, JS, PA, and RA

6.1.1 Perception Asymmetry in 'Level of Trust'

As can be seen from Graph VI-1, the customers had significantly higher degree of trust in their suppliers than their suppliers had in their customers. Closer inspection of the individual questionnaire items regarding the status of supply chain partnership 'trust' suggested that there was a significant difference in the perception of trust on the following sub-item; 'my company feels that the customer (the company name of specific partner is shown here) leads the business relationship by exercising power', (7-point Likert scale, strongly disagree – strongly agree).

For cross-validation purposes, the same question was reworded and asked to the customers as follows: 'my company does not lead business relationship by exercising power to the supplier', (the company name of specific partner is shown here), (7-point Likert scale, strongly disagree – strongly agree).



Graph VI-1: Box plots of JS and TR by the types of Supply Chain Partnership participants

This item was intended to obtain information regarding the level of trust in the partnerships, and one of the important indicators is the degree of the existence of coercible power such as 'buyer power'. The average score from the suppliers on this

question was 3.46 (7-point Likert Scale, strongly disagree (1) - strongly agree (7)), which was lower than the score for 'neither disagree nor agree' (4). On the other hand, the average score from the customers on this question was 5.34, which was located between the scales 'slightly agree' and 'somewhat agree'. a separate ANOVA test (F = 69.938) suggested that this difference was significant at .01. This result clearly indicated that suppliers felt the pressure from buyers in the form of the buyer power; on the other hand, customers believed that they refrained from using buyer power to pressurise their suppliers. The situation where customers such CPG retailers have more market power (buyer power) over their suppliers is common in Europe and the US. Borghesani & De la Cruz (1998) identified a pattern of market power shift from manufacturers to retailers in Europe and the US due to the advent of large discount stores. The recent advent of large discount stores and top supermarket chains in Korea has changed the landscape of Korean CPG retail industry, which is now similar to the western style large discount store-oriented CPG retail industry. Thus, the main reason behind this perception asymmetry is probably the market power shift to CPG retailers in Korea due to the increasing number of large discount stores.

6.1.2 Perception Asymmetry in 'Joint Partnership Management System'

As can be seen from Table VI-8, the customers considered that their joint partnership management systems functioned better than their counterparts (suppliers) did. Further assessment of the individual questionnaire items regarding the status of supply chain partnerships' joint partnership management systems was carried out to identify the source of these differences in perception. A significant difference on the following item was identified.

- Benefits/Risks from the business relationship with the customer/supplier (the company name of specific partner is shown here) are fairly shared, (7-point Likert scale, strongly disagree – strongly agree).

This item was intended to obtain information regarding one of the elements of the joint partnership management system, which was the system of sharing the risks and benefits associated with their partnerships. The same question was posed to both the supplier and the customer of each supply chain partnership. The average score for the suppliers was 4.76 (7-point Likert scale, strongly disagree - strongly agree), which is

lower than 'slightly agree' on the scale. The average score for the suppliers was 5.18, which was slightly higher than 'slightly agree' on the scale. The separate ANOVA test result (F =3.9111) suggested that this difference was significant at .05. The result suggested that customers perceived that the benefits and risks of their partnership were shared more fairly than their partners (supplier) did. This result is similar to that of Ellram & Hendrick (1995), where a significant perception difference was detected between suppliers and customers on the degree of risk sharing system in a partnership. Also, the customers evaluated their benefits/risks sharing systems more favourably than their suppliers did, and this result is also similar to the result of Ellram & Hendrick (1995).

6.2 Model II: Perception Asymmetry among Suppliers and Customers on Supply Chain Partnership

Given the significant MANOVA, a follow-up analysis of separate ANOVAs on each of the dependent variables PEGOAL, PECORP and PESCM were performed. The results of the follow-up analysis of separate ANOVAs are presented in Table VI-9. The results of the follow-up analysis suggested that there was a significant difference among suppliers and customers in their perception of the performance measure PESCM at .01.

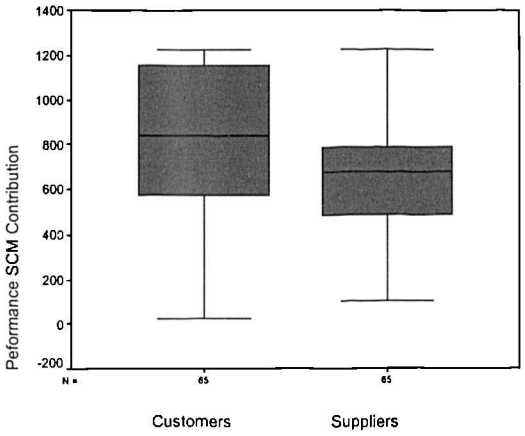
Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Type SCP Participants	PEGOAL	2.094	1	2.094	1.247	.266
	PECORP	67.969	1	67.969	.948	.332
	PESCM	624046.531	1	624046.531	7.278	.008

Table VI-9: The follow-up analysis of separate ANOVAs for MANOVA I on PEGOAL, PECORP and PESCM

6.2.1 Perception Asymmetry in 'Contribution of Supply Chain Partnerships to SCM operation'

A similar close analysis was performed for MANOVA II in order to assess the effects of the individual items of the performance measure 'contribution at SCM operational level'. The result indicated that customers were significantly more satisfied with the contribution of their supply chain partnerships to the performance of their SCM operations.

Graph VI-2: Box plots of PESCM by the types of supply chain partnership participants



- The supply chain partnership with the customer/supplier (the company name of specific partner is shown here) positively influences the increase of our forecasting accuracy (7-point Likert scale, strongly disagree – strongly agree).
- The supply chain partnership with the customer/supplier (the company name of specific partner is shown here) positively influences the reduction of our inventory level (7-point Likert scale, strongly disagree – strongly agree).

Regarding the forecast accuracy, the average score of the suppliers for the forecasting accuracy was 5.03 (on a 7-point Likert Scale, where 1=strongly disagree and 7=strongly agree), which was near the scale-point 'slightly agree'. The average score for the customers on this item was 5.52, which was between the scale-points 'slightly agree' and 'moderately agree'. This perception asymmetry was significant at .05, (F = 4.622). The result suggested that suppliers evaluated the contribution of their supply chain partnership to their SCM operation significantly less favourably than their customers did. In terms of the inventory level, the average score of the suppliers was 4.69, which was between the scale points 'neither disagree nor agree' and 'slightly agree'. For the customers, the score was 5.51, which was located between 'slightly agree' and 'moderately agree'. The difference was significant at .05, (F = 9.946). The main reasons why the suppliers evaluated the contribution of their partnerships less favourably on 1) forecasting accuracy and 2) inventory level requires a separate investigation. A customer can provide demand related information to its partners (suppliers), and they can use this information for forecasting related activities and inventory planning. According to Ellram & Hendrick (1995), however, there tends to be a lack of communication from customers to their suppliers regarding the type of information available and/or the frequency of the updates, and

this makes suppliers believe that their customers are not sharing enough demand information with them. This is probably the reason why the suppliers were less satisfied by the contribution of their partnerships on the above two dimensions. Our data support this, as less than the half of the suppliers received demand related data from their customers, and suppliers were significantly less happy with the level of communication with customers. Also, it was clear that the information in partnerships tends to go more towards to the customers than in other direction. Therefore, it could be concluded that the reason why suppliers evaluated the contribution of their partnerships less favourably in terms of 1) forecasting accuracy and 2) inventory level is that suppliers were not as satisfied as their counterparts by the amount and quality of the information from their customers via partnerships, which were essential to improve the above two dimensions of SCM performance.

7 Association between Performance of Supply Chain Partnership and the Magnitude of the Perception Asymmetry on its Status and Performance

As a final phase of this research, the relationship between the magnitude of the difference of the perceptions of partners within partnerships on three measures of partnership performance was assessed. From the above MANOVAs, it was clear that suppliers and customers did perceive the status of their supply chain partnerships differently in terms of the level trust and the degree of joint partnership management systems. In order to test the second hypothesis, which argues that the perception asymmetry is negatively correlated with the performance of supply chain partnerships, correlation analysis was conducted.

7.1 Creation of New Variables for Measuring Perception Asymmetry

In order to measure the perception asymmetry between suppliers and customers on the status of a supply chain partnership, five new variables, DIT, DTR, DJS, DRA, and DPA, were created. Each variable was created by calculating the absolute value of the difference between the answers given by a supplier and a customer regarding the status of the supply chain partnership they belonged to. In the same way, three new variables, DPEGOAL, DPECORP, and DPESCM, for perception asymmetry on performance, were created.

7.2 Correlation Analyses to Explore the Associations

As an initial step in the correlation analysis, fifteen and nine scatter plots respectively were plotted to examine the general trend of association between 1) DIT, DTR, DJS, DRA, DPA, 2) DPEGOAL, DPECORP, DPESCM, and three measures of the performance of supply chain. There were some indications of negative correlations among 1) some of the new variables referring to the perception difference regarding the status of a supply chain partnership and the performance measure PESCM and PECORP and 2) DPESCM and all three performance measures (Appendix 3).

As a second step, fifteen and nine Pearson's correlation coefficients respectively were calculated between 1) DIT, DTR, DJS, DRA, DPA, 2) DPEGOAL, DPECORP, DPESCM, and three measures of the performance of supply chain. The main reason behind the decision to use Pearson's correlation coefficients was that the data used in this research were parametric.

In order to test whether the correlation coefficients are significantly different to zero, either two-tailed or one-tailed tests should be conducted. Field (2000) suggested that one-tailed tests should be used when the direction of the relationship can be predicted and there is a specific direction to the hypothesis being tested. Mohr & Puck (2003) suggested that the higher levels of perception asymmetry between the partners on the status of their partnership would be negatively correlated with partnership performance. Also, the main hypotheses of this research were to test for possible negative correlations. Therefore, one-tailed significance tests were used for this purpose.

The results of the correlation analysis between perception asymmetry and the performance of partnerships are presented in Table VI-10. As can be seen from Table VI-10, nine out of fifteen correlation coefficients had negative signs. DTR and DPA were negatively correlated with all of the three performance measures and DJS and DRA were negatively correlated with PECORP and PESCM. This presence of negative signs matched the prior expectation of the direction of correlations. However, DIT was not negatively correlated with any of the performance measures.

Two correlation coefficients (DTR - PESCM, and DPA - PESCM) were significant at .01 and those of DTR - PECORP, and DJS - PECORP were significant at .1.

		DIT	DTR	DJS	DRA	DPA
PEGOAL	Pearson Correlation	.009	-.051	.072	.109	-.107
	Sig. (1-tailed)	.469	.334	.272	.178	.182
	N	72	74	74	74	74
PECORP	Pearson Correlation	.001	-.188(*)	-.152(*)	-.119	-.096
	Sig. (1-tailed)	.498	.054	.098	.156	.207
	N	72	74	74	74	74
PESCM	Pearson Correlation	.057	-.325(***)	-.125	.053	-.298(***)
	Sig. (1-tailed)	.316	.002	.144	.327	.005
	N	72	74	74	74	74

Table VI-10: Pearson's correlations between the variable of perception asymmetry DIT, DTR, DJS, DRA and DPA, and three performance measures PEGOAL, PECORP, and PESCM, (* $p<0.1$, ** $p<0.05$, *** $p<0.01$)

The results of the second analysis between perception asymmetry on performance and performance itself are presented in Table V-11. In total, seven out of nine correlation coefficients had negative signs, which confirmed our prior expectation. Three correlation coefficients (DEPESCM - PEGOAL, DEPESCM - PECORP and DEPESCM - PESCM) were significant at .01 .

		DPEGOAL	DPECORP	DEPESCM
PEGOAL	Pearson Correlation	-.017	-.014	-.265(***)
	Sig. (1-tailed)	.897	.904	.023
	N	64	74	74
PECORP	Pearson Correlation	.117	-.111	-.454
	Sig. (1-tailed)	.356	.348	.000(***)
	N	64	74	74
PESCM	Pearson Correlation	.129	-.044	-.331(***)
	Sig. (1-tailed)	.308	.709	.004
	N	64	74	74

Table VI-11: Pearson's correlations between the variables of perception asymmetry DPEGOAL, DPECORP and DPESCM, and three performance measures PEGOAL, PECORP, and PESCM, (* $p<0.1$, ** $p<0.05$, *** $p<0.01$)

Regarding the data set I, the result suggested that there were significant association between DTR, DPA and PESCM. In other words, the larger the perception difference between the partners on the level of trust and partner asymmetry, the worse the performance of a supply chain partnership (contribution at SCM operational level).

