國立成功大學
交通管理科學系
博士論文

供應鏈夥伴關係之財務效果

Financial Effect of Supply Chain Partnership

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本論文業經審查及口試合格特此證明

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摘要

供應鏈管理為有效整合供應商、製造商、倉儲業、及商店，在滿足服務水平的要求下，以最低的成本將產品以適量的數量生產，並在正確的時間配送至正確的地方，然而如何整合供應商、製造商等合作的夥伴進而降低交易成本、甚至是交易風險是供應鏈的一大挑戰。回顧過去文獻，無論是在全球供應鏈管理或運籌管理的研究議題上，多數僅偏重於各類實質成本之降低與最佳化配置、製造與物流耗時之縮短、策略聯盟之對局...等；總括言之，所著重之處多以報酬利潤之創造為主軸，然而，對於技術創新對供應鏈財務影響、供應網路夥伴關係的長、短期財務影響的相關研究卻鮮少著墨，故本研究將針對上述議題分為二個主要研究主體，分述如下：

第一部分：以 IC 產業為主軸，探討技術創新事件對買賣兩方透過不同供應鏈夥伴關係對所產生影響。除了探討公司本身在股票報酬變化是否有差異外；另測試對於整體供應鏈而言，技術創新是否會造成股票報酬有差異以及對於 IC 產業的供應鏈是否有差異。

第二部分：以汽車產業為主軸，探討期間垂直分工特性之關聯。同時，運用時間序列的各種方法，將汽車產業以零組件產業與整車廠（組裝廠）進行區分，進而探究兩者間股價之互動關係。旨在分析汽車產業零組件產業與整車廠兩者間是否反應著其間密切的產業特性一樣，具有亦步亦趨的共移關連性，亦或呈現市場區隔的特性，嘗試將兩者間動態互動關係作最適切且完整之分析，期以此實證結果期以此實證結果作為汽車供應鏈夥伴關係選擇參考及作為投資大眾建構投資組合之重要參考依據。

關鍵詞：供應鏈管理、技術創新、財務效果、時間序列

ABSTRACT

Supply chains integrate and link companies together—supplier's suppliers to the customer's customers—to effectively and efficiently respond to consumer end users at the right time, right place, and right cost. These companies, and organizations as whole, are not always linked directly and are becoming more expansive and virtual in their influence. Unfortunately, supply chains are frequently managed from the perspective of a single supplier-customer relationship; however, suppliers provide value to many different supply chains in their role as suppliers. Customers utilize and participate in multiple supply chains. As a result, it becomes increasingly difficult to optimize the effectiveness and efficiencies of supply chains - direct and indirect. We divided two segments in this thesis bellow statement:

Part Ⅰ： A participating member may have requirements placed upon them by one member that contradicts another member. This section aims at testing whether technology innovations (TI) influence company's return on stock price (SR), partners of all supply chain and the changes of different supply chain in integrated circuit (IC) industry in Taiwan. The result shows that there is a significant financial effect correlation and TI influences for organizations in each supply chain.

Part II: The purpose of this chapter is to examine the interrelationships in stock price between automotive components industry and assembling industry by using time series techniques of cointegration and vector autoregression (VAR). And the short-run dynamic equilibrium relationship not only can give automotive industry to select their partners is their supply chain network but also be a reference in investment portfolios.

Key words: supply chain management, technology innovation, financial effect, time series

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謝　兆　貞　　謹誌

中華民國一百年四月

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國立政治大學圖書館

CHAPTER 1 INTRODUCTION

1.1. Motivation and objectives

1.1.1 The importance of supply chain

In today’s world of interconnected economies companies are no longer stand-alone organizations. Companies are integrating interactively with every link in the chain from the supplier’s suppliers to the customer’s customers; domestically as well as internationally, to quickly and efficiently respond to the end users’ demands. Material providers, manufacturers, wholesalers, distributors, retailers, customers, and a host of logistic service organizations realize that in order to survive and prosper; they must compete cooperatively in order to profit, add value, and obtain synergy. As a result, companies are increasingly collaborating, with other companies - domestically and internationally - especially in their supply chains. In other words, companies look outside their organizations for opportunities to collaborate with partners to ensure that the supply chain is efficient and responsive to dynamic market needs. Supply chain collaboration can deliver substantial benefits and advantages to its partners (Mentzer et al., 2000).

The supply chain integrates activities from the supplier’s suppliers to the customer’s customers domestically as well as internationally, to effectively and efficiently respond to the end users’ demands. This integration creates a virtual meta-organization. Supply chains have traditionally been examined as a set of sequential, vertically organized transactions representing successive stages of value creation (Mabert and Venkataramanan, 1998). While this view allows the examination of operational efficiencies, it tends to restrict the examination of interdependencies at different relationships types that exist among supply chain partners. For example, Choi et al. (2002) indicated that for effective supply chain management how firms interact among themselves to promote establishment strategic relationships. Some investigators have studied long-term cooperative relationships with key suppliers (Carr and Pearson, 1999; Chen et al., 2004a). However, firms often use cooperative relationships to reduce the uncertainty in their product markets through information sharing and cross-firm communication in the form of cooperative relationships that range from cooperative marketing to pooled research and development cooperatives (Bresser, 1988). As a result, ensuring stable relationships between suppliers and their customers is important to both parties.

Supply chains from the network-based perspective and from the long-term relationship as to move closer to the realistic relational behaviors for developing a collaborative supply network and to long-term financial stability for both the supplier and the customer. Notably, in the presence of trust, buyers and suppliers act in a risk-prone way by cooperating, rather than risk-averse way by defecting, even with the knowledge of the other party's potential opportunistic behavior and potential losses.

Collaborative relationships can help firms share risks (Kogut, 1988), access complementary resources (Park et al., 2004), reduce transaction costs and enhance productivity (Kalwani and Narayandas, 1995), and enhance profit performance and competitive advantage over time (Mentzer et al., 2000). In essence, cooperation and trust are self-reinforcing. Initial cooperation results in trust building and the trust developed between supply chain partners enable subsequent cooperation (Nair et al., 2009).

1.1.2 The importance of financial effect on supply chain

Essentially, a supply chain management (SCM) strategy is a specific channel arrangement that is based on interfirm dependencies and relationship management. Supply chain operations require managerial processes that span the boundary space between firms in order to link functional areas and independent firms across organizational boundaries. Few can dispute the need for collaborative supply chains to reduce waste and improve value across the whole chain.

Stern and Reve (1980) illustrated that SCM channel research was fragmented into two distinct epistemological frameworks, namely the economic approach and the behavioral approach to exchange relationships. The first attempts to apply a micro-economic analysis to what is ostensibly a commercial behavioral paradox by examining such variables as costs, design and rationality. The second stream attempts to focus on the socio-political orientation of the channel by examining such variables as power, dependence, trust and commitment. The economic actor would seek to maximize their returns through the operation of opportunistic behaviors; conversely the behavioral actor would seek to maximize their returns through collaboration.

SC can be thought as a strategic inter-organizational relationship for creating and sustaining a competitive advantage (Ireland and Webb, 2007). While the literature on the nature of inter-organizational relationships is rich, one area that has received little attention is that of relational adaptation or degree of bonding strength. One measure of relational strength is how adaptations are accommodated between the partners of a dyadic exchange in response to dynamic perturbations (Easton and Araujo, 1986). In essence, the strength of a relationship can be measured by the degree of accommodation made or the resistance shown to these change events. Previous authors have thought that relationship strength is measured in terms of the direct dollar value of the exchange (Iacobucci and Hopkins, 1992). Others think that the strength of the relationship is determined by the ‘value’ of the relationship (Tuominen, 2004).

However, the current studies on supply chain management are limited in their analysis of the linkages between firms (Rose-Anderssen et al., 2005; Rungtusanatham et al., 2003). In other words, there are little researchers discussing the reality of supply chain collaboration. The concept of collaborating for success is full of virtue and the notions of leveraging core competencies is a compelling vision. Yet, it not well understood the practical mechanics of how to make such complex relationships work on a day-to-day basis (Bowersox et al., 2002; Fawcett and Magnan, 2002). Collaborative inter-organizational of supply chain have many adherents, yet the definitions are fluid and practices have yet to be reutilized. Tuominen (2004) observed while researchers agree on the core components of collaboration (such as trust-commitment, information sharing, conflict resolution, goal congruence, mutuality, and risk/reward sharing as examples), a definitive overall supply chain management framework has yet to emerge, resulting in ad hoc implementations and disjointed practices. For this research, these two points of thought will be conceptualized into two broad ideologies. The first, titled the relationship strength, examines the economic and rationality imperative, whist the second, called the dynamic behavior, examines the behavioral assumptions of exchange. In addition, these two points attempts to explain the interaction and interdependencies of supply chain complexity and relationship development.

1.2. Purpose

One of the major reasons for studying supply chains is so managers can appropriately design and control the channel for optimal performance. An appropriate analytical framework is essential as important elements of channel design and management processes could be overlooked, resulting in suboptimal performance over time. It should be recognized from the outset that the concept of interdependence is central in understanding this framework. It is critical that any framework for analysis pay due attention to the supply chain linkage and value creation influenced by the character of different chain type under study.

However, the value of a supply chain linkage, and cooperative and competitive relationship in such networks linking remain limited. The main purposes provided evidence on linkage performance within the framework of SCM. We divided two sub-purposes of this thesis bellow statement:

The essence and success of SCM is the coordination and integration of firms and functions beginning early in the process, in order to efficiently create and deliver products to consumers (Frohlich and Westbrook, 2001). However, the collaboration mechanism between foundry and fabless design houses is built by the main foundry companies, such as TSMC and UMC (Fang, 2004). These collaborations can be further classified into design collaboration, engineering collaboration, and logistics collaboration. In such an integrated supply chain, benefits include reduced costs, improved processes, and better quality. The key objective of chapter 3 is to examine how the technological innovations influence financial effect on the innovation company as well as on its chain partners. In particularly, we examine three key topics including: (1) the magnitude of financial effect correlations on chain partners prior to the technological innovations; (2) the immediate impact of technology innovations (TI) on the company's stock price, and its subsequent impacts on the prices of its partners on the supply chain; and (3) the time effects of the financial advantages of technology innovation on the company.

However, the purposes of the chapter 4 are: (1) to examine why firms form networks and to explore whether firms in supply networks should have long-term relationships; (2) if firms have formed a network and maintained long-term relationships, then we investigate the strength of relationships with partners and illustrate firm behavior form a single supply network.

1.3. Scope of the study

This study primarily aims to examine the supply chain linkage and value creation influenced by the character of different chain type in Taiwan IC industry and automotive industry. Taiwan's current semiconductor industry provides a representative, real-world example of both the collaboration within and the competition between the supply chains.

On the other side, the structure of the automotive industry consists of upstream, midstream, and downstream segments working together cooperatively in a consolidated chain. Due to the automotive industry operates as supply network structure. Moreover, automotive assembly industry and components industry offered main import and export of output value in Taiwan automotive industry. Hence, the empirical study focused only on automotive assembly and components industry.

1.4. Structure of thesis

Chapter two describes the relevant literature on supply chain in finance management research. Furthermore, it presents a short supply network and long-term relationship and some properties of business environments. As shown in Figure 1.1, the organization of this thesis is including into five chapters.

Chapter three (Study of part Ⅰ：Influence of technological innovations on supply chains) gives an overview on the semiconductor sector with a statistical tabulation of the global market on semiconductors. The IC (Integrated Circuit) industry is one of the products for the semiconductor sector. Subsequently, this chapter also introduces influence of technological innovations on the financial effects of supply chains. Next, discusses the financial effect indicator, together with hypotheses and presents the data collection and the experimental results. Finally, concludes the significant research findings.

Chapter four (Study of part II: Effect of relationships in supply networks) discusses the supply networks, together with effect of relationships in supply networks. Next, presents relationships research from network and strategy perspectives; then, discusses the strength of the relationships within the automotive supply networks. Finally, present the significant research findings the empirical results.

Chapter five concludes this thesis by highlighting interesting results, contributions, and sketching future work.

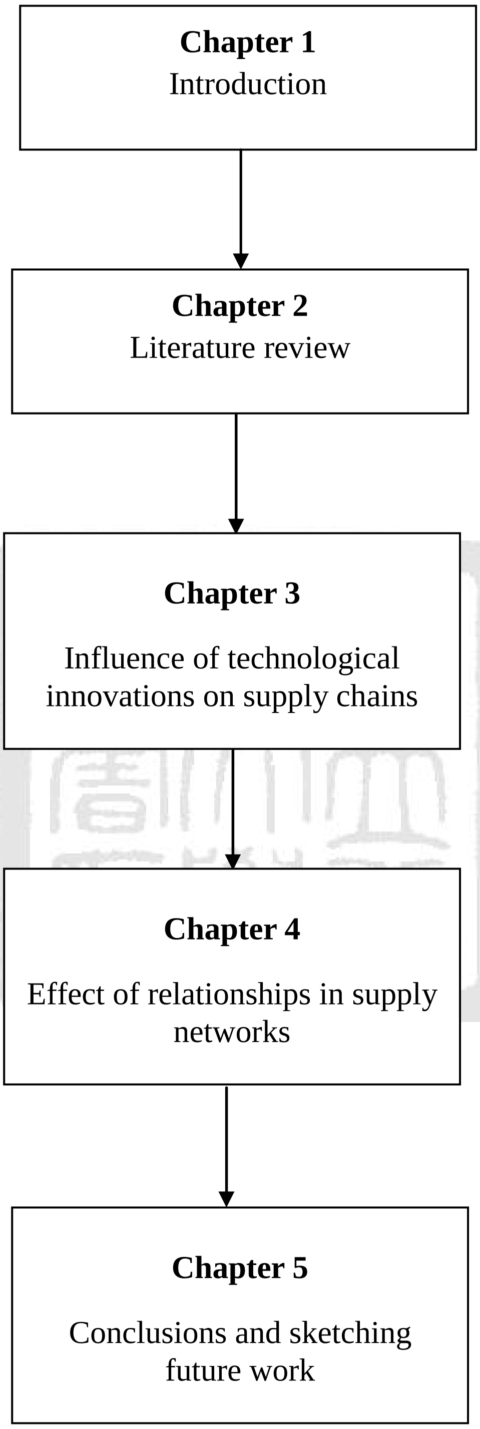

Figure 1.1 Structure of thesis

CHAPTER 2 LITERATURE REVIEW

In this section, we reviewed the following relevant subjects: (1) first, the definition of supply chain and supply chain management; (2) second, explore performance measurement of supply chain management; (3) third, discusses the financial effect on supply chain; and (4) lastly, summarize the review subjects.

2.1. Supply chain

This section starts with definitions of supply chains and their management and provides an overview of different types of supply chains and supply chain performance measures afterwards.

2.2.1 Definitions

Tsay et al. (1998) indicated modern usage of the term seems to be consistent with the following definition: a supply chain is two or more parties linked by a flow of goods, information, and funds. There are other definitions of supply chains, the following definitions are provided to raise the awareness for different meanings of the term supply chain. Mabert and Venkataraman (1998) discuss different views on supply chains: (i) the relational activities between a buyer and seller, (ii) including all upstream suppliers, and (iii) a value chain approach, in which all activities required to bring a product to the market-place are considered part of the supply chain (Persson and Olhager, 2002). Stevens (1989) defines a supply chain as a connected series of activities which is concerned with planning, coordinating and controlling materials, parts, and finished goods from supplier to customer. It is concerned with two distinct flows (material and information) through the organization.

2.2.2 Supply chain management

The first fundamental issue of SCM is the configuration of supply chain. Ballou (2004) visualizes the supply chain (SC), and its management, in terms of a multi-enterprise operation with a focus company comprehensively integrates its supplier's suppliers to the customers or end users. However, Murphy and Wood (2004) portray several configurations. Ballou (2004) visualizes the supply chain, and its management, in terms of a multi-enterprise operation as depicted below.

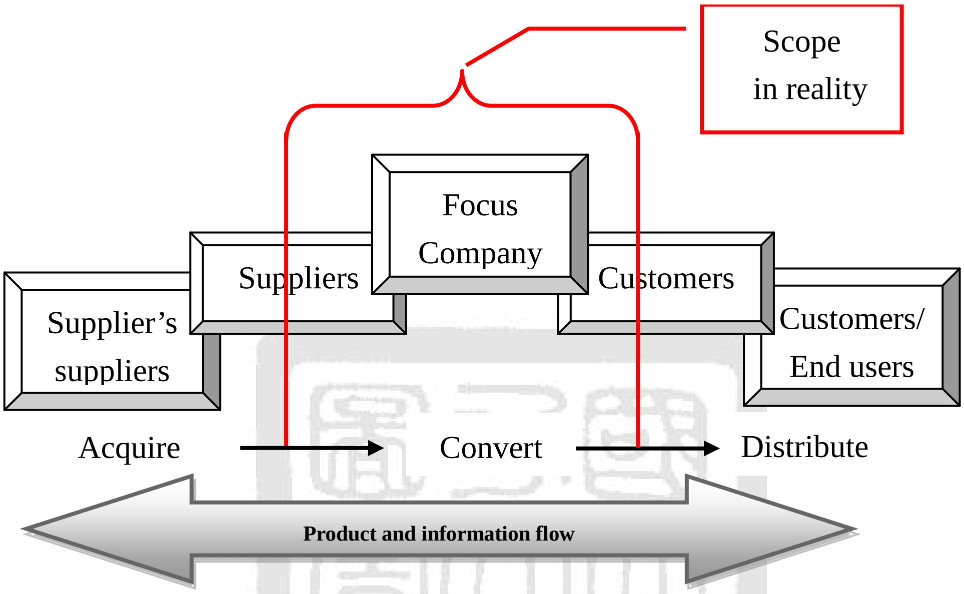

Figure 2.1 Multi-Enterprise supply chains

The scope of reality varies from company to company depending on how the supply chain is managed. Equally important in this multi-enterprise process is that the product and information flow is not always in one direction. Products do not always meet the customers' expectations or are deficient and result in returns, replacements, repairs, recalls, and recycle. Information, not only related to specific products, but to the effectiveness and efficiency of the supply chain process travels in both directions. Also influencing SCM, is how the supply chain is configured. Mentzer as depicted in Murphy and Wood (2004) portrays some configurations in Figure 2.2 below. Like Ballou (2004) in Figure 2.1, supply chains are multi-directional. They also operate at multiple levels and continue to develop, grow, and respond to business needs, objectives, decision making, and technologies.

Christopher (1998) defined SCM as management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole. Other authors, as Handfield and Nichols (1999) Lambert and Cooper (2000) discuss SCM in terms of upstream and downstream relationships. A supply chain encompasses all the activities associated with moving foods from the raw material stage through to the end-user. (Mentzer et al, 2001). The critical element of the supply chain approach is to manage the entire supply chain as if it were a single organization. Careful and timely attention is placed on managing the relationships, information, and material flow across organizational boundaries in an effort to cut cost, increase profit, and enhance flow.

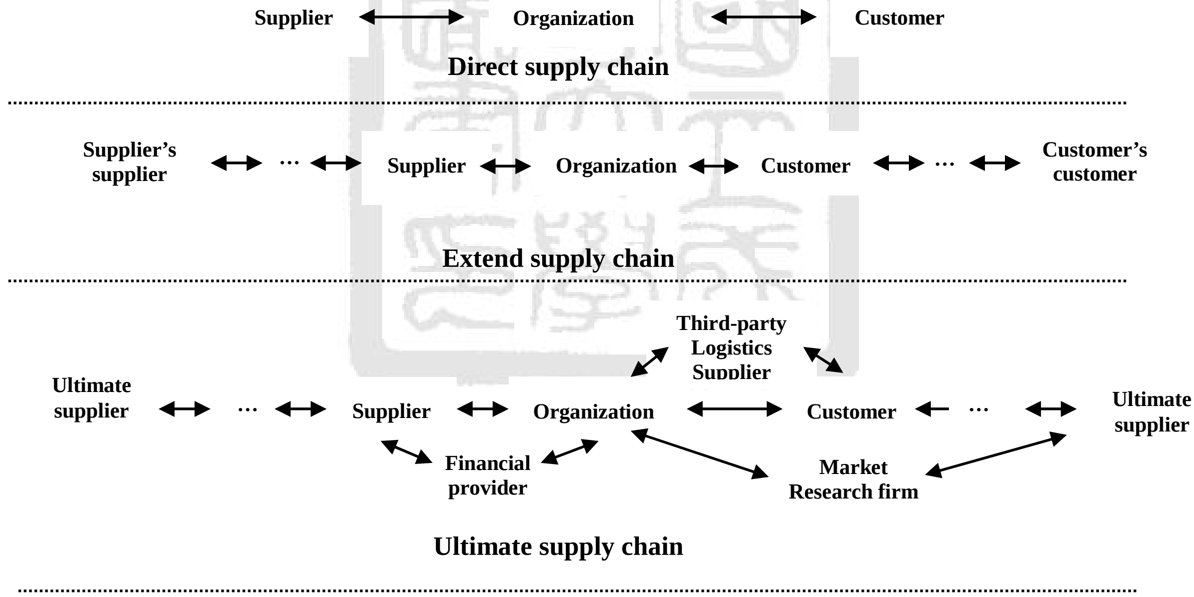

Figure 2.2 Different supply chain configurations

As Figure 2.2 shown, the direct supply chain is the simplest form involving a focus company with its immediate upstream provider and downstream customer. With an extension to including upstream provider's upstream providers and downstream customer's downstream customers, the result is an extended supply chain. An ultimate supply chain extends the chains from the ultimate supplier to the ultimate customer with all potential outsourced companies, such as financial provider, market research firm and third-party logistics provider. The most critical element in the supply chain approach is to manage the entire supply chain as if it were a single organization. Careful and timely attention is placed on managing three aspects, material flow and information flow across organizational boundaries, and even more important the organizational relationships, in an effort to cut cost and increase profit for each of all chain partners. In an optimized, comprehensive treatment, a supply chain encompasses all the activities associated with moving goods from the raw material stage through to the end-user (Mentzer et al., 2001). Equally important in this multi-enterprise process is that the product and information flow is not unidirectionally limited (da Silveira and Caglian, 2006) and impact on cooperate performance (Hendricks et al., 2007). Products do not always meet the customers' expectations or are deficient. The failure results in returns, replacements, repairs, recalls, and recycling.