Regarding the data set II, the performance dimension 'contribution at SCM operational level' was the most sensitive variable to the perception asymmetry. The effect of perception asymmetry of the performance variable 'contribution at SCM operational level' (DPESCM) was significantly negatively associated with all of the performance measures. This means that a partnership with a perception difference between the partners in terms of their evaluation of the performance of the

partnership in this dimension is likely to have lower partnership performance in all three dimensions.

This result was different to the findings of Mohr & Puck (2003), where no significant correlations were found. To discuss the reasons behind this in detail is beyond the scope of this research, as the main research object was 'identifying the existence of the significant association'. Also, the lack of the existing literature and theoretical background is another limitation to the scope of the present research. Fuller and more detailed research is required to answer the above question.

8 Academic Contributions

As mentioned above, issues related to perception asymmetry and its association with the performance of collaborative inter-firm arrangements have not been widely covered by academics, but are important due to the possible negative impact of this asymmetry on the success of partnerships. Thus, this research set out to answer two questions: 1) Do suppliers and customers see things differently, if yes then, in which aspect of supply chain partnerships? 2) Is this difference in any way related to the performance of supply chains?

The final results of this research have made the following major contributions to the existing body of the literature regarding the performance issues of supply chain partnerships. Firstly, it has identified the existence of significant perception asymmetry between customers and suppliers on 1) the status of supply chain partnerships (trust and joint partnership management system) and 2) the performance of supply chain partnerships (contribution at SCM operational level). Also, this research has shed light on the source of these perception differences and the possible reasons behind them. Secondly, this has research demonstrated that the magnitude of perception asymmetry is negatively associated with the performance of partnerships.

VII. Conclusion

This research has examined supply chain partnerships from the Korean CPG industry. The main focus of this research was how to manage supply chain partnerships effectively, and in particular the management of partnership growth and performance management. In order to do this, the research has addressed the following three objectives.

The first research objective was to develop a supply chain partnership classification scheme for academic and managerial purposes. The main characteristics of this classification scheme we obtained are that this scheme is 1) specialised for supply chain partnerships, 2) empirically derived, and 3) based on the five determinants of supply chain performance. In addition, the newly developed scheme has provided an important insight into the pattern of the evolution of supply chain partnerships. On the basis of these findings, some requirements for the evolution of supply chain partnerships, which are in the form of components the partnership development management, were suggested.

The second research objective was to identify the major determinants of the performance of a supply chain partnership and estimate performance models for the three dimensions of supply chain partnership performance. The three performance models provided an important foundation for developing a 'supply chain partnership performance management scheme'.

The third and final research objective was to confirm that suppliers and customers do see things very differently, and investigate the association between these differences and the performance of a supply chain partnership. The third research objective was exploratory in nature; thus, it has provided some interesting research opportunities for academics.

In order to achieve these objectives, a sampling frame was derived from various sources and a total of fifty-four companies (thirty-four large discount store chains, ten supermarket chains, five Internet shopping malls and five TV home shopping channels) in the category of CPG retailers were contacted. The data were collected by means of a self-administered questionnaire survey and the data from seventy-four supply chain partnerships (a total of a hundred and forty-eight questionnaires) were used for analyses. The main characteristic of this survey was that in an effort to

minimise the possible bias from perception asymmetry and for cross-validation purposes, a set of questionnaires was presented to both the supplier and the retailer on the same subject and the responses from each side of the partnership were averaged.

This chapter summarises the findings and contributions of this research. Then, the limitation of this research and suggestions for future research are then discussed.

1 Summary of Research Findings and Contributions

This research has explored three issues related to supply chain partnership management using data collected from Korean CPG supply chains. Full details of the results of three major analyses to achieve the research objectives are presented in Chapters 4, 5, and 6.

1.1 Classification Scheme and Partnership Growth Management

In an attempt to achieve the first research objective, a classification scheme of supply chain partnerships using five performance determinants was developed from the empirical data. According to the classification scheme, there are four distinctive patterns of supply chain partnerships: (Type I) stagnated basic supply chain partnerships, (Type II) developing basic supply chain partnership, (Type III) moderately collaborative supply chain partnerships and (Type IV) highly collaborative supply chain partnerships.

Classification Scheme for Supply Chain Partnerships

Supply chain partnerships in Type I 'Stagnated Basic Supply Chain Partnerships' have lowest levels of all five collaborative elements. These partnerships can be regarded as an extended form of transactional relationships or arm's-length relationships. The growth of such partnerships to the next level is difficult because the basic motivations of these partnerships are short-term oriented and/or the participants of such partnerships do not have sufficient resources to support more collaborative but costly form of partnerships.

Partnerships at the next level are classed as Type II 'developing basic supply chain partnership'. Their main difference from Type I is that partnerships in this category possess limited but higher degrees of IT and joint partnership management systems than those of Type I. Also, participants in Type II partnerships have positive intentions to develop their partnerships further, into more collaborative and

beneficial arrangements. This positive intention and the possession of some degree of collaboration infrastructure (IT and joint partnership management system) enable them to develop their partnership into more collaborative and beneficial relationships.

Participants in Type III, 'moderately collaborative supply chain partnerships' are engaged in more advanced partnerships than the previous two categories, as these partnerships are supported by IT infrastructure (in particular, some degree of IT connection for external information exchange) and joint partnership management systems at a sufficient level. One distinctive characteristic of Type III partnerships is that the role of suppliers carries more weight in many aspects of these partnerships. For example, the gap between IT capacity and perceived fairness of the joint partnership management system between suppliers and customers is smaller than in the previous two categories and there is some degree of suppliers' participation in customers' decision-making processes. Partnerships in the Type III category benefit not only from sufficient operational improvement within their supply chains, but also from some non-operational improvements such as enhanced marketing capability, customer service and new products development.

Type IV, 'highly collaborative supply chain partnerships' can be regarded as the most advanced form of supply chain partnership. They have the highest degree of all five collaborative elements. In particular, their IT capacity is one of the most sophisticated and comprehensive of all. They are capable of exchanging customised and standardised information and their satisfaction with this information exchange is the highest. Another distinctive characteristic is that these partnerships are based on IT and non-IT asset investment designated for their partnerships and they have sufficiently large and sophisticated transactions to justify such investment.

Supply Chain Partnership Growth Management

This classification method for supply chain partnerships based on the empirical data has shed light on how supply chain partnerships evolve, and has provided valuable information to managers of CPG supply chain partnerships about how to manage partnership growth. Also this research has identified the circumstances, conditions and requirements for the evolution of a partnership towards a more collaborative and beneficial form. With the exception of Type I 'stagnated basic supply chain partnerships', partnerships in all the other three types can be regarded as having

varying degrees of potential for evolution into more collaborative partnerships.

The conditions necessary to allow partnerships at Type II to evolve towards more a collaborative form of Type III partnership are 1) more mutual trust, 2) better and more balanced IT capacity, and 3) a more sophisticated joint partnership management system, especially more mutuality in decision-making processes and fairer risk/benefit sharing systems. In particular, mutual trust is the most important requirement because trust itself is an important requirement and at the same time is an important precondition for the other two requirements, IT investment and improvement of joint partnership management systems.

A high level of mutuality is the most important requirement for the evolution from Type III to Type IV, 'Highly Collaborative Partnerships'. If partners in Type III relationships are willing to develop their partnerships to the next stage, the mutuality of the following fields needs to be improved significantly. Firstly, partners in Type III are required to improve the two mutual aspect of their IT capacity, namely 1) closing the gap in IT capacity between partners and 2) improving mutual IT capacity for more external information exchange. Secondly, partners are required to improve the following mutual aspects of 'Joint Partnership Management System': 1) level of mutual satisfaction with profit and risk sharing systems, and 2) greater supplier participation in the decision-making process.

One important point that should be noted is that the results suggested, in addition to the above conditions for the evolution, that the type of retailer is also an important exogenous condition which affects the possibility of partnership evolution. If the retail side partner is a large discount store, there is a higher potential to evolve into a more collaborative supply chain partnership. On the other hand, if the retail side partner is a supermarket chain or an alternative retailer, then evolution towards the next stage might be more difficult, due to the low resource availability, less sophisticated supply chain environment and tighter profit margins.

1.2 Supply Chain Partnership Performance Management

In order to achieve the second research objective, firstly a series of the hypotheses tests was conducted to test the significance of the individual influence of each factor of the performance of a supply chain partnership. Then, three models, each reflecting an individual dimension of partnership performance were estimated. In addition to

these, overcoming the limitations of past research and suggesting a method for managing partnership performance can be regarded as important contributions of this research. The findings and the research contributions are summarised here.

Overcoming the limitation of the past research

Issues related to supply chain partnerships have been receiving a considerable amount of academic attention, but these works are often exposed to the following weakness: 1) the use of the supply chain performance measures as proxy measures for the performance of supply chain partnerships without clear justifications or modifications, 2) inappropriate data collection methods, which expose the results to the problem of perception asymmetry, and 3) the lack of an integrated approach with the focus on a limited number of individual factors.

In order to overcome the first limitation, two new measures 1) extent of goal achievement and 2) contribution at SCM operational level, which are specialised measures for supply chain partnership performance, were developed and successfully incorporated into the main analyses and the model estimation of the present study. To overcome the second research limitation, perception asymmetry on performance measures and their determinants were removed during the process of data collection by posing the same questions to both participants of each partnership studied and averaging the responses. In order to overcome the third limitation, the two traditional approaches of looking at the partnership performance of a collaborative inter-firm arrangement in terms of 1) the physical characteristics of partnerships and 2) the interactive nature of partnership between organisations were combined. The integration of these two distinctive approaches was achieved by selecting the determinants of partnership performance identified by research from both perspectives.

How to Improve the Performance of a Supply Chain Partnership?

On the basis of the three models estimated during this research, the concept of supply chain partnership performance management was developed. This concept of partnership performance management is based on the idea that instead of looking at the performance of partnership as one broad concept, it is necessary to consider this performance in smaller and more manageable pieces in order to facilitate efforts to improve the performance by focusing available resources on the targeted dimensions.

This study suggests that the performance of supply chain partnerships can be divided

into three smaller performance dimensions, which are 1) the extent of goal achievement, 2) the enhancement of a company's competitive position, and 3) the contribution at SCM operational level. Therefore, when we refer to a successful or well-performing supply chain partnership, we can expect one or more of the following characteristics: 1) the participants believe that the degree of goal achievement in terms of forming and maintaining the partnership is satisfactory, 2) they believe that the partnership enhances their competitive positions and 3) their SCM operations are greatly facilitated by the partnership. Each dimension of the performance of a supply chain partnership is determined by various factors (Table VII-1). Thus, in order to improve a certain dimension of a supply chain partnership, participants ought to focus on improving certain attributes of their partnership solely or jointly with their partners.

Performance Dimensions	Critical Performance Determinants
Extent of Goal Achievement	1. Well established and functioning joint partnership management system 2. Strong mutual trust among partners
Enhancement of Company's Competitive Position	1. Well established and functioning joint partnership management system 2. Sufficient level of investment dedicated to their partnerships
Contribution at SCM Operational Level	1. High degree of internal and external IT capacity and information exchange 2. Strong mutual trust among partners

Table VII-1: Three individual dimensions of the performance of supply chain partnership and its critical determinants

In addition, efforts to improve the performance of supply chain partnerships need to be made in a more organised manner; thus, this research suggests a three-step approach to improving the performance of supply chain partnerships. Firstly, the process of identifying the need to improve any of the three dimensions should be carried out. Upon completion of step 1, the process of identifying the requirements for improving the dimension of partnership performance that partners wish to improve needs to be carried out. Then, as a final step, a detailed action plan should be drawn up to improve the areas identified in step 2.

1.3 Perception Asymmetry among Suppliers and Customers and Its Association with the Performance of Supply Chain Partnership

The third research objective was achieved by running two analyses to test for perception differences between suppliers and customers, and the strength and direction of its association with partnership performance. Due to the lack of previous

research and theoretical background, the main focus of this element of the research is purely exploratory.

The main contributions from the results of achieving the third research objective are summarised here.

The results suggested that suppliers and customers do have different perceptions about the status and the performance of their supply chain partnerships. This research revealed that such differences stem from disagreement about the level of mutual trust and the fairness of risk/benefit sharing system. In terms of the performance of supply chain partnerships, suppliers evaluated the contribution of their partnerships in terms of improving inventory management and forecasting accuracy significantly less favourably than did customers. This difference was the cause of the performance perception asymmetry.

In addition, this research has confirmed that perception asymmetry and the performance of partnerships are negatively related. A partnership with a larger perception difference between the partners regarding the level of trust and partner asymmetry will have poorer partnership performance on dimension III, 'contribution at SCM operational level'. Also, a partnership with larger a perception difference between the partners in terms of their evaluation of the performance of the partnership on dimension III will have lower partnership performance in all three performance dimensions.

2 Suggestions for Future Research

This thesis has provided a set of important academic contributions to our understanding of supply chain partnerships and their performance. However, there are some important questions which this study could not answer, as they lay beyond the scope of this thesis. In the final section of this thesis, these unanswered questions are discussed and on the basis of these, research questions and directions for future research are suggested.

2.1 Research Suggestions for Results I

Firstly, the following two questions that remain unanswered by the present results should be answered by further research: 1) Why did suppliers in Type IV partnerships show the highest dissatisfaction with the abuse of the buyer power of their customers? 2) Why was only customised information, and not standardised

information, exchanged between the companies in Type III partnerships? Secondly, the data used for this research were collected only from companies in the Korean CPG industry. Similar studies should be carried out with data collected from different countries with different characteristics of CPG supply chains, economic and social contexts in order to increase external validity. Thirdly, the limitation to the evolution of supply chain partnership imposed by the type of retailer requires more research attention. Fourthly, it is also possible for a supply chain partnership to devolve due to, for example, M&A or switching sourcing to different suppliers. The possibility of devolution of a supply chain partnership and its patterns should be included in the supply chain partnership evolution management scheme.

2.2 Research Suggestions for Results II

Firstly, the focus of this research was limited to dyadic partnerships. There are partnerships in CPG supply chain where more than two participants are involved, but the decision to restrict the scope of this study to dyadic supply chain partnerships was made for the following reasons. Firstly, it was difficult to find enough partnerships involving more than two parties and secondly, there is little existing literature covering issues related to the measurement of partnership performance when more than two parties are involved. Clearly, it is evident that companies in Korean CPG supply chains are very interested in more sophisticated forms of partnership involving more than two partners. Thus, in the future, when information about such sophisticated supply chain partnerships becomes more widely available, a similar study needs to be conducted to check whether the findings of this research remain valid for non-dyadic supply chain partnerships.

Another concern is the sample size. Due to the relatively small sample size of this study, (in total, seventy-four partnerships) the initial plan of using structural equation modelling was abandoned and regression analyses were used instead. In terms of the requirements for sufficient statistical power and the guidelines for sample size put forward by Stevens (1991), the sample size of seventy-four was sufficient; however, tests of construct validity by factor analysis or structural equation modelling could not be carried out due to these techniques' stricter sample size requirements. Therefore, a replication of this study with a larger sample size is recommended in order to remedy this weakness. Thirdly, the data were collected from Korean CPG supply chains, and all the companies involved in this study were Korean companies.

During the study, it came to the researcher's attention that some major discount store chains from abroad, such as Wal-mart Korea, have direct business relationships with international suppliers. This raises two interesting questions for future research: 1) What are the determinants of a successful international supply chain partnership, and 2) How can the performance of international supply chain partnerships be measured?

2.3 Research Suggestions for Results III

As mentioned above, the scope of this research was limited to the identification of perception differences between suppliers and customers and testing the strength and direction of their association with partnership performance, due to the insufficient number of studies covering this topic. This lack of prior literature and theory was especially problematic when choosing analytical methods for testing the significant associations, as there is little literature and theory suggesting the possible one-way causal effect from the independent to dependent variables. This one-way causality, in which perceptual differences influence performance, could be assumed from common sense and field experience. However, this assumption was avoided at this initial, exploratory stage and Pearson's correlation was used as the main analytical method.

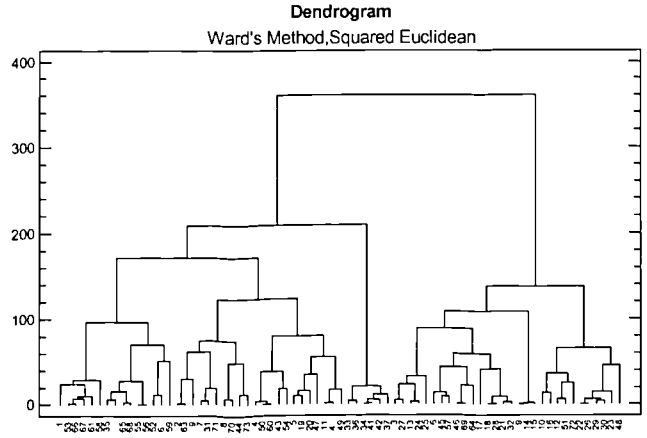
Given the above limitations, it is not easy to suggest any managerial implications from the results of this research; however, the results and limitations of this research lead to interesting directions for future research. Firstly, as discussed above, a study with wider data representing supply chain partnerships in various industries and more rigorous analytical methods is required. When more research and knowledge become available, more advanced analytical methods, such as multiple regression analysis or structural equation modelling (SEM), can be applied to analyse data representing supply chain partnerships in various industries. This will give more opportunity to examine the causality issue between the perception asymmetry and the performance. Secondly, an in-depth investigation regarding the causes of perception asymmetry should be carried out to find out the root cause of such perception asymmetry between suppliers and customers, so that the solutions to the problem of perception asymmetry can be found.

Appendix

Appendix 1: Results I, Classification Scheme and Evolution of Supply Chain Partnership

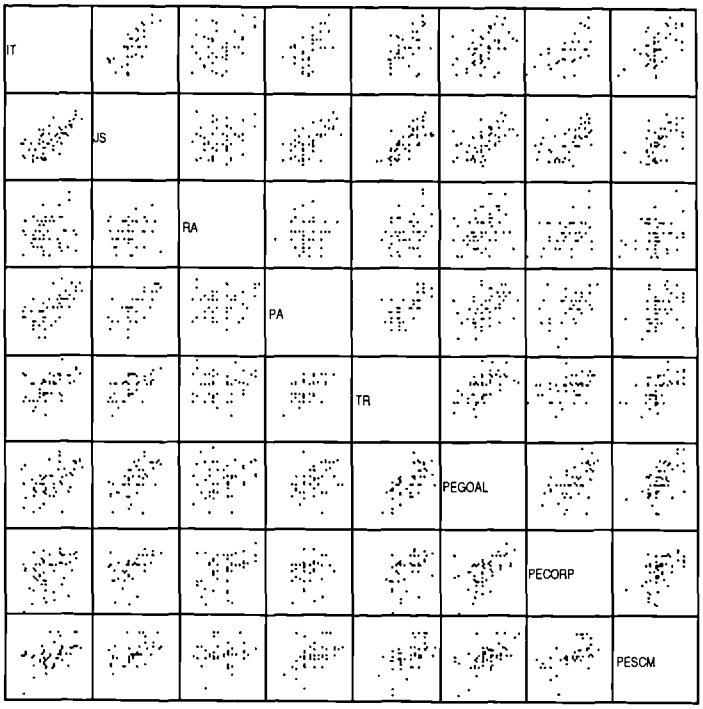
Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance
1	4.91209	0.4267	19	1.14801	0.9498	38	4.27206	0.5109	56	4.37387	0.4969
2	1.41236	0.9230	20	3.01425	0.6978	39	2.59631	0.7619	57	4.85597	0.4337
3	4.53034	0.4758	21	6.50219	0.2604	40	5.27806	0.3829	58	3.92848	0.5598
4	1.85583	0.8687	22	0.8285	0.9752	41	3.54892	0.6160	59	7.83668	0.1655
5	2/.7653	0.7361	23	2.87041	0.7200	42	5.89404	0.3167	60	10.8409	0.0546
6	3.36563	0.6438	24	5.51997	0.3558	43	4.78719	0.4424	61	1.42006	0.9221
7	3.57712	0.6118	25	4.09999	0.5351	44	8.07599	0.1521	62	5.07864	0.4064
8	6.69845	0.2441	26	15.1942	0.0096	45	4.44771	0.4869	63	10.8682	0.0541
9	9.32545	0.0968	27	2.59793	0.7617	46	3.69831	0.5936	64	1.28549	0.9364
10	9.31926	0.0970	28	5.19573	0.3925	47	4.02378	0.5460	65	5.07943	0.4063
11	3.07177	0.6889	29	1.33498	0.9313	48	7.89138	0.1623	66	4.09089	0.5364
12	3.26925	0.6586	30	2.29675	0.8067	49	9.03467	0.1077	67	3.16865	0.6740
13	4.01798	0.5468	31	3.70538	0.5926	50	4.90923	0.4271	68	3.32967	0.6493
14	7.65492	0.1763	32	2.23247	0.8161	51	2.5959	0.7620	69	2.59764	0.7617
15	8.62915	0.1248	33	2.29947	0.8063	52	4.16607	0.5258	70	4.99034	0.4171
16	8.48726	0.1313	34	7.74124	0.1711	53	5.31653	0.3785	71	6.02653	0.3036
17	6.50479	0.2601	35	5.1984	0.3922	54	0.96539	0.9653	72	4.43326	0.4889
18	11.4713	0.0428	36	1.82993	0.8721	55	2.74702	0.7389	73	7.28213	0.2005
			37	7.22392	0.2045				74	7.56258	0.1820

(Identifying Multivariate Outliers for Cluster Analysis)

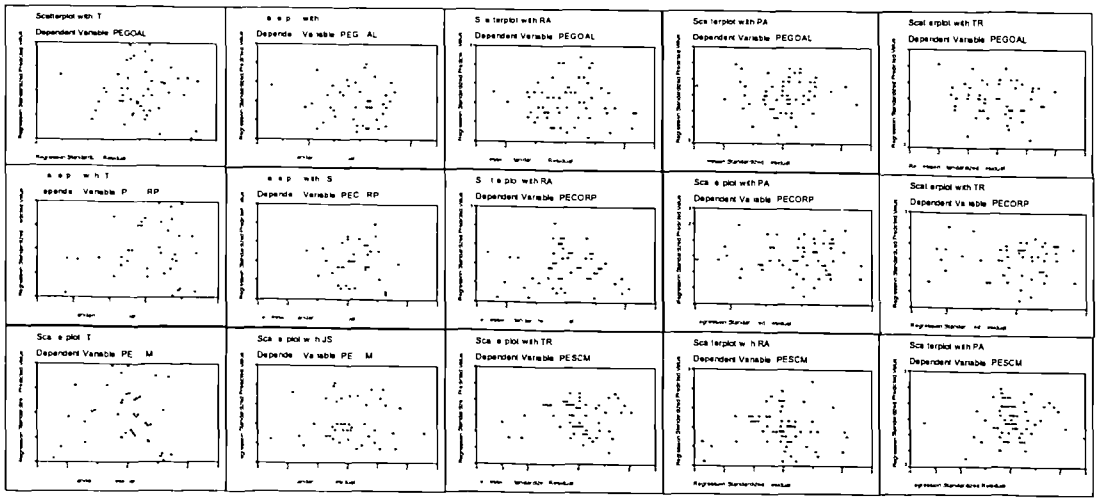


(Dendrogram, Ward's Method with Squared Euclidean Measure)

Appendix 2: Results II, Factors Influencing the Success of a Supply Chain Partnership



(15 Scatter Charts between IT, TR, JS, PA, RA, PEGOAL, PECORP, and PESCM)



(15 Residual Plots between IT, TR, JS, PA, RA, PEGOAL, PECORP, and PESCM)