2.2. Supply chain relationship

2.2.1 Supply chain relationship

It has been suggested that the different forms of supply chain relationships can be described in terms of a continuum (for example, Williamson, 1985, uses an economic perspective). Subsequently, the idea that exchange relationships can be categorized into different levels of relationships has proved to be extremely useful for formalizing governance strategies, and for much subsequent research (Donaldson and O'Toole, 2000). However, while partnerships can also be based on contractual arrangements, they are more likely to be based on implicit understandings and historical trading patterns.

Dyer and Singh's (1998) descriptions, the two most common categories of relationships in marketing channel and inter-organizational literature can be generally defined as 'arm-length transactional’ type relationships, and ‘partnership’ type relationships (Golicic et al., 2003; O'Toole and Donaldson, 2000). Hence, partnerships actor collaborate to various degrees due to commercial and mutuality reasons despite having no equity interest (or at least a passive equity interest) in each other. Thus, dyadic partnerships with any obvious form of ownership will not be investigated in this research, similar to Heide and John’s approach (1990).

Conversely, partnership relationships have been described as a form of ‘managed coordination’ (Peterson and Wysocki, 1998). Describing this managed coordination, Peterson and Wysocki (1998) posit that the relationship is built on the mutual interests of the exchange actors who tend to pursue relationships that are long-term, sharing in benefits and risk, open to information exchange, stable and supportive of interdependence. Moreover, for ease of construct development this research will simplify the various typologies and limit the investigation to true partnership type relationships.

2.2.2 Strategic alliance

Generally, a strategic alliance will exist between two or more independent organizations that forge economic, legal or interpersonal connections that are aligned with a jointly developed goal or interest. Typically, strategic alliance connections are intended as enduring and are substantial, cutting across inter-firm and intra-firm boundaries, thus substantially altering each member’s behavior to fit the joint objectives (Coughlan et al., 1996).

Usually found underlying a strategic alliance is a complex and detailed legal contract (Parkhe, 1993), and this is a key differentiator between a strategic alliance and a partnership. However, while partnerships can also be based on contractual arrangements, they are more likely to be based on implicit understandings and historical trading patterns. Thus, the level of resource, legal, management and emotional commitment for a strategic alliance would tend to be greater than in a partnership. Strategic alliances have been described under various labels such as close relationships, partnerships, relational governance, vertical quasi-integration, hybrid governance, and relationship commitment (Kale et al., 2000; Serapio and Cascio, 1996; Stuart, 1997). Hence, another important difference is that strategic alliances are seen as critical to the future prospects of a business, while a partnership may be very important, but it is not seen as vital (Das and Rahman, 2001).

The power of the partners in an alliance is balanced and their respective influence is high, as each side could exert considerable sway over the other (Frazier, 1999). This is not necessarily the same where two partners of unequal size and power decide to cooperate in a partnership. Hence, as partnerships tend to be much more common and less well researched than formal strategic alliances.

2.2.3 Supply network

Networks are becoming increasingly important as competitive pressures force firms to adopt flexible and more focused organizational structures (Chan et al., 1997). Supply networks are nested within wider inter-organization networks and consist of interconnected entities whose primary purpose is the procurement, use, and transformation of resources to provide packages of goods and services (Harland et al., 2004).

Supply networks could define as sets of supply chains, describing the flow of goods and services from original sources to end customers. The relatively recent incorporation of the term ‘network’ into supply chain management reflects an attempt to make the latter wider and more strategic by harnessing the resource potential of the network in a more effective manner than competing firms (Harland, 1996). And from the bellow figure the supply chain is likely in the level 3 and supply network is in the level 4 encompass the mess and complexity of networks include a broad, strategic view of resource acquisition, development, management, and transport.

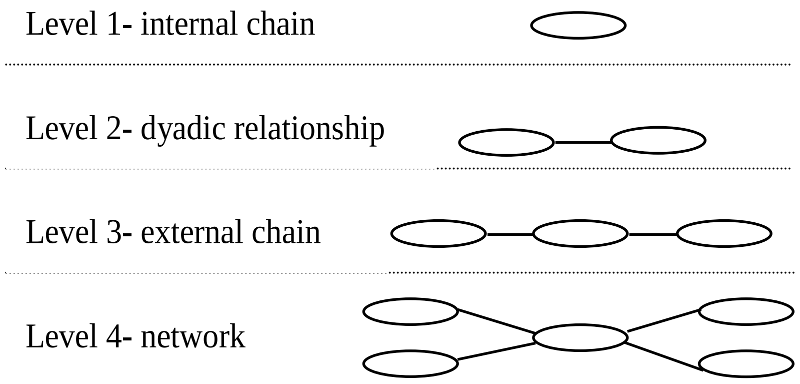

Figure 2.3 The type of chain

Supply network comprise chains through which goods and services flow from original supply sources to end customers (Harland, 1996). Supply networks encompass the mess and complexity of networks involving lateral links and two-way exchanges, and include a broad, strategic view of resource acquisition, development, management, and transport. Supply networks are increasingly complex as multiple companies, as well as companies from different continents, participate in a product’s delivery process. Eberrs and Jarillo (1998) define industry network as a set of organizations that have developed recurring ties when serving a particular market.

Long-term relationships are critical to supply networks, as they are the foundation of both network stability and change. Kotabe et al. (2003) stated that by maintaining long-term relationships, a supplier will become part of a well-managed chain, and that such suppliers will have a lasting effect on the competitiveness of the entire supply chain. Furthermore, Ebers and Jarillo (1998) indicated that supply network and competitive interaction tend towards long-term purposeful arrangements in order to obtain long-term sustainable competitive advantage. This reflects two observations. Firstly, there has been renewed interest in linking supply networks with interconnected relationships (Harland et al., 2004). Networks of interdependent relationships can be developed and fostered through strategic collaboration with the goal of deriving mutual benefits (Chen and Paulraj, 2004a; Dyer, 2000a). Secondly, opportunism (Walter et al., 2003) and dependence asymmetry (Narayandas and Rangan, 2004) may undermine a firm's network strategy in various ways. However, research on cooperative and competitive relationship in such networks remains limited.

In sum, we adopt the concept that SC partners can work as if they were a part of a single enterprise or as long-term supply network relationships to last effect on the competitiveness of the entire supply chain (Kotabe et al., 2003;) and dependence asymmetry (Narayandas and Rangan, 2004) and enjoy their associated benefits (Chen and Paulraj, 2004a; Dyer, 2000a).

2.3. Performance measurement of supply chain management

As previous discusses, SC collaboration partnerships can increase collaborative advantage, enhance firm performance and to improve supply chains (Corbett et al., 1999). Hence, supply chain management (SCM) becomes one of the premier strategies that 21st century businesses consider to reduce costs, increase profits, and penetrate global markets. Otto and Kotzab (2003) present a perspective concerning performance measurement of managing a supply chain and explore suitable metrics to measure the effectiveness of supply chain management, where "effectiveness" is the ability of an organization to meet goals. They identified six possibilities to look at supply chain management, which differ by the perspective one looks at supply chain management. These possibilities play a major role in the selection of suitable performance metrics and are presented in the following:

1. The system dynamics perspective is the basis of the entire discussion.

The purpose of this perspective is the management of trade-offs along the complete supply chain.

2. Operations research perspective

The operations research perspective is characterized as a method-oriented or algorithm-oriented approach towards supply chain management. Here a supply chain is perceived as a resource network and the management of this supply chain has to configure this network and to program the flows within the configuration. SCM is also a critical driver of shareholder value and competitive differentiation (D’avanzio et al., 2003). Supply chain management (SCM) is an integrated philosophy which links immediate upstream provider and downstream customer to effectively and efficiently respond to end users at the right time, right place, and right cost.

3. Logistic perspective

The logistic perspective sees a supply chain as a sequence of generic processes that should be integrated sequentially, vertically, and horizontally. The evolution of business logistics can be divided into three phases (Masters and Pohlen, 1994): functional management (1960-1970s), internal integration (1980s), and external integration (1990s). Kentand and Flint (1997) provide a similar description of the logistics evolution

4. Marketing perspective

The marketing perspective recognizes supply chain management as tool to connect customers with products and serves as a potential driver for marketing’s positive effect on the shareholder value. Its purpose is the segmentation of products and markets and combine both using the right distribution channel.

5. Organization perspective

From the organization perspective, a supply chain appears as a set of inter-organizational relationships. The purpose of supply chain management is determining and mastering the need to coordinate and manage relationships.

6. Strategy perspective

Strategy perceives supply chain management as a mean to vary certain competencies in a chain and re-locating of resources in order to maximize profits. The essence of an operations strategy could be characterized as consisting of a pattern of decisions affecting the ability to meet the long-term objectives, market requirements, and the manufacturing task. The categories, generally ranging from six to ten in number, are usually divided into structural and infrastructural decision categories (Hayes and Wheelwright, 1984). The former included process technology, capacity, facilities and vertical integration. The latter included human resources, organization and so on….

7. Financial perspective

As previous discussions, the relationship strength of SC, examining the economic and rationality imperative are little emphasis. Below are several researches which focus on strength of SC and financial effect. Ramcharran (2001) using correlation analysis, indicate high corrections coeffeicients of P/E ration between suppliers and its respect automobile makers. Vickery et al. (1999) using correlation analysis, found significant relationships among supply chain flexibility and different measure of performance (return on investment, return on sales, and market share) in furniture industry.

Several researchers have provided descriptions of financial effect on SCM. Mitra and Singhal (2008) showed that the stock market reacts positively to integration activities among supply chain partners. In addition, they found that firms with higher cost efficiency and better inventory management benefit more with supply chain integration. Rungtusanatham et al. (2003) used the concept of resourced-based theory to explain that the operational performance of a firm can benefit by its supply chain linkage, a guarantee in quality from suppliers and to customers. That is, developing, strengthening, and protecting relationships with suppliers on the upstream side and with customers on the downstream side while firm making decision.

Form above seven perspectives discussing, we can conduct that the performance creation from SCM could be cost savings through the transfer of best practices, enhanced capacity and flexibility for collective actions, better decision making and increased revenue through marketing’s positive effect on the shareholder value, and innovation through the combination and cross-pollination of ideas. Benefits by business synergy may not be immediately visible; however potential long-term rewards are enticing and strategic (Min et al., 2005). Synthesizing the above studies, this research conceptualizes SC advantage and performance are viewed from SC collaboration means two or more autonomous firms working jointly to plan and execute supply chain operations or means have good relationship strength among SC partners work.

2.4. Summary

SCM is the integration of all activities associated with the flow and transformation of goods from new materials, through to the end user, as well as associated information flows, through improved SC relationships to achieve a sustainable competitive advantage (Handfeld and Nichols, 1999). The literature is replete with buzzwords such as: integrated purchasing strategy, integrated logistics, supplier integration, buyer supplier partnerships, supply base management, strategic supplier alliances, SC synchronization and SCM, to address elements or stages of this new management philosophy (Tan et al., 1999).

SCM has been defined to explicitly recognize the strategic nature of coordination between trading partners and to explain the dual purpose of SCM: to improve the performance of an individual organization, and to improve the performance of the whole supply chain. The concept of SCM has received increasing attention from academicians, consultants, and business managers alike (Croom et al., 2000; Tan et al., 2002). Many organizations have begun to recognize that SCM is the key to building sustainable competitive edge for their products and/or services in an increasingly crowded marketplace.

Otherwise, from the studies and literature above, benefits of an integrated supply chain include reduced costs, improved processes, better quality and increased value (Richey et al.