(PEGOAL: Identifying Outliers as Influential Observations)

	Actual Value	Prd Value	Rsd	Deleted Rsd	Std Rsd	Stdt Rsd	Stdt Rsd (D)	M Distance	Cook's Distance	Leverage	COVR	SDFFIT	C	JS	TR
1	4 67	4.70	-0.03	-0 03	-0.04	-0.04	-0.04	1.56	0.00	0.02	1.08	-0.01	0.00	0.00	-0.01
2	4 67	4.73	-0 06	-0 06	-0 08	-0.08	-0.08	0.30	0.00	0.00	1.06	-0.01	0.00	0.00	0.00
3	4 00	3.41	0 59	0 61	0.74	0.75	0.75	2.03	0.01	0.03	1.06	0.16	0.12	-0.10	0.01
4	4 67	4 18	0.49	0.51	0.62	0.63	0.62	1.19	0.00	0.02	1.06	0.11	0.02	-0.08	0.07
5	5 33	4.19	1.15	1.17	1.44	1.46	1.47	0.35	0.01	0.00	0.97	0.20	0.07	0.07	-0 10
6	4 40	4 22	0 18	0.18	0.22	0.22	0.22	0.18	0.00	0.00	1.06	0.03	0.01	-0.01	0.01
7	4 50	4 86	-0 36	-0.37	-0.45	-0.46	-0.46	0.68	0.00	0.01	1.06	-0.07	0.03	-0.04	0 00
8	5 80	5.24	0 56	0.60	0.70	0.73	0.73	4.45	0.01	0.06	1.10	0.21	-0.12	-0 09	0.18
9	5 00	4 48	0 52	0.54	0.65	0 67	0.66	1.60	0.01	0.02	1.06	0.13	-0.02	-0.08	0.10
10	2 83	3 72	-0 89	-0.92	-1.11	-1.13	-1.14	1.38	0.01	0 02	1.02	-0 21	-0.12	0.15	-0.06
11	4 67	4 10	0 57	0.58	0.71	0.72	0.72	0.81	0 00	0.01	1.05	0.11	0.05	0.05	-0.08
12	3 83	3 58	0 26	0.27	0 32	0 33	0.33	1.94	0.00	0.03	1.08	0.07	0.05	0.01	-0.05
13	3 00	3 51	-0 51	-0.53	-0 64	-0.66	-0.65	1.83	0.01	0.03	1.07	-0.13	-0.11	-0.01	0.09
14	2 40	3 38	-0 98	-1.02	-1.23	-1.25	-1.26	1.89	0.02	0.03	1.02	-0 25	-0.22	0.04	0.12
15	4 00	4.57	-0 57	-0 59	-0.71	-0.73	-0.73	2.45	0.01	0.03	1.07	-0.16	0.03	0.11	-0 13
16	5 33	4 61	0.72	0.74	0 91	0.92	0.92	0.89	0 01	0.01	1.03	0 15	-0.04	-0 07	0 10
17	2.33	4 05	-1 72	-1 75	-2.16	-2.18	-2 24	0.18	0 03	0.00	0 86	-0.29	-0.14	0 01	0 08
18	4 00	4.26	-0 26	-0.29	-0.33	-0.35	-0.34	5.63	0 00	0.08	1.14	-0.11	-0.02	-0 09	0 09
19	4.00	3.75	0 25	0.26	0.32	0.32	0.32	0.79	0.00	0.01	1.06	0.05	0.04	0.00	-0.02

20	4.50	3.88	0.62	0.64	0.78	0.79	0.79	0.94	0.01	0.01	1.04	0.13	0.08	0.04	-0.09
21	4.25	3.70	0.55	0.56	0.69	0.70	0.70	0.89	0.00	0.01	1.05	0.11	0.08	-0.06	0.00
22	4.33	3.97	0.37	0.37	0.46	0.47	0.46	0.47	0.00	0.01	1.05	0.07	0.04	0.01	-0.03
23	3.33	3.26	0.07	0.07	0.09	0.09	0.09	2.51	0.00	0.03	1.10	0.02	0.02	-0.01	0.00
24	4.20	3.11	1.09	1.15	1.37	1.41	1.42	3.10	0.04	0.04	1.01	0.35	0 30	-0.19	-0.04
25	3.00	3.40	-0.40	-0.41	-0.50	-0.51	-0.51	1.73	0.00	0.02	1.07	-0.10	-0.08	0.04	0.02
26	2.00	2.90	-0.90	-0.98	-1.13	-1.19	-1.19	5.13	0.04	0.07	1.07	-0.36	-0.32	-0 02	0.26
27	3.60	3.24	0.36	0.37	0.45	0.46	0.46	2.31	0.00	0.03	1.08	0.10	0.09	-0.04	-0 03
28	3.60	3.22	0.38	0.39	0.47	0.48	0.48	2.56	0.00	0.04	1.09	0.11	0.10	-0.02	-0.06
29	3.50	3.70	-0.20	-0.21	-0.25	-0.26	-0.25	0.89	0.00	0.01	1.07	-0 04	-0.03	0.02	0.00
30	4.00	3.60	0.40	0.42	0.51	0.52	0.51	1.25	0.00	0.02	1.06	0.09	0.07	0 00	-0.05
31	3.50	3.27	0.23	0.24	0.29	0.30	0.29	3.37	0.00	0.05	1.11	0.07	0.06	0 01	-0 06
32	4.00	4.49	-0.49	-0.50	-0.62	-0.62	-0.62	0.19	0.00	0.00	1.04	-0.08	0.00	-0.03	0.02
33	4.60	4.10	0.50	0.51	0.63	0.64	0.63	0.81	0.00	0.01	1.05	0.10	0.04	0.05	-0.07
34	5.50	5.52	-0.02	-0.02	-0.02	-0.02	-0.02	3.19	0.00	0.04	1.11	-0.01	0.00	0.00	0 00
35	5.67	5.23	0.43	0.45	0.55	0.56	0.55	1.71	0.00	0.02	1.07	0.11	-0.07	0 06	0.01
36	6.00	5.01	0.99	1.01	1.24	1.26	1.26	0.98	0.01	0.01	1.00	0.21	-0.11	0.10	0 01
37	5.83	5.41	0.42	0.45	0.53	0.55	0.55	4.38	0.01	0.06	1.11	0.15	-0.08	0.13	-0.05
38	5.17	5.38	-0.22	-0.23	-0.27	-0.28	-0.28	2.22	0.00	0.03	1.09	-0.06	0.04	-0.03	-0 01
39	4.83	5.01	-0.18	-0.19	-0.23	-0.23	-0.23	0.98	0.00	0.01	1.07	-0.04	0.02	-0.02	0.00
40	3.83	4.89	-1.06	-1.12	-1.33	-1.37	-1.38	2.95	0.04	0.04	1.02	-0.33	0.07	-0.28	0.19
41	5.40	4.32	1.08	1.11	1.36	1.38	1.39	0.89	0.02	0.01	0.99	0.23	0.05	0.14	-0.14
42	4.67	5.25	-0.58	-0.61	-0.74	-0.75	-0.75	1.62	0.01	0.02	1.06	-0.14	0.10	-0.04	-0.05
43	4.83	5.08	-0.25	-0.25	-0.31	-0.32	-0.31	1.31	0.00	0.02	1.07	-0.06	0.03	-0.03	0.00
44	3.50	3.89	-0.39	-0.41	-0.49	-0.50	-0.50	2.25	0.00	0.03	1.08	-0.11	-0.03	0.09	-0.06
45	5.33	4.82	0.51	0.53	0.64	0.66	0.65	2.26	0 01	0.03	1.07	0.14	-0.03	0.12	-0.08
46	3 83	3.89	-0.06	-0.06	-0.07	-0.07	-0.07	2.25	0.00	0.03	1.09	-0.02	0.00	0.01	-0.01
47	3.83	4.00	-0.17	-0.17	-0.22	-0.22	-0.22	0.47	0.00	0.01	1.06	-0 03	-0.01	0.02	-0.01
48	2 00	4.18	-2.18	-2.45	-2.74	-2.91	-3.07	7.09	0.35	0.10	0.80	-1.08	-0.26	-0.88	0.97
49	3.67	2.82	0.85	0.95	1.07	1.13	1.13	6.30	0.05	0.09	1.10	0.38	0.33	0.04	-0.29
50	3.67	4.24	-0.58	-0.59	-0.72	-0.73	-0.73	0.78	0.00	0.01	1.05	-0.12	-0.01	0.07	-0 07
51	3.80	4.02	-0.22	-0.23	-0.28	-0.29	-0.28	1.15	0.00	0.02	1.07	-0.05	-0.01	0.04	-0.02
52	3.40	3.57	-0.17	-0.17	-0.21	-0.21	-0 21	1.65	0.00	0.02	1.08	-0.04	-0.03	0.03	-0.01
53	5 67	5.52	0.15	0.16	0.19	0.19	0.19	3.19	0.00	0.04	1.11	0.05	-0.03	0.03	0.00
54	6.60	4 81	1.79	1 82	2.25	2.27	2.34	0.52	0.04	0.01	0.85	0.34	-0.15	0.01	0.14
55	4.33	4.19	0.15	0 15	0.19	0.19	0.19	0.35	0.00	0.00	1.06	0.03	0.01	0.01	-0.01
56	5.67	5 13	0.54	0 57	0.68	0.70	0.69	2.57	0.01	0.04	1.07	0.16	-0.07	0.13	-0.05
57	6 67	4 98	1.69	1.77	2.13	2.18	2.24	2.36	0.08	0.03	0.89	0.49	-0.16	0.41	-0.22
58	4 33	3 82	0.51	0.54	0.64	0.66	0.66	2.94	0.01	0.04	1.08	0.16	0.05	-0 14	0.09
59	6 33	4 93	1.41	1.44	1.77	1.79	1.82	1.02	0.03	0.01	0.93	0.31	-0.13	0.19	-0.05
60	4 00	5 33	-1.33	-1.46	-1.67	-1.75	-1.78	5.80	0.11	0.08	1.01	-0.57	0.32	0.26	-0.52
61	3 17	4 24	-1.08	-1.10	-1.35	-1.37	-1.38	0.78	0.02	0.01	0.99	-0.22	-0.02	0.14	-0.12
62	3 50	4 75	-1.25	-1.27	-1.57	-1.59	-1.60	0.55	0.02	0.01	0.96	-0.24	0.09	0.03	-0.12
63	5 50	5 74	-0 24	-0.26	-0.30	-0.31	-0.31	4.44	0.00	0.06	1.12	-0.09	0.06	-0.06	0.00
64	6 00	4 68	1.32	1.35	1.66	1.68	1.70	0.67	0.02	0.01	0.95	0.26	-0.08	-0.08	0.16
65	2 67	4 03	-1.37	-1.40	-1.72	-1.74	-1.77	0.59	0.02	0.01	0.94	-0.26	-0.13	-0.08	0.16
66	5 00	5 20	-0.20	-0.21	-0.26	-0.26	-0.26	2.00	0.00	0.03	1.08	-0.05	0.04	0.00	-0.04
67	5 67	4 77	0 90	0.93	1.13	1.15	1.15	1.26	0.01	0.02	1.02	0.21	-0.08	-0.08	0.15
68	5 00	4 63	0 37	0.38	0.46	0.47	0.47	1.96	0.00	0.03	1.08	0.10	-0.02	-0.06	0.08
69	5 00	5 07	-0.07	-0.07	-0.09	-0.09	-0.09	2.31	0.00	0.03	1.09	-0.02	0.01	0.01	-0.02
70	3 17	4.22	-1.06	-1 07	-1.33	-1.34	-1.35	0.18	0.01	0.00	0.98	-0.17	-0.04	0.07	-0.05
71	4.83	5.31	-0.47	-0.51	-0.60	-0.62	-0.62	4.07	0.01	0.06	1.10	-0.17	0.10	0.06	-0.14
72	4 00	4 64	-0.64	-0.65	-0.81	-0.82	-0.81	0.26	0.00	0.00	1.03	-0.11	0.02	-0.04	0.01
73	3 17	3 69	-0 52	-0.57	-0.66	-0.69	-0.68	4.60	0.01	0.06	1.11	-0.20	-0.06	0.18	-0.12
74	4 00	5.28	-1.28	-1.35	-1.61	-1.66	-1.68	2.88	0.05	0.04	0.98	-0.40	0.20	-0.31	0.10

(PECORP: Identifying Outliers as Influential Observations)

	Actual Value	Prd Va ue	Rsd	De eted Rsd	Std Rsd	Stdt. Rsd	Stdt Rsd (D)	M Distance	Cook s D stance	Leverage	COVR.	SDFFIT	C	JS	RA
1	7921	6793 59	1127.41	1203 23	0.66	0.68	0.68	3.61	0.01	0.05	1.09	0.18	0.02	0.06	-0.16
2	8281	8762.73	-481.73	-493 47	-0.28	-0.29	-0.28	0.75	0.00	0.01	1.07	-0.04	0.01	-0.01	-0.02
3	6241	5616.43	624.57	662 25	0.37	0.38	0.38	3.17	0.00	0.04	1.10	0.09	0.07	-0.04	-0.05
4	5041	7423 31	-2382 31	-2439 18	-1.40	-1.41	-1.42	0.72	0.02	0.01	0.98	-0.22	-0.12	0.13	-0.10
5	8100	8624.66	-524 66	-547.78	-0.31	-0 31	-0.31	2.09	0.00	0.03	1.08	-0.07	0.00	0.02	-0.05
6	3481	6955.86	-3474.86	-3570 85	-2.04	-2.07	-2.12	0.98	0.04	0.01	0.89	-0.35	-0.13	-0.01	0.24
7	10609	8600 46	2008.54	2057 27	1.18	1.19	1.20	0.74	0.01	0.01	1.01	0.19	-0.09	0.12	-0.04
8	10404	8762 73	1641.27	1681 27	0.96	0.97	0.97	0.75	0.01	0.01	1.03	0.15	-0.04	0.03	0.08
9	7056	7566 22	-510 22	-518.07	-0.30	-0.30	-0.30	0.12	0.00	0.00	1.06	-0.04	-0.02	0.01	-0.01
10	5929	6369 70	-440.70	-455.20	-0 26	-0.26	-0.26	1.34	0.00	0.02	1.07	-0.05	-0.04	0.03	0.01
11	8464	8166 89	297.11	302.74	0.17	0.18	0.17	0.37	0.00	0.01	1.06	0.02	0.00	0.00	0.01
12	6084	7423.31	-1339.31	-1371 28	-0.79	-0.80	-0.79	0.72	0.01	0.01	1.04	-0.12	-0.07	0.07	-0.05
13	5184	6512 61	-1328.61	-1369 30	-0.78	-0.79	-0.79	1.18	0.01	0.02	1.05	-0.14	-0.09	0.04	0.07
14	2704	5759 34	-3055.34	-3249.72	-1.79	-1.85	-1.88	3.38	0.07	0.05	0.96	-0.47	-0.30	0.11	0.33
15	8464	7413 63	1050 37	1066 25	0.62	0.62	0.62	0.10	0.00	0.00	1.04	0.08	0.03	-0 02	-0.01
16	7744	8014 30	-270.30	-274.43	-0.16	-0.16	-0.16	0.11	0.00	0.00	1.06	-0 02	0.00	0.00	-0.01
17	6889	7566.22	-677.22	-687.64	-0.40	-0.40	-0.40	0.12	0.00	0.00	1.05	-0 05	-0.02	0 02	-0.01
18	6561	8447.87	-1886.87	-1938.63	-1.11	-1.12	-1.12	0.96	0.01	0.01	1.02	-0.19	0.08	-0.13	0.07
19	7225	6965.54	259.46	264.68	0.15	0.15	0.15	0.45	0.00	0.01	1.06	0.02	0.01	-0 01	0.00
20	8649	7871.39	777.61	795.17	0.46	0.46	0.46	0.63	0.00	0.01	1.06	0.07	0.02	-0 03	0.04
21	8649	7738.16	910.84	980.16	0.53	0.55	0.55	4.18	0.01	0.06	1.11	0.15	0.07	-0 10	0.12
22	9025	7413.63	1611.37	1635 73	0.95	0.95	0.95	0.10	0.00	0.00	1.02	0.12	0.05	-0.03	-0.01
23	8281	6231.63	2049.37	2156 84	1.20	1.23	1.24	2.65	0.03	0.04	1.03	0 28	0 25	-0 24	0.06
24	8100	6389.06	1710.94	1837.58	1.00	1.04	1.04	4.04	0.03	0.06	1.07	0.28	0 23	-0.25	0.13
25	7569	6374.54	1194.46	1238 18	0.70	0.71	0.71	1.59	0.01	0.02	1.06	0.14	0.12	-0.10	0.00
26	6561	6074.20	486 80	508.11	0.29	0.29	0.29	2.08	0.00	0.03	1.09	0.06	0.05	-0.04	-0 01
27	5041	6226.79	-1185.79	-1236.78	-0.70	-0.71	-0.71	2.02	0.01	0.03	1.07	-0.15	-0.13	0.11	0 00
28	6241	5916.77	324.23	339.60	0.19	0.19	0.19	2.32	0.00	0.03	1.09	0.04	0.03	-0.02	-0 02
29	8649	6517.45	2131.55	2193.00	1.25	1.27	1.27	1.06	0.02	0.01	1.00	0.22	0.17	-0.11	-0.06
30	7569	6970.38	598.62	612.05	0.35	0.36	0.35	0.61	0.00	0.01	1.06	0.05	0.04	-0.03	0.00
31	6400	6822.63	-422.63	-433.87	-0 25	-0.25	-0.25	0.90	0.00	0.01	1.07	-0.04	-0 03	0.03	0.00
32	9409	8309.80	1099.20	1116.75	0.64	0.65	0.65	0.16	0.00	0.00	1.04	0.08	-0 01	0.02	0 02
33	8464	7403.95	1060.05	1083.85	0.62	0.63	0.63	0.62	0.00	0.01	1.05	0.09	0 01	0.02	-0 06

34	10609	10860.26	-251.26	-281.09	-0.15	-0.16	-0.15	6.76	0.00	0.09	1.17	-0.05	0.03	-0.02	-0.04
35	11236	10111.84	1124.16	1206.55	0.66	0.68	0.68	4.00	0.01	0.05	1.10	0.18	-0.10	0.06	0.13
36	8464	8595.62	-131.62	-135.92	-0.08	-0.08	-0.08	1.32	0.00	0.02	1.08	-0.01	0.01	-0.01	0.01
37	12100	10855.42	1244.58	1380.22	0.73	0.77	0.77	6.19	0.02	0.08	1.13	0.25	-0.17	0.12	0.15
38	10609	9954.41	654.59	691.89	0.38	0.39	0.39	2.95	0.00	0.04	1.10	0.09	-0.06	0 05	0.04
39	7396	9053.39	-1657.39	-1704.40	-0.97	-0.99	-0.99	1.03	0.01	0.01	1.03	-0.17	0.10	-0.10	-0.03
40	8649	9959.25	-1310.25	-1390.57	-0.77	-0.79	-0.79	3.23	0.01	0.04	1.08	-0.20	0.11	-0.07	-0.12
41	8464	8767.57	-303.57	-312.99	-0.18	-0.18	-0.18	1.21	0.00	0.02	1.07	-0.03	0.01	0 00	-0.02
42	9025	10116.67	-1091.67	-1184.81	-0.64	-0.67	-0.66	4.75	0.01	0.07	1.11	-0.19	0.09	-0.03	-0.15
43	9801	10116.67	-315.67	-342.61	-0.19	-0.19	-0.19	4.75	0.00	0.07	1.13	-0.06	0.03	-0.01	-0 04
44	6889	6522.29	366.71	378.13	0.22	0.22	0.22	1.22	0.00	0.02	1.07	0.04	0.03	-0.03	0.00
45	9801	9048.55	752.45	776.98	0.44	0.45	0.45	1.32	0.00	0.02	1.07	0.08	-0.05	0.06	-0.01
46	7921	6064.52	1856.48	1937.00	1.09	1.11	1.11	2.05	0.02	0.03	1.03	0.23	0.17	-0.09	-0.12
47	5041	6812.95	-1771.95	-1813.24	-1.04	-1.05	-1.05	0.68	0.01	0.01	1.02	-0.16	-0.10	0.05	0.07
48	10000	8905.64	1094.36	1121.35	0.64	0.65	0.65	0.77	0.00	0.01	1.05	0.10	-0.05	0.05	0.02
49	5776	6837.15	-1061.15	-1128.47	-0.62	-0.64	-0.64	3.37	0.01	0.05	1.09	-0.16	-0.12	0.13	-0.09
50	8281	8028.82	252.18	263.08	0.15	0.15	0.15	2.04	0.00	0.03	1.09	0.03	0.01	-0.02	0.02
51	3969	7275.56	-3306.56	-3399.75	-1.94	-1.97	-2.01	1.01	0.04	0.01	0.91	-0.34	-0.21	0.23	-0.15
52	3721	6984.90	-3263.90	-3442.46	-1.91	-1.97	-2.01	2.80	0.07	0.04	0.93	-0.47	-0.32	0 38	-0.27
53	9409	9181.78	227.22	245.97	0.13	0.14	0.14	4.58	0.00	0.06	1.13	0.04	-0.03	0.04	-0.02
54	8836	7999.79	836.21	856.33	0.49	0.50	0.49	0.73	0.00	0.01	1.06	0.08	-0.02	0.04	-0.04
55	6400	7709.13	-1309.13	-1328.02	-0.77	-0.77	-0.77	0.05	0.00	0.00	1.03	-0.09	-0.01	-0.01	0.02
56	10000	9038.87	961.13	1012.99	0.56	0.58	0.58	2.75	0.01	0.04	1.08	0.13	-0.09	0.11	-0.05
57	9216	8738.53	477.47	502.81	0.28	0.29	0.29	2.69	0.00	0.04	1.10	0.07	-0.04	0.05	-0.03
58	5776	5916.77	-140.77	-147.45	-0.08	-0.08	-0.08	2.32	0.00	0.03	1.09	-0.02	-0.01	0.01	0.01
59	11025	7985.27	3039.73	3257.45	1.78	1.85	1.88	3.89	0.08	0.05	0.96	0.50	-0.16	0.35	-0 39
60	5776	7389.43	-1613.43	-1719.40	-0.95	-0.98	-0.98	3.51	0.02	0.05	1.07	-0.25	0.03	-0.13	0.21
61	7396	7571.06	-175.06	-178.63	-0.10	-0.10	-0.10	0.48	0.00	0.01	1.06	-0.01	-0.01	0.01	-0.01
62	4225	7394.27	-3169.27	-3316.98	-1 86	-1.90	-1.94	2.26	0.06	0.03	0.93	-0.42	0.02	-0.20	0.34
63	10201	8866.93	1334.07	1577.60	0.78	0.85	0.85	10.28	0.04	0.14	1.20	0.36	-0.19	0.31	-0.26
64	8649	8314.64	334.36	340.52	0.20	0.20	0.20	0.33	0.00	0.00	1.06	0.03	0.00	0.00	0.01
65	4096	6645 84	-2549.84	-2713.00	-1.50	-1.54	-1.56	3.40	0.05	0.05	1.00	-0.39	-0.07	-0.10	0.35
66	9801	8447.87	1353.13	1390.24	*0.79*	*0.80*	*0.80*	*0.96*	*0.01*	0.01	1.04	0.13	-0.06	0.09	-0.05
67	10201	7399.11	2801.89	2892.45	1.64	1.67	1.69	1.30	0.03	0.02	0.96	0.30	0.01	0.11	-0.23
68	11025	7256 20	3768.80	3849 45	2.21	2.23	2.30	0.54	0.04	0.01	0.86	0.34	0.09	0.03	-0.20
69	9801	8304 96	1496.04	1522 24	0.88	0.89	0.88	0.27	0.00	0.00	1.03	0.12	-0.03	0.05	-0.01
70	6724	7108 45	-384.45	-392 60	-0 23	-0 23	-0.23	0.53	0.00	0.01	1.06	-0.03	-0.01	0.00	0.02
71	6889	8452.71	-1563.71	-1595.70	-0 92	-0.93	-0.93	0.48	0.01	0.01	1.03	-0.13	0.05	-0.08	0.02
72	8836	9067 91	-231.91	-241.28	-0.14	-0.14	-0.14	1.85	0.00	0.03	1.08	-0.03	0.01	0.00	-0.02
73	10201	6689 40	3511.60	3768 86	2.06	2.13	2.19	4.00	0.11	0.05	0.92	0.59	0.44	-0.51	0.32
74	4624	9491 80	-4867.80	-5128 22	-2.86	-2.93	-3.10	2.72	0.15	0.04	0.75	-0.72	0.53	-0.60	0.10