2008). The benefit plays an important role, and trust and commitment (Tan et al., 2002) are the key factors of coordination. In order to investigate the relationship strength, examines the economic and rationality imperative, chapter 3 is to studies the financial effect correlation on the direct supply chain configuration, which integrates and links immediate upstream provider and downstream customer to effectively and efficiently respond to end users at the right time, right place, and right cost. The dynamic behavior examines the behavioral assumptions of exchange and explains the interaction and interdependencies of supply chain complexity and relationship development. In chapter 4, the thesis focuses on exploring the effect on relationships within a network configuration. Therefore, the supply network and long-term relationship were needed to discuss as follow.

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CHAPTER 3 INFLUENCE OF TECHNOLOGICAL INNOVATIONS ON SUPPLY CHAINS

The development of theory must be accompanied by strong programs of empirical investigation in order to understand marketing and channel relationships more completely. Webster (1992) notes top priority should be given to analysis of the forces and factors that cause firms to move along the continuum from transactions to long-term relationships to strategic alliances, and perhaps back again. Despite this early appeal to the research community, little has been achieved since. Therefore, it is hoped that this study will in a small way address some of the methodological and managerial issues that in discussing the economic and rationality imperative of relationship strength.

Taiwan's current semiconductor industry provides a representative, real-world example of both the collaboration within and the competition between the supply chains – to wit, upstream and downstream relationships in technologies and capital orientation. To compete successfully in the market, companies in the industry require continuous technology innovations for new products. Further, the collaboration mechanism between foundry and fables design houses is built by the main foundry companies, such as TSMC and UMC (Fang and Wu, 2006). These collaborations can be further classified into design collaboration, engineering collaboration, and logistics collaboration. However, technological developments and their implementation require the best of human resources, capital and in-house technologies to be a success. As a result, companies invest heavily to recruit technologists to research, invent, develop, and implement both new processes and new products. In order to avoid the uncertainties inherent in uncorrelated theoretical modeling, this research used the semiconductor sector in Taiwan as the test industry.

Technology innovation (TI) is very specialized, a process involving basic and applied research, product development, manufacture, marketing, and including the adoption and application of TI (Sauvage, 2003; Damanpour, 1991). The key objective of this research is to examine how the technological innovations influence financial effect on the innovation company as well as on its chain partners. In particularly, we examine three key topics including: (1) the magnitude of financial effect correlations on chain partners prior to the technological innovations; (2) the immediate impact of technology innovations (TI) on the company's SR, and its subsequent impacts on the prices of its partners on the supply chain; and (3) the time effects of the financial advantages of technology innovation on the company.

3.1. Innovation

3.1.1 Definitions

Innovation refers to the new concept, approach, or technology which can change the original product or process or introduce an entirely new product or process (Zott, 2003). Innovation stems from a continuum, and can be a learning process (Drucker, 1985) and occurs through a spiral knowledge operation resulting in organizational inner knowledge interacting with outside knowledge (Nonaka and Takeuchi, 1955). Innovation is a complex, interactive process that includes a large amount of co-evolution of scientific, technological and societal systems, in which cause and effect are often difficult to distinguish (Smits, 2002). Innovation requires deliberate efforts to create effective linkages between technological arrangements, people and social organizational arrangements (Geels, 2004). The goal is to offer the customers new choices, better functioning products, and to increase the service level.

The innovation depends on both customer and firm perspectives (Booz et al., 1982). The perceived on new product by customers may influence the product adoption and diffusion which may determine the innovation decisions and timing. On the other hand, innovation may enlarge the domain of the firm to face an unfamiliar domain based on the concept of organization-environment relations (Normann, 1971). It also depends on firm's resources, a resource-based view (RBV). The resources include tangible and intangible assets which are tied semi-permanently to the firm (Wernerfelt, 1984, 2005). Innovation is intangible assets which require the integration with technology and customer for competences.

Based on customer requirements, the adoption of new products and/or processes increases competitiveness and overall profitability (Zahra et al., 1999). The firm may gain sustainability and differentiating itself from the competitors with new product innovation (Maslennikova and Foley, 2000). Oke et al., (2007) investigated the innovativeness of different types are predominant in UK small to medium-sized enterprises (SMEs), whether these innovations are radical or incremental and to investigate their impact on sales turnover growth. Thus, if a company is looking for growth levels that are significantly larger than the growth of the industry, it takes innovation seriously to expand their market scope to achieve long term growth (McDermott and O'Connor, 2002)

On the other hand, technology innovation (TI) is a process integrates research, product development, manufacturing, marketing, adoption and application. At the micro-level, individuals or groups carry out TI processes and build accumulative knowledge through the process of engendering, integrating, and modulating (Kogut and Zander 1992; Johnson 1992); at a more macro-level, TI is a process associated with regulation, policies, and culture characterized by dynamic interaction, as well as a result of reiterative negotiation among different relevant groups (Balthasar et al., 2000; Nieto, 2003).

3.1.2 Innovation and financial effects

Research has examined the effect of TI investments on firms' broad performance measures, such as signaling effect on stock price changes around the announcement (Zantout et al.,1994), effect of innovation on profitability (Leiponen, 2000; Hanel and St-Pierre, 2002).

In particular, Hertzel et al. (2008) acutely pointed out on average, important wealth effects occur prior to and at bankruptcy filings and even extend beyond industry company’s competitors.

3.1.3 Innovation of supply chain on financial effects

Rose-Anderssen et al. (2005) conclude that innovation is a risk for both the company and the customer because prospective new customers might not accept new products, but once the new product had been accepted, the whole supply chain in the organization would change to fit the new markets and customers. Ulusoy (2003) analyzes the innovation and SCM and concludes the need of adopting product differentiation, particularly more knowledge-intensive products as the dominant competitive strategy. He also suggests the need for improvement in various areas of supply chain, specifically the improvement of supplier relations, defining core competencies and fostering strategic partnerships, and continuously monitoring the delivery performance. Wan et al. (2005) delaminate 71 companies, finding significant relationships between a firm’s innovation and organizational structure and the possibility that the associated supply chain would change or adapt when new products were developed and distributed.

There is a limited research in financial effect linking with technology innovation and even with the direct supply chain configuration. In addition, there is limited evidence that explores the impact of the potential financial effect between innovation and partners of the SCs practices. This should be interest which not only to the shareholders, but also of interest to the providers of chain partners enhancement products and services.

3.2. Research design, hypothesis and data setting

The research design of this chapter consists of the definition of financial effect indicator, experimental hypotheses, and data setting.

3.2.1 *Financial effect indicator*

Stock price is conventionally taken as the ultimate financial indicator of the company's overall performance i.e., economic value and wealth effects (Agrawal and Kamakura, 1995; Mitchell and Stafford, 2000; Hertzel et al., 2008). Hence, this research used the stock prices as the performance measurement indicator. However, in order to properly compare across the time periods as well as companies, the study computes the reward ratio, Return on Daily Stock Price (SR) (Ramcharran, 2001; Vickery et al., 1999). The ratio will be used to study the impacts of technology innovations on individual company's stock price over times, and will also act as an organizational performance relationship indicator to study the impacts within the partners on supply chains and across different supply chains in the IC industry in Taiwan. Its formulation is as follows.

$$\text{Return on Daily Stock Price (SR)} = \ln \frac{P_i}{P_{i-1}}$$

Where P_i is the daily stock closing price on day i. The study uses the adjusted daily stock price tabulated by the Taiwan Economic Journal database to calculate the SR. A positive significant statistical correlation in SR between up- and down-stream partners indicates a firm organizational financial relationship between those partners in the chain.

3.2.2 *Research hypotheses*

This research studies four financial issues on the innovation and supply chain collaboration. They include the study of: (1) whether or not there is a correlation on stock performance of the supply chain partnership; (2) whether or not the technology innovation will have an impact on the financial effect of the innovative company; (3) as well as its supply chain partners; (4) the time effects of the financial impacts.

1. Financial synthesis on SCs.

To study the financial synthesis on all the partners in the supply chain collaboration, this chapter hypothesizes that there are no pair-wide positive corrections between any pair of partners' SR. Formally, the hypotheses for TSMC and UMC respective chain are constructed as follows.

H_1: *There were positive collaborative in the SR for supply chain partners in the foundry supply chain relationship..*

To analyze the pair-wise relationship between up and down-stream partners on the supply chain, this article summarizes the relationship with a correlation coefficient, the Pearson's correlation (Pearson's r) for two interval-level variables. A statistical significant positive correlation r on the SR means there is a positive financial synergy toward the relationship between up- and down-stream partners.

1. The financial impacts of technology innovation on foundries.

This research studies the impacts of technological innovation on the stock prices of the innovative manufacturing foundry, by focusing on the relation between 0.13-Micron technology and stock prices. Acceleration to mass production begun in the 3rd quarter of 2002, when TSMC was able to provide an ample capacity for customers to take full advantage of having leading-edge technology for their high-performance designs. This is also the case for UMC. Observed on TSMC and UMC two manufacturing foundries, this chapter statistically tests whether TI influences their respective stock prices. Thus, formally, the hypotheses are constructed as follows.

H_2: *There were impacts of 0.13-Micron technological innovation on innovative foundry's SR.*

This research compares each foundry's SR against the comparison group, DRAM for the time period of no 0.13-Micron technology. The study uses Pearson's correlation r to test whether or not statistical differences occur for SR of innovative foundries, TSMC and

UMC and other non-innovative DRAMs.

2. The impacts of technology innovation on financial synthesis on SCs.

In addition to the study of financial impact of innovation on companies, this research studies whether or not the innovation has diminishing financial effects on the financial synthesis on the partners in the supply chain collaboration. The study statistically tests the impacts of 0.13-Micron technology innovation on manufacturing firm’s chain partners, including its upstream, IC designing and downstream, IC testing. The study hypothesizes that:

H_3: *There were impacts of 0.13-Micron technological innovation on the SR of foundry’s supply chain partners.*

3. The time effects of technology innovation.

The innovation effects may last a period of time. The effects may be the result of patents or hard to duplicate the technological processes. The 0.13-Micron technology involves an innovation in manufacturing process. The expectation is that the innovative foundries sustain advanced manufacturing technology until other foundries emulate the technology. Thus, the study hypothesizes the following statement.

H_4: *There were prolonged length of time period of the impacts of 0.13-Micron technological innovation on the SR of foundry’s.*

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3.2.3 *Data collection and 0.13-Micron Process*

As noted earlier, TSMC and UMC are currently the world's two largest foundries. The IC supply chain includes the design, manufacture, and packaging and testing. Each foundry, with their upstream and downstream partners, forms their respective supply chain. Through the interviews, the design, manufacturing, packing and testing, companies participating in the TSMC supply chain are respectively VIA, TSMC, and ASE; while the participating companies for UMC are SIS, UMC, and SPIL. Even though MediaTek is also one of the designers for UMC, it was only recently listed in the Taiwan Stock Exchange, therefore, this chapter selects SIS as the upstream partner of UMC to compare against the TSMC chain (See Table 3.1). The observation period is between Jan. 2000 to Dec. 2004.