(PESCM: Identifying Outliers as Influential Observations)

	Actual Va ue	Prd Value	Rsd	Deleted Rsd	Std Rsd	Stdt Rsd	Stdt Rsd (D)	M Distance	Cook's Distance	Leverage	COVR.	SDFFIT	C	JS	TR	Type II
1	2704	2515.38	188 62	217 49	0 26	0.28	0.28	8.70	0.00	0.12	1.22	0.11	0.00	-0.03	0.05	-0.09
2	2916	2845 05	70.95	80.31	0.10	0.11	0.10	7.52	0.00	0.10	1.20	0.04	0.00	0.01	0.00	-0.03
3	2601	1980 88	620.12	692 70	0 87	0.92	0.91	6.66	0.02	0.09	1.13	0.31	0.17	-0.01	-0.05	-0.27
4	2025	2289 01	-264.01	-296.92	-0.37	-0.39	-0.39	7.10	0.00	0.10	1.18	-0.14	-0.03	0.03	-0.04	0.12
5	2601	2963 34	-362 34	-372 12	-0 51	-0.51	-0.51	0.93	0.00	0.01	1.07	-0.08	-0.01	-0.04	0.05	-0.03
6	2601	2412 40	188 60	198 39	0 26	0.27	0.27	2.62	0.00	0.04	1.11	0.06	0.01	-0.05	0.03	0.01
7	3025	2819 16	205 84	212.15	0 29	0.29	0.29	1.19	0.00	0.02	1.09	0.05	-0.01	-0.03	0.03	0.01
8	2916	3271.90	-355 90	-389.17	-0 50	-0.52	-0.52	5.25	0.01	0.07	1.14	-0.16	0.08	0.08	-0.14	-0.01
9	2704	2337 97	366 03	416 92	0 51	0.55	0.54	7.92	0.01	0.11	1.19	0.20	0.01	-0.18	0.14	0.01
10	729	2455 10	-1726.10	-1776 36	-2 41	-2.45	-2.54	1.08	0.04	0.01	0.76	-0.43	-0.20	0.25	-0.01	-0.13
11	1936	2791 08	-855 08	-877 99	-1 19	-1.21	-1.21	0.92	0.01	0.01	1.00	-0.20	-0.07	-0.07	0.13	-0.07
12	1936	2485 19	-549.19	-575 45	-0.77	-0.79	-0.78	2.34	0.01	0.03	1.07	-0.17	-0.11	-0.04	0.14	-0.05
13	841	2084 13	-1243.13	-1309.75	-1.74	-1.78	-1.81	2.73	0.04	0.04	0.93	-0.42	-0.32	0.17	0.17	-0.12
14	625	1918.17	-1293.17	-1383.64	-1 81	-1.87	-1.90	3.79	0.06	0.05	0.92	-0.50	-0.37	0.30	0.12	-0.12
15	2704	2455 61	248.39	283 07	0 35	0.37	0.37	7.96	0.00	0.11	1.20	0.14	0.00	-0.12	0.10	0.01
16	2809	2445 84	363.16	402.99	0 51	0.53	0.53	6.23	0.01	0.09	1.16	0.18	0.00	-0.16	0.12	0.01
17	2304	2506.96	-202.96	-208.16	-0 28	-0.29	-0.29	0.84	0.00	0.01	1.08	-0.05	-0.02	0.02	0.00	-0.01
18	2500	2353.20	146 80	152.17	0 21	0.21	0.21	1.59	0.00	0.02	1.10	0.04	0.03	-0.01	-0.02	0.01
19	3025	2551.74	473 26	486.82	0 66	0.67	0.67	1.05	0.00	0.01	1.06	0.11	0.07	0.01	-0.07	0.04
20	3364	2954 18	409 82	432.06	0 57	0.59	0.59	2.77	0.00	0.04	1.09	0.14	0.03	0.09	-0.11	0.04
21	3025	2970 86	54.14	56.28	0 08	0.08	0.08	1.79	0.00	0.02	1.10	0.02	0.00	0.01	-0.01	0.00
22	2601	2680 44	-79 44	-81.31	-0 11	-0.11	-0.11	0.69	0.00	0.01	1.08	-0.02	-0.01	0.00	0.01	-0.01
23	2116	2290 97	-174.97	-181.71	-0 24	-0.25	-0.25	1.72	0.00	0.02	1.10	-0.05	-0.03	0.01	0.02	-0.02
24	3249	2298 49	950.51	993.03	1.33	1.36	1.37	2.14	0.02	0.03	0.99	0.29	0.21	-0.02	-0.19	0.09
25	3025	2010 91	1014.09	1076.24	1.42	1.46	1.47	3.23	0.03	0.04	0.99	0.36	0.25	-0.23	-0.06	0.09
26	2704	1962 09	741 91	815.25	1 04	1.09	1.09	5.58	0.03	0.08	1.09	0.34	0.28	0.01	-0.27	0.09
27	2704	2180 93	523.07	548 14	0 73	0.75	0.75	2.35	0.01	0.03	1.07	0.16	0.12	-0.04	-0.08	0.05
28	2500	2219 57	280 43	295 91	0 39	0.40	0.40	2.83	0.00	0.04	1.11	0.09	0.07	0.00	-0.07	0.03
29	2116	2602.99	-486 99	-498.27	-0 68	-0.69	-0.69	0.67	0.00	0.01	1.05	-0.10	-0.05	0.01	0.05	-0.04
30	2401	2276.44	124 56	129.43	0.17	0.18	0.18	1.76	0.00	0.02	1.10	0.03	0.02	-0.01	-0.02	0.01
31	2116	2126.83	-10.83	-11.56	-0.02	-0.02	-0.02	3.64	0.00	0.05	1.13	0.00	0.00	0.00	0.00	0.00
32	2809	2675 16	133 84	137.05	0.19	0.19	0.19	0.73	0.00	0.01	1.08	0.03	0.00	-0.02	0.01	0.01
33	2500	2500.65	-0 65	-0.67	0.00	0.00	0.00	0.81	0.00	0.01	1.09	0.00	0.00	0 00	0.00	0.00
34	4489	3657.50	831 50	867.60	1 16	1.19	1.19	2.05	0.02	0.03	1.02	0.25	-0.17	0.11	0.08	0.04
35	3249	3806 77	-557 77	-592 98	-0 78	-0.80	-0.80	3.35	0.01	0.05	1.09	-0.20	0.12	-0.15	0.00	-0.03
36	3844	3444 35	399 65	411.58	0.56	0.57	0.56	1.13	0.00	0.02	1.07	0.10	-0.05	0.05	0.01	0.02
37	3364	3798.39	-434 39	-465.61	-0 61	-0.63	-0.63	3.91	0.01	0.05	1.11	-0.17	0.08	-0.14	0.03	-0.03
38	3844	3906.43	-62.43	-66.85	-0.09	-0.09	-0.09	3.84	0.00	0.05	1.13	-0.02	0.02	-0.02	0.00	0.00
39	2209	3590.94	-1381.94	-1440.65	-1.93	-1.97	-2.01	1.99	0.04	0.03	0.88	-0.42	0.22	-0.28	0.01	-0.08
40	2809	3354.20	-545.20	-568.19	-0.76	-0.78	-0.78	1.97	0.01	0.03	1.07	-0.16	0.03	-0.12	0.07	-0.04
41	3025	2946.06	78.94	80.99	0.11	0.11	0.11	0.86	0.00	0.01	1.09	0.02	0.00	0.01	-0.01	0.01
42	3364	3668.56	-304 56	-318 03	-0 43	-0.43	-0.43	2.11	0.00	0.03	1.09	-0.09	0.06	-0.04	-0.03	-0.01
43	3364	3506.58	-142.58	-147.49	-0 20	-0.20	-0.20	1.44	0.00	0.02	1.09	-0.04	0.02	-0.02	0.00	-0.01
44	2601	2486.69	114.31	127.35	0.16	0.17	0.17	6.49	0.00	0.09	1.18	0.06	0 01	0.00	0.00	-0.05
45	3025	2355 31	669.69	745.79	0.94	0.99	0.99	6.46	0.03	0.09	1.12	0 33	0 09	-0.02	0.05	-0.31
46	1296	1916.22	-620.22	-715.89	-0.87	-0.93	-0.93	8.77	0.03	0.12	1.16	-0.37	-0.13	0.18	-0.13	0.30
47	1369	2257.03	-888.03	-987.35	-1.24	-1.31	-1.31	6 36	0.05	0.09	1.07	-0.44	-0.15	0.03	-0.03	0.41

48	2500	2324.38	175.62	206.02	0.25	0.27	0.26	9.78	0.00	0.13	1.24	0.11	0.05	0.05	-0.06	-0.08
49	1600	1667.04	-67.04	-81.78	-0.09	-0.10	-0.10	12.17	0.00	0.17	1.29	-0.05	-0.04	-0.01	0 03	0 03
50	4900	2907.59	1992.41	2028.54	2.78	2.81	2.96	0.31	0.04	0.00	0.67	0.40	-0.04	-0.12	0.13	0.12
51	2025	2964.20	-939.20	-954.37	-1.31	-1.32	-1.33	0.17	0.01	0.00	0.97	-0.17	0.00	-0.02	0 01	-0 06
52	2401	2611.29	-210.29	-215.15	-0.29	-0.30	-0.30	0.66	0.00	0.01	1.08	-0.04	-0.02	0.00	0.02	-0 02
53	4900	3795.79	1104.21	1166.28	1.54	1.59	1.60	2.90	0.04	0.04	0.97	0.38	-0.26	0.23	0 06	0 06
54	4900	3229.99	1670.01	1707.43	2.33	2.36	2.44	0.61	0.03	0.01	0.78	0.37	-0.18	0.02	0.16	0.09
55	3249	3127.23	121.77	126.86	0.17	0.17	0.17	1.94	0.00	0.03	1.10	0.04	0.00	0 03	-0.02	0.01
56	3600	3565.97	34.03	35.64	0.05	0.05	0.05	2.31	0.00	0.03	1.11	0.01	0.00	0 01	0.00	0.00
57	4489	3549.29	939.71	992.80	1.31	1.35	1.36	2.92	0.03	0.04	1.01	0.32	-0.10	0.27	-0.11	0 07
58	3481	2668.25	812.75	832.65	1.14	1.15	1.15	0.76	0 01	0 01	1.01	0.18	0.03	-0.11	0.05	0.05
59	4489	3234.05	1254.95	1280.84	1.75	1.77	1.80	0.49	0.02	0.01	0.90	0.26	-0.11	0 08	0.04	0 07
60	3481	3641.24	-160.24	-173.61	-0.22	-0.23	-0.23	4.64	0.00	0.06	1.14	-0.07	0.05	0.01	-0 06	0.00
61	3844	3009.93	834.07	847.85	1.17	1 17	1.18	0.20	0.01	0.00	0 99	0.15	-0.03	0.00	0.03	0.05
62	2025	3499.67	-1474.67	-1524.61	-2.06	-2.09	-2.15	1.40	0.04	0.02	0.85	-0.40	0.21	-0.23	-0.03	-0 09
63	3481	3847.05	-366.05	-388 06	-0.51	-0 53	-0.52	3.15	0.00	0.04	1.11	-0.13	0.09	-0.07	-0.04	-0 02
64	2916	3278.39	-362.39	-370.72	-0.51	-0.51	-0.51	0.65	0.00	0.01	1.07	-0.08	0.04	-0.01	-0.03	-0.02
65	2304	2597.46	-293.46	-300.27	-0.41	-0.41	-0.41	0.67	0.00	0.01	1.07	-0.06	-0.03	0.00	0.03	-0.02
66	4900	3786.20	1113.80	1174.55	1.56	1.60	1.62	2.79	0.03	0.04	0.96	0.38	-0.28	0.17	0.14	0 05
67	3249	3335.18	-86.18	-88.57	-0.12	-0.12	-0.12	0.98	0.00	0.01	1.09	-0.02	0.01	0.00	-0.01	0 00
68	2809	3285.39	-476.39	-489.59	-0.67	-0.67	-0.67	0.98	0.00	0.01	1.06	-0.11	0.06	0.01	-0.06	-0 02
69	3136	3520.67	-384.67	-401.24	-0.54	-0.55	-0.55	2.03	0.00	0.03	1.09	-0.11	0.08	0.00	-0.07	-0 01
70	2500	2903.35	-403.35	-409.77	-0.56	-0.57	-0 57	0.16	0.00	0.00	1.06	-0.07	0.00	0.00	0.00	-0.03
71	2916	3313.39	-397.39	-432.44	-0.56	-0.58	-0.58	4.93	0.01	0.07	1.13	-0.17	0.09	0.08	-0.15	-0.01
72	3136	2788.65	347.35	355.55	0.49	0.49	0.49	0.70	0 00	0.01	1.07	0.08	0.00	-0 04	0.03	0 02
73	2025	2464.26	-439.26	-458 90	-0.61	-0.63	-0.62	2.14	0.00	0.03	1.08	-0.13	-0.03	0.11	-0 05	-0 02
74	2116	3112.44	-996.44	-1020.06	-1.39	-1.41	-1.42	0.70	0.01	0.01	0.97	-0.22	0.09	0.05	-0.12	-0 05