General Manager Chen said[a]: VIA as a fabless design companies, the key success factor for VIA is partnership with TSMC. TSMC's General Manager Tsai also indicated having long-term strategic partnership with VIA is successful collaboration; While ASE[b] involved in IC test program development, front-end engineering test, wafer probing, wafer bump, substrate design and manufacturing, wafer level packaging, flip chip package to comprehensive electronic manufacturing services to main customer TSMC. Even TSMC and ASE cooperate with TSMC in product category rules of IC (Integrated Circuit Product Category Rule, referred to as the IC PCR). These IC PCR system followed international standards ISO14025, characteristics of the semiconductor manufacturing process, integrating the views of domestic and foreign manufacturers to develop, covering energy use, water use and carbon footprint (Carbon Footprint)[c].

Therefore, partnerships of IC supply chain to be implemented in an exchange can be

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[a] Source: 1. http://www.oc.com.tw/readvarticlen.asp?id=21995
2. economic newspaper, date: 2011/2/25
3. http://www.money.und.com, date: 2011/2/10

[b] Source: 1. http://www.money.und.com, date: 2011/2/10

[c] Source: TSMC and UMC website, date: 2009/9/18

dictated by the structural and environmental context, and then as a consequence, the IC supply chain can also be constrained for strategic and environmental reasons. Partnerships actor collaborate to various degrees due to commercial and mutuality reasons despite having no equity interest (or at least a passive equity interest) in each other. This point is accepted by Coyle et al. (2003) who noted firm attempt to reduce risk relationship to guarantee the supply of an expensive and critical component would best be delivered through a form of relational based ‘partnership’ with the key supplier. This arrangement would have the advantage of reducing searching costs, supplier development and embedding costs, promoting information exchange for closer coordination, and adding value to both organizations.

Further, much attention has been placed on ensuring the Total Cost of Ownership (TCO) is used as a system wide metric for ensuring inventory minimization, quality improvement, and supplier development (Bowersox et al., 2002). To achieve these goals, it is necessary for the procurement function to promote collaboration and reduce opportunism.

SIS and UMC announced that they get a strategic alliance in 2003[d] and UMC can get 3/7 SIS seats of Board of Directors. They both committed wafer capacity support to each one for the patent disputes and for cross-licensing of intellectual property rights in order to achieve mutually beneficial goals. Siliconware Corp., an IC testing plant, takes responsibility with UMC was merged by SPIL in January 2000. SPIL[e] involved in IC test program development, front-end engineering test, wafer probing, wafer bump and flip chip package to comprehensive electronic manufacturing services to main customer UMC.

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[d] Source: http://www.epochtimes.com/b5/3/1/14/n265661.htm, date: 2003/1/14

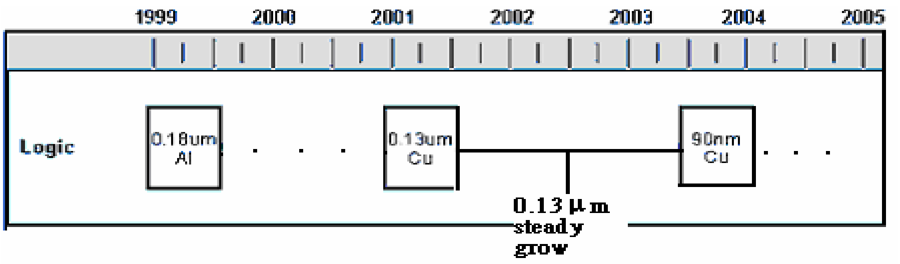
[e] Source: http://money.chinatimes.com/news/news-content.aspx?id=20101103001506&cid=1204, date: 2010/11/3

Table 3.1 Up and down-streams of the SCs for IC industry

		Design	Manufacture	Packaging	Testing
Foundry Supply Chain	TSMC chain	VIA	TSMC	ASE	
	UMC chain	MediaTek SIS	UMC	SPIL	SPIL KYE

An Application Specific Integrated Circuit (ASIC) is a circuit that is designed, customized, or programmed for a specific application rather than for a wide range of various applications. Most ASICs are categorized as VLSI (very large scale integration). Examples may include an IC chip for a toy horse that walks, an IC chip that manages the interface between memory, a microprocessor used as the central processing unit (CPU) of an engineering workstation, and an IC chip in a weather satellite.

0.13-Micron manufacturing technology reduces die size by more than 20% and provides performance improvements by 30% compared with the same device on 0.15-Micron manufacturing technology. The timeline of the development of advanced Logic Technology by both TSMC and UMC is shown in Figure 2. TSMC has experienced the fastest customer adoption rate of 0.13-Micron technology in the industry, as evidenced by the record number of early tape-outs. Over the few years immediate following, many of TSMC and UMC foundries deployed 0.13-Micron technology with an ample production capacity for customers to take full advantage of having leading-edge technology for their high-performance designs. Acceleration to mass production begun in the *3rd quarter of 2002* resulted in the industry's leading technology to customers for the best performance and value. (http://www.tsmc.com/chinese/b_technology/b01_platform/b010102_013um.htm).



Source: TSMC (2004/4), UMC (2004/7)

Figure 3.1 Logic IC development timeline

The adaptation of 0.13-Micron replaced the low-end manufacturing technology. In its introduction stage, the output by the 0.13-Micron respectively counted for 5% and 2% of overall output at TSMC and USC in the 3rd quarter of 2002. But, it grew to 8% and 6% in the following quarter respectively (see Table 3.2).

Table 3.2 The technology composition of IC manufacturing companies in 2002

	Firms	0.25mm and above	0.18/0.17mm	0.165/0.16mm	0.15/0.14mm	0.13/0.1mm
3rd Q	TSMC[1]	52%	23%	-	20%	5%
	UMC[1]	47%	26%	16%	9%	2%
4th Q	TSMC[1]	47%	21%	-	24%	8%
	UMC[1]	50%	22%	14%	8%	6%
DRAM (3Q)	NANYA[2]	-	90%	-	10%	-
	PROMOS[2]	-	45%	-	55%	-
	PSC[2]	-	-	40%	60%	-

Source: [1]Taiwan Economic Journal (TEJ) Database

[2] DRAMeXchange, Salomon Smith Barney, TSMC, UMC

On the other hand, another IC manufacturing group, DRAM has aggressively developed and implemented 0.13-Micron technology. Starting mass production only in the *1st quarter of 2003*, they nonetheless became the key manufacturing technology (see Table 3.3). Thus, they offered no 0.13-Micron technology in 2002.

Table 3.3 The technology composition of DRAM in 2003 and 2004

	Firms	2003 1Q	2003 2Q	2003 3Q	2003 4Q	2004
DRAM	NANYA	0.175mm	0.14mm		0.11mm	0.12mm
	PROMOS	0.14mm		0.12mm	0.11mm	0.11mm
	PSC	0.13 mm		0.11mm		0.1 mm

Source: Taiwan Institute Economic Research Database; Salomon Smith Barney.

This section provides an overview on the global semiconductor sector and IC (Integrated Circuit) industry, and also discusses Taiwanese IC industry to provide the background for the experiment design and analysis.

3.3. Global Semiconductor sector and Taiwan's IC industry

3.3.1 Global semiconductor sector

Except for a slow-down in global high-tech industry prosperity during 2001-2002 that resulted shrinkages of 32% and 2% respectively, the semiconductor sector has grown in a double-digit worldwide since 1999. Its continuous global expansion reached 204 billion US dollar in 2000. In a 5-year period from 1999 to 2004, the market increased by 42.4% as shown in Table 3.4.

Table 3.4 The global semiconductor sector

	1999	2000	2001	2002	2003	2004
Global (in billions) (% increase)	149.4 (18%)	204.4 (36.8%)	139 (-32%)	142.1 (2.2%)	166.4 (17.1%)	212.8 (27.9%)
By region						
United State	47.5	64.1	35.8	31.7	32.3	39.4
Europe	31.9	42.3	30.2	27.3	32.3	38.5
Japan	32.8	46.7	33.2	30.9	38.9	46.2
Taiwan ①	13.1	22.9	15.6	18.9	23.8	33.3
Other Asian	24.1	28.4	24.2	33.3	39.1	55.4
By product/industry						
Discrete	13.1	16.9	12.2	12.5	13.3	16
Opto-Electronics	5.8	9.8	7.4	6.8	9.5	13.8
IC	130.2	176.9	118.5	121.9	140	178.1

Note：①Exchange rate calculation according to Central Bank of China (Taiwan)

Source: Direct-General of Budget, Account and Statistic, Executive Yuan, ROC (2005/02/15), WSTS, IT IS

Eighty percent of the semiconductor sector's output is Integrated Circuit (IC). Stable pricing resulted in a stable demand. The annual IC industry grew to 178 billions US dollar in 2004. Tracking the continuous global market expansion, sales of semiconductor related products by Taiwan reached, a then-maximum 33.3 billion US dollar in 2004 (one trillion NT dollars). This represents a 150% increase compared with the annual output in 1999. Overall, Taiwan is now ranked the fourth global IC provider.

Table 3.5 The segmental value of IC products in Taiwan

By segment	1999	2000	2001	2002	2003	2004
IC design	2.3	3.7	3.6	4.3	5.5	7.8
IC manufacturing (Foundry)	8.2 (4.4)	15 (9.5)	9 (6.1)	11 (7.1)	13.7 (9)	19 (12)
IC packing	2	3.1	2.3	2.7	3.4	4.8
IC testing	0.6	1.1	0.7	0.9	1.2	1.7

Note：[1] in billion US dollars, exchange rate calculation according to Central Bank of China (Taiwan)

Source: Direct-General of Budget, Account and Statistic, Executive Yuan, ROC (2005/02/15), WSTS, ITIS

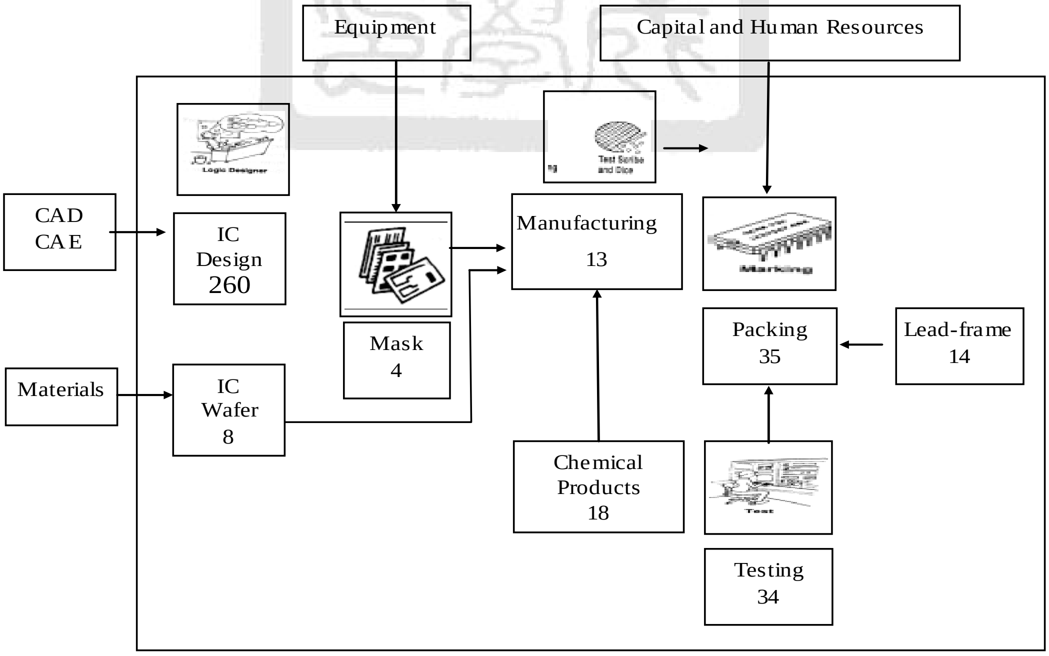
3.3.2 Taiwan's IC industry

The IC industry consists of design, manufacturing, and packing and testing segments as shown in. In Taiwan, the major segments of IC products are IC design and manufacturing (Table 3.5). In total, the two segments accounted for 80% of Taiwan's IC products with the annual IC foundry production output of 12 billions US dollars in 2004. This makes Taiwan the largest IC foundry manufacturer in the world. The IC design segment is also growing very rapidly in Taiwan, with a production output of 7.8 billions US dollars in 2004, which makes her the second largest IC designer in the world.

The Taiwan IC industry has established itself as a comprehensive upstream-downstream collaborated supply chain domestically. The structure of IC industry in Taiwan consists of a series of design (upstream), manufacturing (midstream) and testing and packaging (downstream) segments working together cooperatively in a collaborated chain as portrayed. By the end of 2004, Taiwan semiconductor industry consisted of 260 IC fables houses, 8 wafer suppliers, 4 mask makers, 13 fabrication companies, 35 packaging houses, 34 testing houses, and 14 substrate suppliers, 18 chemical suppliers, etc. in Figure 3.2 below.

The design phase of the IC industry occurs in the upstream segment of the supply chain.

The products undergo polishing and production in the manufacturing stages of the chain. The IC manufacturing includes three types of manufacturing companies- foundry, dynamic random access memory (DRAM) and integrated device manufacturer (IDM). Foundry is a factory where devices like integrated circuits are manufactured for specific customers. DRAM is a type of random access memory that stores each bit of data in a separate capacitor within an integrated circuit. However, IDM is a semiconductor company which simultaneously designs and manufactures integrated circuit products. Along with other smaller foundries, the world's two largest ones, TSMC and UMC, are located in Taiwan. Testing and packaging is a downstream segment and some companies provide both testing and package services. Appendix A lists the full names of all the design, manufacturing and testing and packing companies in Taiwan. The complete upstream-through-downstream collaborated relationship combined with the continuous technological innovation of new IC products and a high utilization on production capacity make the industry successful globally.



Source: ITIS, 2005/3

Figure 3.2 Structure of the Taiwan IC industry

3.4. Methodology

3.4.1 Pearson’s correlation

Again, the study uses the Pearson’s correlation to verify whether their SRs are statistical correlated after the 0.13-Micron technology innovation was implemented for mass production.

3.4.2 ANOVA to test

The research uses ANOVA to test whether or not the SR of innovative foundries may differ from the other non-innovative foundries. The study uses and compares monthly averages of adjusted daily stock prices to judge whether the pattern alternates.

3.4.3 Regression analysis

SCM and business performance has been the focus of numerous studies using from firms’ data. Mitra and Singhal (2008) demonstrated that the stock market reacts positively to integration among supply chain partners. Ramcharran (2001) used simple regression to indicate significant linkages by P/E ratio between suppliers and automobile manufacturers. The study replicated the Ramcharran (2001) methodology to estimate the degree of linkage. The impact on profitability (as measured by the SR) of this interdependence is estimated by using regression analysis:

$$SR_t^m = a_1 SR_{t-1}^d + a_2 SR_{t+1}^p \qquad \text{(Eq. 3-1)}$$

where SR_t^m = the SR of each manufacturer of the SC in the current period

SR_{t-1}^d = the SR of each designers of the SC in the previous period

SR_{t+1}^p = the SR of firms of testing and packaging of the SC in the later period

t = time period (daily)

A lagged impact between SR_{t-1}^d on SR_t^m and SR_t^m on SR_{t+1}^p are assumed. This is reasonable since the current demand (profitability) for final products is based on order rot inputs from designers placed in the previous period. If a_1 >0 and significant, the manufacturer is impacted by the profitability of the designers. If $a_2>0$ and significant, the firms of packing and testing impacted by the profitability of the manufacturer. The magnitude of linkage can be inferred as low if $0<a_1<1$, $0<a_2<1$, and high if $a_1>1$, $a_2>1$. Coefficient of determination is the best measurement of goodness of fit of the linear model. This coefficient shows to what extent the change taking place in the dependent variable is accounted for by independent variable or variables.

3.5. Results

The article organizes the experiment results in 3 sections. The first section tabulates the chain effects on the SR prior to the innovation. The second section is the results of the innovation impacts on the innovative companies as well as on the chain partners; while the third section shows the result of the time effects on the innovation.

3.5.1 Supply chain correlation

The higher the correlation of SR, the higher the collaboration between upstream and downstream of the chain partners is. Table 3.6 showed that there is a significant pair-wise positive correlation among design, foundry and packing and testing for both TSMC and UMC chains on daily SR for the time period beginning on Oct. 26 of 2000 and ending on June 30 (2nd quarter) of 2002. Thus, this research accepts the hypotheses H_1, meaning that there is a financial effect correlation among chain partners in both TSMC and UMC chains. In other words, the supply chain collaboration does provide mutually collaborated impact on each other's SR.

Table 3.6 Correlation analysis of SR prior to the innovation

			TSMC chain			UMC chain		
			Design	Foundry	Packaging	Design	Foundry	Packaging
			VIA	TSMC	ASE	SIS	UMC	SPIL
TSMC chain	Design	VIA	**-**	**0.49****	**0.52****			
	Foundry	TSMC		-	0.60**			
UMC chain	Design	SIS				**-**	**0.48****	**0.51****
	Foundry	UMC					**-**	**0.62****

Note: 1. Time period: 10/26/2000~06/30/2002;

2. **Correlation coefficient significantly different from zero at the 0.01 level

3.5.2 The impacts of innovation on innovative foundries (TSMC and UMC)

This section tabulates the results of the statistical analyses of the innovation impact on the foundries. H2$_{a(b)}$ assumes that the 0.13-Micron technological innovation has effect on SR for TSMC and UMC. While the innovative foundries are the experimental group, the study uses the non-innovative, but also IC manufacturing companies, DRAM as the comparison group. The result shows that there were positive correlation within each respective group, between two innovative IC foundries as well as three non-innovative DRAMs, prior to and after both were adopted the innovative 0.13-Micron manufacturing technology. Thus, this research accepts the hypotheses H$_{2.}$ However, the correlation changed among January 2002 to December 2002 and the changes of correlation range are as following: [-0.01, 0.44], [0.17, 0.79], [0.51, 0.78], [0.212, 0.52], [0.48, 0.51], [0.35, 0.60], [0.48, 0.69], [0.43, 0.70], [0.48, 0.52], [0.58, 0.63], [0.47, 0.79], [0.31, 0.72].

Table 3.7 Correlation analysis of SR by monthly

		TSMC	UMC	PROMOS	PSC	NANYA
2002/1	TSMC	-				
	UMC	0.74^{**}	-			
	PROMOS	0.44^{*}	0.21	-		
	PSC	0.33	-0.01	0.81^{**}	-	
	NANYA	0.42^{*}	0.02	0.54^{**}	0.57^{**}	-
		TSMC	UMC	PROMOS	PSC	NANYA
2002/2	TSMC	-				
	UMC	0.68^{*}	-			
	PROMOS	0.54	0.17	-		
	PSC	0.59^{*}	0.50	0.79^{**}	-	
	NANYA	0.79^{**}	0.52	0.57	0.78^{**}	-
		TSMC	UMC	PROMOS	PSC	NANYA
2002/3	TSMC	-				
	UMC	0.78^{**}	-			
	PROMOS	0.77^{**}	0.56^{**}	-		
	PSC	0.71^{**}	0.58^{**}	0.91^{**}	-	
	NANYA	0.65^{**}	0.51^{*}	0.84^{**}	0.818	-
		TSMC	UMC	PROMOS	PSC	NANYA
2002/4	TSMC	-				
	UMC	0.75^{**}	-			
	PROMOS	0.29	0.18	-		
	PSC	0.44^{*}	0.13^{**}	0.63	-	
	NANYA	0.52^{*}	0.29	0.72^{**}	0.57	-

		TSMC	UMC	PRMOS	PSC	NANYA
2002/5	TSMC	-				
	UMC	0.80^{**}	-			
	PRMOS	0.51^{*}	0.53^{*}	-		
	PSC	0.48^{*}	0.48^{*}	0.83^{**}	-	
	NANYA	0.46^{*}	0.36	0.84^{**}	0.88^{*}	-
		TSMC	UMC	PMOS	PSC	NANYA
2002/6	TSMC	-				
	UMC	0.92^{**}	-			
	PMOS	0.53^{**}	0.60^{**}	-		
	PSC	0.48^{*}	0.59^{**}	0.91^{**}	-	
	NANYA	0.35	0.49^{*}	0.83^{**}	0.90^{**}	-
		TSMC	UMC	PMOS	PSC	NANYA
2002/7	TSMC	-				
	UMC	0.90^{**}	-			
	PMOS	0.63^{**}	0.69^{**}	-		
	PSC	0.48^{*}	0.58^{**}	0.87^{**}	-	
	NANYA	0.53^{**}	0.65^{**}	0.91^{**}	0.94^{**}	-
		TSMC	UMC	PMOS	PSC	NANYA
2002/8	TSMC	-				
	UMC	0.84^{**}	-			
	PMOS	0.70^{**}	0.59^{**}	-		
	PSC	0.49^{*}	0.43^{*}	0.69^{**}	-	
	NANYA	0.59^{**}	0.53^{*}	0.80^{**}	0.86^{**}	-
2002/9		TSMC	UMS	PRMOS	PSC	NANYA

	TSMC	-				
	UMS	0.92^{**}	-			
	PRMOS	0.51^{*}	0.48^{*}	-		
	PSC	0.49^{*}	0.52^{*}	0.87^{**}	-	
	NANYA	0.51^{*}	0.52^{*}	0.69^{**}	0.64^{**}	-
		TSMC	UMC	PMOS	PSC	NANYA
2002/10	TSMC	-				
	UMC	0.94^{**}	-			
	PMOS	0.63^{**}	0.58^{**}	-		
	PSC	0.66^{**}	0.74^{**}	0.68^{**}	-	
	NANYA	0.60^{**}	0.67^{**}	0.70^{**}	0.77^{**}	-
		TSMC	UMC	PRMOS	PSC	NANYA
2002/11	TSMC	-				
	UMC	0.92^{**}	-			
	PRMOS	0.64^{**}	0.47^{**}	-		
	PSC	0.79^{**}	0.66^{**}	0.80^{**}	-	
	NANYA	0.71^{**}	0.63^{**}	0.64^{**}	0.90^{**}	-
		TSMC	UMC	PMOS	PSC	NANYA
2002/12	TSMC	-				
	UMC	0.85^{**}	-			
	PMOS	0.31	0.48^{*}	-		
	PSC	0.50^{*}	0.60^{**}	0.81^{**}	-	
	NANYA	0.60^{**}	0.72^{**}	0.78^{**}	0.89^{**}	-

Note: 1. Time period: 2002/1~2002/12;

2. $^{**(*)}$ Correlation coefficient significantly different from zero at the 0.01(0.05) level

Table 3.8 is shown quarter by quart test form first quarter 2002 to first quarter 2003. The changes of correlation range are as following: [0.28, 0.74], [0.42, 0.83], [0.47, 0.91], [0.44, 0.90], and [0.39, 0.88].