Appendix 3: Results III, Perception Asymmetry among Partners of SCP and its Association with Performance

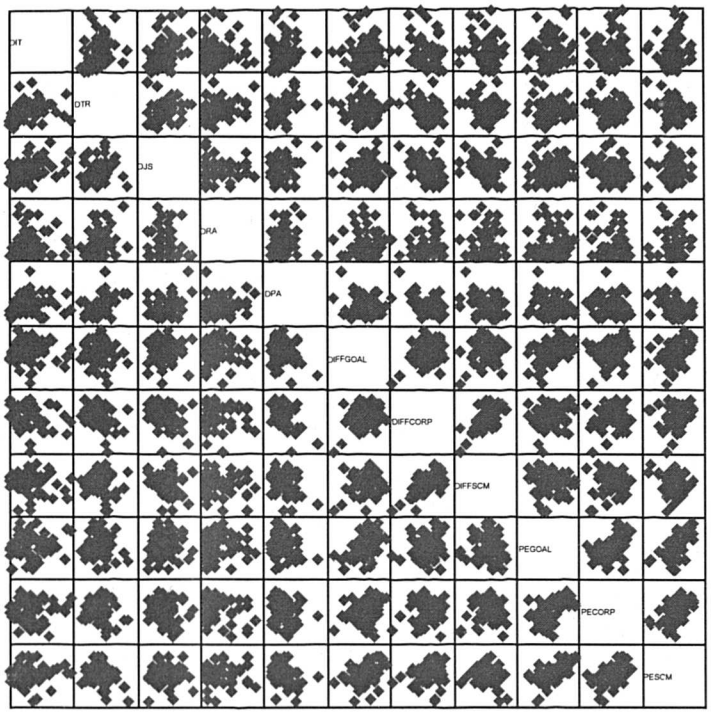
(Identifying Multivariate Outliers for MANOVA Data Set I)

Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance
1	2.5186	0.77369	**38**	5.30499	0.379803	**75**	10.01271	0.074876	**112**	2.88325	0.717979
2	6.04293	0.30206	**39**	6.4731	0.262865	**76**	4.48024	0.482532	**113**	3.53761	0.617705
3	4.01842	0.54677	**40**	3.19401	0.670104	**77**	0.91083	0.969433	**114**	4.08212	0.537654
4	4.93785	0.42351	**41**	3.45749	0.629829	**78**	5.0712	0.407253	**115**	2.29771	0.806603
5	4.24685	0.51445	**42**	3.84105	0.57252	**79**	1.54632	0.907663	**116**	3.08864	0.686322
6	6.18209	0.28890	**43**	3.66622	0.598399	**80**	5.56906	0.350433	**117**	3.21041	0.667583
7	4.33632	0.50208	**44**	1.47364	0.916092	**81**	1.78087	0.878558	**118**	3.34233	0.647367
8	6.15599	0.29134	**45**	2.15212	0.827721	**82**	10.93287	0.052727	**119**	8.55378	0.128242
9	1.64059	0.89630	**46**	6.62999	0.249644	**83**	8.29955	0.140481	**120**	8.69353	0.121931
10	17.98158	0.00297	**47**	1.68298	0.891037	**84**	3.52487	0.619628	**121**	5.07608	0.406666
11	2.60523	0.76057	**48**	5.58601	0.348607	**85**	2.89572	0.716059	**122**	6.84961	0.232067
12	1.42994	0.92101	**49**	3.60371	0.607756	**86**	5.93811	0.312288	**123**	24.4553	0.000177
13	9.99172	0.07547	**50**	4.94232	0.42296	**87**	6.0164	0.304626	**124**	5.59039	0.348136
14	12.02668	0.03442	**51**	4.10101	0.534967	**88**			**125**	2.76543	0.736094
15	4.60062	0.46653	**52**			**89**	5.22794	0.3887	**126**	2.76424	0.736277
16	2.66401	0.75162	**53**	1.22276	0.942675	**90**	8.18555	0.146302	**127**	3.45763	0.629808
17	4.91476	0.42637	**54**	2.48718	0.778425	**91**	2.08697	0.836985	**128**	0.77988	0.978299
18	3.60567	0.60746	**55**	1.19512	0.945345	**92**	4.49741	0.48023	**129**	9.30651	0.097446
19	1.69558	0.88946	**56**	1.43477	0.920472	**93**	0.84354	0.974174	**130**	6.4885	0.261543
20	1.86324	0.86773	**57**	1.34816	0.929899	**94**	1.22812	0.942151	**131**	4.68717	0.455238
21	1.51008	0.91190	**58**	1.22897	0.942068	**95**	3.85498	0.570479	**132**	3.01245	0.698066
22	0.12124	0.99974	**59**	1.15416	0.949199	**96**	4.05876	0.540987	**133**	6.5106	0.259654
23	1.31721	0.93315	**60**	6.91351	0.227153	**97**	4.74242	0.448117	**134**	10.02819	0 07444
24	1.72194	0.88612	**61**	9.2555	0.099297	**98**	5.14329	0.398645	**135**	1.01863	0.961049
25	1.86632	0.86732	**62**	5.51198	0.356634	**99**	6.15019	0.291878	**136**	7.52343	0.18453
26	10.50404	0.06215	**63**	7.54734	0.18301	**100**	8.37468	0.136759	**137**	12.61763	0.027238
27	2.65527	0.75295	**64**	4.39574	0.493953	**101**	5.7329	0.333082	**138**	4.83203	0.436722
28	3.22108	0.66594	**65**	10.92679	0.052851	**102**	4.08802	0.536814	**139**	10.09883	0.072483
29	0.89792	0.97037	**66**	7.14338	0.210193	**103**	0.95394	0.966195	**140**	6.65561	0.247538
30	1.54665	0.90762	**67**	4.20051	0.520923	**104**	1.91801	0.86037	**141**	1.54311	0.908042
31	4.56149	0.47170	**68**	4.90843	0.427158	**105**	3.91996	0.560996	**142**	6.92745	0.226092
32	0.95262	0.96630	**69**	4.87749	0.431014	**106**	4.8155	0.438809	**143**	1.6132	0.899648

33	2.26405	0.81153	**70**	4.80883	0.439654	**107**	0.45948	0.993532	**144**	24.09409	0.000208
34	6.77662	0.23779	**71**	9.65373	0.085663	**108**	3.62023	0.605278	**145**	1.83737	0.871159
35	5.10307	0.40343	**72**	7.91351	0.161067	**109**	4.50155	0.479676	**146**	2.29446	0.80708
36	8.96046	0.11065	**73**	7.91351	0.161067	**110**	4.86795	0.432208	**147**	7.83629	0.165492
37	6.10085	0.29653	**74**	4.98152	0.41814	**111**	4.90047	0.428147	**148**	9.78582	0.081536

(Identifying Multivariate Outliers for MANOVA Data Set II)

Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance	Case Number	D^2	Significance
1	0.19186	0.978893	**38**	3.93728	0.268317	**75**	0.53948	0.910136	**112**	4.32346	0.228588
2	0.16043	0.983709	**39**	1.0551	0.787923	**76**	0.703	0.872498	**113**	1.49705	0.682951
3	2.78763	0.42554	**40**	0.2344	0.971854	**77**	0.69878	0.873491	**114**	1.35034	0.717215
4	1.27572	0.734907	**41**	0.5454	0.90881	**78**	3.25248	0.354311	**115**	1.74342	0.627324
5	2.01374	0.56956	**42**	0.9314	0.817844	**79**	1.29957	0.729235	**116**	0.16679	0.982764
6	7.42648	0.059478	**43**	1.69545	0.637946	**80**	2.41518	0.490815	**117**	1.61967	0.654938
7	1.90745	0.591836	**44**	1.43011	0.698492	**81**	1.62799	0.65306	**118**	0.97144	0.808162
8	1.90745	0.591836	**45**	0.46129	0.92731	**82**	1.62115	0.654604	**119**	1.50912	0.680167
9	0.6745	0.879185	**46**	3.65473	0.301242	**83**			**120**	4.09863	0.251009
10	7.33744	0.061886	**47**	3.45044	0.327247	**84**	5.49324	0.139043	**121**	2.10451	0.551001
11	3.02066	0.388451	**48**	1.29984	0.729171	**85**	0.46764	0.925941	**122**	23.72397	2.85E-05
12	0.95018	0.813304	**49**	0.93377	0.817272	**86**	0.76261	0.858388	**123**	3.15396	0.368491
13	8.71967	0.03326	**50**	6.13912	0.105034	**87**	0.86787	0.833174	**124**		
14	11.74171	0.008322	**51**	6.13912	0.105034	**88**	3.75322	0.289374	**125**	8.64268	0.034439
15	1.79265	0.616536	**52**	2.48333	0.478311	**89**			**126**	7.72015	0.052164
16	1.82359	0.609815	**53**	3.65644	0.301032	**90**			**127**	4.32281	0.22865
17	3.28052	0.350363	**54**	3.65644	0.301032	**91**	1.05691	0.787485	**128**	3.67305	0.299002
18			**55**	3.65644	0.301032	**92**	0.7225	0.867899	**129**		
19	2.17389	0.53711	**56**	3.65644	0.301032	**93**	1.57237	0.665671	**130**	7.12802	0.067927
20	0.91636	0.821478	**57**	5.74047	0.124943	**94**	0.55037	0.907694	**131**	3.96282	0.265507
21	0.60182	0.896016	**58**	3.65644	0.301032	**95**	0.65311	0.884173	**132**		
22			**59**	4.38328	0.222941	**96**	3.8771	0.275045	**133**	5.97155	0.113003
23			**60**	5.41712	0.143681	**97**	4.33853	0.227153	**134**	1.40721	0.703846
24	2.41518	0.490815	**61**	3.99755	0.261729	**98**	1.90022	0.593372	**135**	4.34059	0.226958
25	2.01013	0.570307	**62**	2.50532	0.47433	**99**	2.30138	0.512257	**136**	13.06581	0.004496
26	3.31938	0.344954	**63**	0.81452	0.845991	**100**	3.92907	0.269226	**137**	1.21843	0.748588
27	0.82754	0.842869	**64**	2.85166	0.415066	**101**	2.1407	0.543723	**138**	4.08884	0.252029
28	0.43217	0.93352	**65**	5.49474	0.138954	**102**	2.06277	0.559481	**139**	2.87003	0.412101
29	0.85196	0.837003	**66**	3.18783	0.363562	**103**	6.44276	0.091947	**140**	2.49912	0.47545
30	1.12891	0.7701	**67**	2.79606	0.424149	**104**	0.25021	0.969103	**141**	2.48805	0.477455
31	0.53948	0.910136	**68**	4.6403	0.200112	**105**	3.1942	0.362641	**142**	3.85104	0.278005
32	0.46855	0.925744	**69**	4.0481	0.256317	**106**	0.89128	0.827532	**143**	3.89391	0.27315
33	0.79679	0.850235	**70**	2.45881	0.482781	**107**	1.62375	0.654017	**144**	6.34182	0.096114
34	2.30547	0.511474	**71**	2.27224	0.51786	**108**	4.01629	0.25971	**145**	2.19074	0.533775
35	1.64812	0.648529	**72**	1.96381	0.579952	**109**	3.29876	0.347815	**146**		
36	3.07346	0.380437	**73**	2.75481	0.430993	**110**	2.17323	0.53724	**147**	6.13498	0.105225
37	1.93151	0.586743	**74**	2.57145	0.462517	**111**	2.62662	0.452842	**148**	2.77821	0.4271



(Scatter Charts between DIT, DTR, DJS, DPA, DRA, DPEGOAL, DPECORP, DPESCM and PEGOAL, PECORP and PESCM)

Appendix 4: Questionnaires Type A and B

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Introduction

Thank you very much for participating the survey.