Table 3.8 Correlation analysis of SR by quarterly

		TSMC	UMC	PSC	PROMOS	NANYA
2002/1-2002/3	TSMC	-				
	UMC	0.74^{**}	-			
	PSC	0.46^{**}	0.25^{*}	-		
	PROMOS	0.55^{**}	0.31^{*}	0.83^{**}	-	
	NANYA	0.54^{**}	0.28^{*}	0.69^{**}	0.65^{**}	-
		TSMC	UMC	PSC	PROMOS	NANYA
2002/4-2002/6	TSMC	-				
	UMC	0.83^{**}	-			
	PSC	0.44^{**}	0.50^{**}	-		
	PROMOS	0.53^{**}	0.58^{**}	0.85^{**}	-	
	NANYA	0.42^{**}	0.47^{**}	0.88^{**}	0.84^{**}	-
		TSMC	UMC	PSC	PROMOS	NANYA
2002/7-2002/9	TSMC	-				
	UMC	0.91^{**}	-			
	PSC	0.47^{**}	0.49^{**}	-		
	PROMOS	0.56^{**}	0.51^{**}	0.77^{**}	-	
	NANYA	0.50^{**}	0.52^{**}	0.73^{**}	0.72^{**}	-
2002/10-2002/12		TSMC	UMC	PSC	PROMOS	NANYA
	TSMC	-				

	UMC	0.90**	-			
	PSC	0.67**	0.70**	-		
	PROMOS	0.44**	0.47**	0.75**	-	
	NANYA	0.66**	0.73**	0.84**	0.66**	-
		TSMC	UMC	PSC	PROMOS	NANYA
2003/1-2003/3	TSMC	-				
	UMC	0.88**	-			
	PSC	0.56**	0.53**	-		
	PROMOS	0.39**	0.37**	0.64**	-	
	NANYA	0.51**	0.54**	0.82**	0.61**	-

Note: 1. Time period: 2002/1~2003/3;

3. $^{**(*)}$ Correlation coefficient significantly different from zero at the 0.01(0.05) level

Another testing separates three time intervals: 2002/1-2002/9, 2002/10-2003/3 and 2003/4-2003/9 as shown in Table 3.9. While the correlation changed after a quarter of innovative technology was implemented by foundries. For the time period of 1st – 3rd quarters of 2002, the correlation range is within [0.39, 0.54], however, after a quarter of mass production, the range changed to [0.52, 0.72]. A quarter after the DRAMs implemented the same technology, the range again changed back to a lower correlation to [0.15, 0.52]. Both statistical methods collectively reject the hypothesis that the innovation has no effects on innovative companies'.

3.5.3 The impacts of technology on foundry supply chain (TSMC Chain and UMC Chain)

This section tabulates the results of the statistical analyses of the innovation impact on innovative companies' chain partners with respect to their mutual financial synthesis. H_3 hypothesizes that having 0.13-Micron technology will influence the SR of supply chain partners of the innovative foundries, TSMC and UMC, respectively.

Table 3.9 Correlation analysis of SR among three time interval

2002/1-2002/9		TSMC	UMC	PSC	PROMOS	NANYA
	UMC	0.82^{**}	-			
	PSC	0.54^{**}	0.46^{**}	-		
	PROMOS	0.45^{**}	0.39^{**}	0.83^{**}	-	
	NANYA	0.49^{**}	0.41^{**}	0.74^{**}	0.76^{**}	-
2002/10-2003/3		**TSMC**	**UMC**	**PSC**	**PROMOS**	**NANYA**
	UMC	**0.88^{**}**	**-**			
	PSC	**0.52^{**}**	**0.52^{**}**	**-**		
	PROMOS	**0.68^{**}**	**0.69^{**}**	**0.74^{**}**	**-**	
	NANYA	**0.66^{**}**	**0.72^{**}**	**0.67^{**}**	**0.81^{**}**	**-**
2003/4-2003/9	TSMC	UMC	PSC	PROMOS	NANYA	TSMC
	UMC	0.75^{**}	-			
	PSC	0.15	0.23^{**}	-		
	PROMOS	0.31^{**}	0.40^{**}	0.71^{**}	-	
	NANYA	0.46^{**}	0.52^{**}	0.54^{**}	0.70^{**}	-

Note: 1. Time period: 2002/1~2003/9;

2. **Correlation coefficient significantly different from zero at the 0.01 level (2-tailed).

Table 3.10 shows that there is a significant pair-wise positive correlation among design, foundry and packing and testing for both TSMC and UMC chains on the SR on daily stock prices for the time period beginning on 3rd quarter of 2002 till year-end of 2003. Thus, this chapter accepts the hypotheses H_3, meaning that the technology innovation of an innovative company will impact on the financial effect of its chain partners. That is, the companies on the collaborative supply chain will also reap the financial rewards of their partners' technology innovation.

Table 3.10 Correlation analysis of SR after the innovations

			TSMC chain			UMC chain		
			Design	Foundry	Packaging	Design	Foundry	Packaging
			VIA	TSMC	ASE	SIS	UMC	SPIL
TSMC Chain	Design	VIA	**-**	**0.46****	**0.48****			
	Foundry	TSMC		**-**	**0.67****			
UMC Chain	Design	SIS				**-**	**0.59****	**0.53***
	Foundry	UMC					**-**	**0.66***

Note: 1. Time period: 2002/7/01~2003/12/31;

2. $^{**(*)}$ Correlation coefficient significantly different from zero at the 0.01(0.05) level

3.5.4 Time effects

The foundries, TSMC and UMC implemented 0.13-Micron manufacturing technology in the 3rd quarter of 2002, while DRAM companies adopted the similar technology in the 1st quarter of 2003. To study the time effects on innovation, this chapter uses ANOVA to compare the SR for innovative foundries TSMC and UMC and three at-the-time non-innovative DRAM, PSC, Promos and Nanya. The article tabulates the ANOVA test results for the time period starting at the 1st quarter of 2002 to the 3rd quarter of 2003 in Table 3.11. The results show that for all the time periods, there were no SR differences within either the foundry or DRAM respective group. On the other hand, the statistical analysis between groups has showed a series of 3 distinguished time periods. The analysis showed a significant statistical difference between foundry and DRAM groups in the first time interval, 1st to 3rd quarters of 2002.

Table 3.11 T-test and ANOVA test in SR in different time interval

Year	Quarter	Groups	F	Sig.
2002	Jan-Mar	Foundry[a]	2.00	0.16
		DRAM	0.09	0.91
		Between[a]	20.95	0.00**
	Apr-Jun	Foundry[a]	1.11	0.29
		DRAM	0.01	0.99
		Between[a]	12.79	0.00**
	Jul-Sept	Foundry[a]	0.04	0.85
		DRAM	0.04	0.97
		Between[a]	8.14	0.01**
	Oct-Dec	Foundry[a]	0.11	0.75
		DRAM	0.14	0.87
		Between[a]	1.69	*0.20*
2003	Jan-Mar	Foundry[a]	2.17	0.14
		DRAM	0.12	0.89
		Between[a]	0.57	*0.45*
	Apr-Jun	Foundry[a]	0.41	0.52
		DRAM	0.33	0.72
		Between[a]	19.52	0.00**
	Jul-Sept	Foundry[a]	0.04	0.86
		DRAM	0.02	0.99
		Between[a]	10.72	0.01**

Foundry: TSMC & UMC
DRAM: PSC, PROMOS & NANYA

Note: 1. [a] use t-test

2. **indicate there is significantly different at the 0.01 level.

However, there were no statistical difference for the second time interval, 4th quarter of 2002 to 1st quarter of 2003. The difference in returns between groups was again shown after the 1st quarter of 2003.

This analysis showed that the innovation does not have an observable effect until a quarter after its implementation (mass production). Even though, the firms deployed the mass production of 0.13-Micron manufacturing innovation in the beginning of the 3rd quarter of 2002, its impact on the returns did not realize until a quarter afterward which is in the 4th quarter. The DRAM companies also demonstrated an identical phenomenon, that is, their innovation effect on the returns also showed a delay by a quarter. As the result, the innovation effect on returns for foundries only lasted for no more than 6 months. It is the time interval that foundries implemented their 0.13-Micron manufacturing technology, before DRAM companies adopted the similar technology. Thus, this research accepts the hypotheses $H_{4,}$ meaning that there was prolonged length of time period of the impacts of 0.13-Micron technological innovation on the SR of foundry.

3.5.1 Regression analysis

Model of stochastic time series generated by the ARMA process can be done with the Box-Jenkins approach. The methods and procedures can be found in the literature Box and Jenkins (1976), Brillinger (1981) and Chatfield (1975). Using the AIC and BIC criteria, the best model is found to be ARMA (3, 3). The estimate of parameters; standard errors and the p-values are given in Table 3.12 and Table 3.13.

The slope coefficient (a1) measures the change in the SR of each IC manufacturer in the current period when the SR of the designer changes by one unit in the previous period. Also, the slope coefficient (a2) measures the change in the SR of each IC manufacturer in the current period when the SR of the firms of testing and packaging by one unit in the later period.

The slope coefficient (a1) is positive and significant when the SR of the designer changes by one unit in the previous period. But the magnitude of linkage can be inferred as low in TSMC chain.

Table 3.12 ARMA model estimate for the TSMC chain

Variable	Coefficient	Std. Error	t-Statistic	Prob.
VIA(-1)	0.04	0.05	0.86^{**}	0.39
ASE	0.12	0.04	2.95	0.00
AR(3)	0.75	0.22	3.33	0.00
MA(3)	-0.78	0.21	-3.78	0.00
R-squared	0.02	Mean dependent var		0.00
Adjusted R-squared	0.02	S.D. dependent var		2.69
S.E. of regression	2.67	AIC		4.81
Sum squared resid	3004.40	BIC		4.85
Log likelihood	-1022.44	Durbin-Watson stat		2.02
Q3=0.90 (p value=0.34)				
JB=4.76 (p value=0.09)				

Note: 1. The regression results of Eq. 3-1 for each auto manufacturer are presented.

2. Time period: 2002/1~2003/9.

3. **statistical significant of coefficient at 95 percent and above.

The slope coefficient (a1) is significant and negative when the SR of the designer changes by one unit in the previous period. But the magnitude of linkage can be inferred as low in UMC chain. Like the results of other studies on performance, this chapter provides further evidence on performance of linkage within the framework of SCM.

Table 3.13 ARMA model estimate for the UMC chain

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIS(-1)	-0.03	0.04	-0.81^{**}	0.42
SIP(1)	0.12	0.04	3.15	0.00
AR(3)	0.77	0.15	5.14	0.00
MA(3)	-0.81	0.14	-5.78	0.00
R-squared	0.03	Mean dependent var		-0.11
Adjusted R-squared	0.02	S.D. dependent var		2.79
S.E. of regression	2.75	AIC		4.87
Sum squared resid	3205.36	BIC		4.91
Log likelihood	-1036.26	Durbin-Watson stat		2.09
Q3=6.66 (p value=0.01)				
JB=3.48 (p value=0.18)				

Note: 1. The regression results of Eq. 3-1 for each auto manufacturer are presented.

2.Time period: 2002/1~2003/9;

3. *statistical significant of coefficient at 95 percent and above.