This survey is a research project "Measuring the Success of a Supply Chain Partnership" undertaken by Cass Business School and is design to explore various aspects of supply chain partnership performance.

This questionnaire is designed to obtain information related to the supply chain partnership and the performance related issues. Please follow the detailed instructions included with each of questions.

After completion of your questionnaire, please used the enclosed self addressed stamped envelope and return to me. Please note, all the information provided will be kept strictly in confidence. Result will be sent to you upon completion of the research.

Once again, thank you very much for your co-operation. It will significantly contribute to the development of knowledge in supply chain management.

Participant Information (For Tracking Purpose Only) (TYPE B)

Company		**Telephone**	
Name		**Fax**	
Position		**Email**	

How long have you been in business with your supplier (ABC)?

Year	Month

May we contact you in the future for further research?

Yes	No

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The questions from 1 to 2 are related to the general situation of your company's supply chain

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
1	My company has guidelines for developing, maintaining and monitoring supply chain partnership.	☐	☐	☐	☐	☐	☐	☐
2	My company maintains an integrated database and access method to facilitate internal and/or external information sharing	☐	☐	☐	☐	☐	☐	☐

The questions from 3 to 6 are related to the state of information exchange between your company and the customer DEF

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
3	My company has ability to share **standardised** information externally with the supplier ABC	☐	☐	☐	☐	☐	☐	☐
4	My company has ability to share **customised** information externally with the supplier ABC	☐	☐	☐	☐	☐	☐	☐
5	My company has invested in technology designed to facilitate information exchange with the supplier ABC	☐	☐	☐	☐	☐	☐	☐
6	The supplier ABC is willing to share transactional/strategic level information.	☐	☐	☐	☐	☐	☐	☐

The questions from 7 to 8 are related to the state of information exchange between your company and the supplier ABC

Do you receive the following information from the customer DEF?		(Yes/ No)	How often? (Ex, Daily, Weekly..)	Evaluate the quality of the information you receive Very Poor ····· Fair ····· Excellent						
7	Inventory level information from the supplier ABC	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐
8	Order related information from the supplier ABC	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐

The questions from 9 to 16 are related to the state of supply chain partnership between your company and the supplier ABC

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
9	The supplier ABC is one of our prime suppliers	☐	☐	☐	☐	☐	☐	☐
10	My company has a track record of investing relationship specific asset, which is related to the supplier ABC	☐	☐	☐	☐	☐	☐	☐
11	My company clearly defines roles and responsibilities with the supplier ABC	☐	☐	☐	☐	☐	☐	☐
12	My company intents to avoid exercising power to the supplier ABC.	☐	☐	☐	☐	☐	☐	☐
13	The business relationship with the supplier ABC is based on the trust	☐	☐	☐	☐	☐	☐	☐
14	Risks and benefits from the business relationship with the supplier ABC are fairly shared	☐	☐	☐	☐	☐	☐	☐
15	The supplier ABC places as much as amount of importance on a value on keeping commitment comparing to us	☐	☐	☐	☐	☐	☐	☐
16	The supplier ABC has a similar degree of w ngness to change comparing to us	☐	☐	☐	☐	☐	☐	☐

The questions 17 & 33 are related to performance of supply chain partnership between your company and the customer DEF

	Strongly Disagree	Somewhat Disag ee	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree

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17	My company expects that the supply chain partnership with the supplier ABC will continue for long term	☐	☐	☐	☐	☐	☐	☐
18	My company is intending to establish a closer partnership with supplier ABC	☐	☐	☐	☐	☐	☐	☐

19	**List as many as three main objectives of your supply chain partnership with the supplier ABC**	Evaluation of the achievements of the these objectives						
	1	**Very Poor** ····· **Fair** ····· **Excellent**						
		☐	☐	☐	☐	☐	☐	☐
	2	**Very Poor** ····· **Fair** ····· **Excellent**						
		☐	☐	☐	☐	☐	☐	☐
	3	**Very Poor** ····· **Fair** ····· **Excellent**						
		☐	☐	☐	☐	☐	☐	☐

The supply chain partnership between my company and the customer DEF positively influences		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
20	The sales level of my company	☐	☐	☐	☐	☐	☐	☐
21	*The profit of my company*	☐	☐	☐	☐	☐	☐	☐
22	*The cost control of my company*	☐	☐	☐	☐	☐	☐	☐
23	The technology development of my company	☐	☐	☐	☐	☐	☐	☐
24	The new product development of my company	☐	☐	☐	☐	☐	☐	☐
25	The knowledge transfer to my company	☐	☐	☐	☐	☐	☐	☐
26	Manufacturing and quality control of my company	☐	☐	☐	☐	☐	☐	☐
27	Marketing activities of my company	☐	☐	☐	☐	☐	☐	☐
28	Customer service of my company	☐	☐	☐	☐	☐	☐	☐

The supply chain collaborative relationship between our company and the supplier ABC positively influences:		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
29	Reduction of lead time from order placement to the supplier ABC to the receipt of the order	☐	☐	☐	☐	☐	☐	☐
30	Supply chain responsiveness of the supplier ABC to my company	☐	☐	☐	☐	☐	☐	☐
31	Cost reduction of all SCM activities related to with the supplier ABC	☐	☐	☐	☐	☐	☐	☐
32	Increase of our forecasting accuracy	☐	☐	☐	☐	☐	☐	☐
33	Reduction of our inventory level	☐	☐	☐	☐	☐	☐	☐

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After completion of your questionnaire, please used the enclosed self addressed stamped envelope and return to me. Please note, all the information provided will be kept strictly in confidence. Result will be sent to you upon completion of the research.

Once again, thank you very much for your co-operation. It will significantly contribute to the development of knowledge in supply chain management.

Participant Information (For Tracking Purpose Only) (TYPE A)

Company		Telephone	
Name		Fax	
Position		Email	

How long have you been in business with your customer (DEF)?

Year	Month

May we contact you in the future for follow-up research?

Yes	No

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The questions from 1 to 2 are related to the general situation of your company's supply chain

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
1	My company has guidelines for developing, maintaining and monitoring supply chain partnership.	☐	☐	☐	☐	☐	☐	☐
2	My company maintains an integrated database and access method to facilitate internal and/or external information sharing.	☐	☐	☐	☐	☐	☐	☐

The questions from 3 to 6 are related to the state of information exchange between your company and the customer DEF

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
3	My company has ability to share **standardised** information externally with the customer DEF	☐	☐	☐	☐	☐	☐	☐
4	My company has ability to share **customised** information externally with the customer DEF	☐	☐	☐	☐	☐	☐	☐
5	My company has invested in technology designed to facilitate information exchange with the customer DEF.	☐	☐	☐	☐	☐	☐	☐
6	The customer DEF is willing to share transactional/strategic level information	☐	☐	☐	☐	☐	☐	☐

The questions from 7 to 10 are related to the state of information exchange between your company and the customer DEF

Do you receive the following information from the customer DEF?		(Yes/ No)	How often? (Ex, Daily, Weekly..)	Evaluate the quality of the information you receive: Very Poor ····· Fair ····· Excellent						
7	Demand forecast information from the customer DEF	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐
8	Performance related information from customer DEF	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐
9	Promotion related information from DEF	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐
10	Sales related information from DEF	(Yes/ No)		☐	☐	☐	☐	☐	☐	☐

The questions from 11 to 19 are related to the state of supply chain partnership between your company and the customer DEF

Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
11	The customer DEF is one of our prime customers.	☐	☐	☐	☐	☐	☐	☐
12	My company clearly defines roles and responsibilities with the customer DEF with our relationsh p	☐	☐	☐	☐	☐	☐	☐
13	My company has a track record of taking part in strategic decisions making of the customer DEF	☐	☐	☐	☐	☐	☐	☐
14	My company has routinised communications with the customer DEF on day-to-day operational and non-operational issues	☐	☐	☐	☐	☐	☐	☐
15	The business re ationsh p with the customer DEF is based on trust	☐	☐	☐	☐	☐	☐	☐
16	My company feels that the customer DEF leads the business relationsh p by exercising power	☐	☐	☐	☐	☐	☐	☐
17	Risks and benef ts from the business re ationship with the customer DEF are fa rly shared	☐	☐	☐	☐	☐	☐	☐
18	The customer DEF places as much as amount of importance on a value on keeping commitment comparing to us	☐	☐	☐	☐	☐	☐	☐
19	The customer DEF has a s mi ar degree of w ngness to change comparing to us	☐	☐	☐	☐	☐	☐	☐

The questions 20 & 36 are related to performance of supply chain partnership between your company and the customer DEF

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Please indicate the amount that you agree or disagree with the following statement		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
20	My company expects that the supply chain partnership with the customer DEF will continue for long term.	☐	☐	☐	☐	☐	☐	☐
21	My company is intending to establish a closer partnership with the customer DEF	☐	☐	☐	☐	☐	☐	☐

22	List as many as three main objectives of forming supply cha n partnership with the customer DEF.	Evaluation of the achievements of the these objectives						
	1	Very Poor ·····			Fair ·····			Excellent
		☐	☐	☐	☐	☐	☐	☐
	2	Very Poor ·····			Fair ·····			Excellent
		☐	☐	☐	☐	☐	☐	☐
	3	Very Poor ·····			Fair ·····			Excellent
		☐	☐	☐	☐	☐	☐	☐

The supply chain partnership between my company and the customer DEF positively influences		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
23	The sales level of my company	☐	☐	☐	☐	☐	☐	☐
24	The profit of my company	☐	☐	☐	☐	☐	☐	☐
25	The cost control of my company	☐	☐	☐	☐	☐	☐	☐
26	The technology development of my company	☐	☐	☐	☐	☐	☐	☐
27	The new product development of my company	☐	☐	☐	☐	☐	☐	☐
28	The knowledge transfer to my company	☐	☐	☐	☐	☐	☐	☐
29	Manufacturing and quality control of my company	☐	☐	☐	☐	☐	☐	☐
30	Marketing activities of my company	☐	☐	☐	☐	☐	☐	☐
31	Customer service of my company	☐	☐	☐	☐	☐	☐	☐

The supply chain collaborative relationship between our company and the customer DEF positively influences:		Strongly Disagree	Somewhat Disagree	Slightly Disagree	Neutral	Slightly Agree	Somewhat Agree	Strongly Agree
32	Reduction of lead time from receipt of an order from the customer DEF to the fulfilment of the order	☐	☐	☐	☐	☐	☐	☐
33	Supply chain responsiveness to the customer DEF	☐	☐	☐	☐	☐	☐	☐
34	Cost reduction of all SCM activities related to the customer DEF	☐	☐	☐	☐	☐	☐	☐
35	Increase of our forecasting accuracy	☐	☐	☐	☐	☐	☐	☐
36	Reduction of our inventory level	☐	☐	☐	☐	☐	☐	☐

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