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3.6. *Summary*

This research studied the financial synergy on supply chains. In addition, the research studied the innovation effects, 0.13-Micron process technology on the financial effects of innovative company as well as chain partners. The innovative 0.13-Micron manufacturing process reduces die size by more than 20 percent and provides performance improvements for 30 percent when compared to the same device on TSMC 0.15-Micron process technology. The statistical results support all the hypotheses. First, the results show a significant positive SR effect resulting from supply chain collaboration, even though the correlation of the TSMC chain was slightly higher than UMC chain. The higher the correlation of SR, the higher the collaboration between upstream and downstream of the chain partners is. Table 3.6 showed that there is a significant pair-wise positive correlation among design, foundry and packing and testing for both TSMC and UMC chains. Thus, this represented that there was a financial effect correlation among chain partners in both TSMC and UMC chains. In other words, the supply chain collaboration does provide mutually collaborated impact on each other's stock prices. The results were supported by Hunt and Morgan (1994) who observed that important relationships between firms that are seen as more involved and committed and will display higher degrees of collaborative behavior. Conversely, higher level relationships will also display correspondingly lower levels of opportunistic or negative behaviors. But the magnitude of linkage is low by regression analysis.

Secondly, the results show that the innovation impact on returns for a company will affect not only its own company's SR, but also its SR of supply chain partners'. However, the effect exhibited a time delay until the beneficial impacts over technologically non-innovative competitors was realized. The delay was a financial quarter (3 months) in the experiments. Unfortunately, whenever their competitors adopt the same innovative technology, such a technology competitive advantage disappears. In this research, the advantage only lasted for the time period between their adaptations of the similar innovative technology, 6-months.

CHAPTER 4 EFFECT OF RELATIONSHIPS IN SUPPLY NETWORKS

In today's world of interconnected economies, firms are no longer stand-alone organizations. Extended production networks and expanded trade have intensified competition in most industries. Consequently, firms exploit core resources and competences to develop and sustain a strong market position.

Supply chains, the network of firms that contributes both inbound and outbound products and services along an industry value chains, had drawn increasing attention from organization theorists since the 1980s. Since the late 1980s, researches in various fields have been concerned with developing an understanding of organizations abilities to manage, and manage in the networks of organizations kinked by economic exchange (Harland, 1996). Competition is changing from firm level to network level: firms take parting in end product supply networks that compete against alternative end product networks. Drucker (1997) indicated the network changes business control because of scratching and mixing the ownership of the economic units. Moreover, the participating companies in the supply networks may not remain the same over the product life-cycle.

Over the past few years, relationships between suppliers and assemblers in the West and have been transformed. The automotive industry has undergone considerable technology and organizational change. On the assemble side the traditional Fordist methods of production have largely been replaced by various hybirds of Japanese lean production methods as assembles try to satisfy an increasingly diversified pattern of demand for vehicles (Womack et al., 1990; Boyer and Freyssenet, 2002). And the growing tendency for outsourcing has led to a significant increase in the number of partners that participate in global supply networks. Furthermore, the companies that participate in the production of a product variant can change over time, for example, the fluctuations of currency rates or minor changes in the product designing (Andel, 2001). The situation in Taiwan is the same- large assembly firms have out-sourced an increasing percentage of work to large suppliers- in this sense it is modular but then force suppliers to co-locate with their assembly plants.

Taiwanese automotive industry provides both collaboration within and competition among assembly manufacturers and the automotive component manufacturers. In identifying the numerous theoretical determinants of supply networks, we test our conceptual arguments in the context of vertical supply networks in the automotive industry.

Specifically, our study examines the relationship among the automotive assembly manufacturers and their independent upstream suppliers (automotive component manufacturers). In the following subsections we describe the relationships research from network and strategy perspectives; then, we discuss the strength of the relationships within the supply networks and develop the proposition.

4.1. Network and long-term relationship

4.1.1 Define network

A network is defined as a way of organizing economic activities through inter-firm coordination and cooperation in order to exchange or share information or resources. Network actors are influenced by their conceptual frameworks, which allow them to comprehend and act in the network, and to set network boundaries by including or excluding others. Network theories reflect actors' capabilities and intentions in the network. Network theory when applied to relationships emphasizes the role of relationship dyads in understanding changes in supply networks. In this context, the concept of a supply network represents the verifiable determination of relevant network components (Jüttner and Schlange, 1996). Moreover, the relatively recent incorporation of the term "network" into supply chain management (SCM) research represents an attempt to make the concept wider and more strategic by enabling firms to harness the resource potential of the network in a more effective manner.

Supply networks can be defined as sets of supply chains, describing the flow of goods and services from original sources to end customers (Harland et al., 2004). Hertz (2006) noted that supply chain networks are a very specific type of network, and are concerned with the connections and dependencies between firms, going from raw materials to final customers. A network is an aggregate of actors that are interrelated and interconnected through relationships. In order to understand a network, we thus have to study and understand relationships, and early studies attempted to explain the nature of relationship processes.

4.1.2 Long-term relationship

Some investigators have studied long-term cooperative relationships with key suppliers (Carr and Pearson, 1999; Chen et al., 2004b). Choi and Krause (2006) describe how in an automotive supply network, a plastic molding company and a metal parts manufacturer can be interdependent. They found such interdependencies often occur beyond the purview of the focal company. In such relational patterns, these suppliers may continue to pursue a cooperative strategy in spite of the exit strategy adopted by the focal buying company (Choi and Wu, 2009). Nelson (1989) argued actors engage in repeated and transitive relational exchanges facilitate how trust and social norms emerge over time. However, the results highlight that the norms or meta-norms established among the firms in the supply networks inhibit an increasing proportion of agents from defecting. Even in situations where firms are able to gain high rewards from opportunistic behavior, mutual cooperative behavior would survive and thrive as long as there is sufficient incentive to do so. For instance, Denso as the major top-tier supplier to Toyota has had a history of showing comparable or sometimes higher earnings compared to Toyota (Nair et al., 2009). Therefore, it is important to study supply chains from the network-based perspective and from the long-term equilibrium as to move closer to the realistic relational behaviors in supply chains.

4.2. Research proposition and data setting

4.2.1 Research proposition

An important sub-topic in these research streams has been the issue of defection behavior. Pathak et al. (2007) highlight the relevance of complexity in supply chain and operations management research and shown in an ongoing buyer-supplier dyadic relationship when the decision is to exit, a buyer would act opportunistically in short term which we refer to as defection behavior. Rossetti and Choi (2005) describe how large buying companies in the aerospace industry made short-term, opportunistic decisions that led to long-term consequences.

In addition, we have considered why the arrangement of networks among organizations can yield long-term sustainable competitive advantages, as well as examining the potential importance of close relationships as strategic assets (Johnson, 1999; Kale et al., 2000). However, firms often use cooperative relationships to reduce the uncertainty in their product markets through information sharing and cross-firm communication in the form of cooperative relationships that range from cooperative marketing to pooled research and development cooperatives (Bresser, 1988). As a result, ensuring stable relationships between suppliers and their customers is important to both parties. Thus, consequences of relationship continuity relate to long-term financial stability for both the supplier and the customer.

Research also suggests that strategic relationships extend the boundaries of investigation and give access to the resources of others (McEvily and Zaheer, 1999; Gulati et al., 2000). Moreover, because strategic relationships embody a promise of fair play and a mutually beneficial, long-term relationship, they provide pressure not to behave opportunistically and support investment in relationships that often pay returns only in the long run. As Harland (1996) acutely described putting "network" into supply chain management reflects an attempt to make the latter wider and more strategic by harnessing the resource potential of the network in a more effective manner than competing firms. The important point to note is supply networks as a complex adaptive system are simulated using cellular automata through a dynamic evolution of cooperation and defection among supply network agents. Beyond the goal of achieving product performance, strategic relationship provide a sharing of risk and trust at a level that allows extensive cooperation in strategic business areas and product development from engineering and marketing to production planning, inventory and quality management (Walter et al., 2003).

Therefore, Holmen et al. (2007) described how to develop and to maintain a supply network from upstream and longitudinal supply perspectives. Patnayakuni et al. (2006) denoted strategic supply networks as a series of collective goals and aspirations, in which members have a high level of integration in the operation and each partner has a long-term orientation. By actively engaging in such network, firms recognize that value-generation increasingly rests at the network level rather than at that of the individual firm. Here we adopt the concepts in Hertz (2006) and Gulati et al. (2000) to define supply networks as consisting of interconnected entities whose primary purpose is accessing resources and adding capabilities, moving from raw materials to final customers. Therefore, this chapter suggests that a firm can benefit from harnessing complementarities in supply networks, and that such benefits can accrue more strongly to firms that foster durable linkages. We thus make the following proposition:

Proposition 1: Firms in supply networks should have significant long-term relationships.

With regard to the relationships in a supply network, three elements have been identified: coopetition, dependence asymmetry and resources. All three factors are important tools when describing the general structure or strength of the relationships. Firms cooperate and coordinate with others in order to exchange or share information or resources. Scholars have argued that firms can generate economic rents and achieve superior, long-run performance through simultaneous competition and cooperation (Lado et al., 1997) and that coopetition is the most advantageous relationship between competitors. However, the manufacturer and supplier are separate companies that have individual goals (Iyer and Bergen, 1997), and it is not certain that the supplier will support the manufacturer’s requests. Although some scholars suggest that collaboration among rivals may inhibit competition by facilitating (Porter and Fuller, 1986), others suggest that firms derive valuable resources from their collaborative-competitive relationships and strengthen their competitive capabilities (Gnyawali and Madhavan, 2001). This point is supported by Wathne and Heide (2004), who consider the likelihood that a manufacturer’s request for modifications will be accommodated.

Dependence asymmetry refers to the difference between the organization’s dependence on a partner and the partner’s dependence on the organization (Geyskens et al., 1996). Gadde and Håkansson (2001) mentioned that the focal firm can search for alternative suppliers to become less dependent on specific ones, but both parties can also handle power and dependence in a more constructive way. Narayandas and Rangan (2004) indicated that higher levels of dependence asymmetry may cause relationships to become unstable and dysfunctional. For example, the less dependent organization may exercise its power advantage in the relationship, and thus the more dependent organization may attempt to balance the relationship by becoming less so. We therefore note that dependence asymmetry may influence firm behavior with regard to strategy development.

On the other hand, change may concern the resource ties and capabilities which exist in firms. When these resources and their related active systems have complementarities, their potential to create sustained competitive advantage is enhanced. Dyer and Nobeoka (2000b), representing the resource based view (RBV), claimed that large companies are able to create, adapt, and control a specific network structure due to their position as central actors in a network, and that this forms the basis for strategic action. Additionally, an increasing competitive environment makes it difficult for firms to mobilize the resources that they needed to compete effectively, and the ensuing exchanges have lead to relational interdependency (Arin˜o and de la Torre, 1998; Wernerfelt, 1984; Svahn and Westerlund, 2007). Möller and Halinen (1999) indicated that network vision capability refers to management skills and competencies in creating valid views of networks and their potential evolution. For example, the technological capabilities of a supplier stem from its ability to access and deploy those that exist within its supply network (Walter et al., 2003).

A firm has a collection of different roles toward other actors. In this chapter we try to describe the strength of relationships within a network. The thesis has its foundation on the network perspective, which assumes that firms are interrelated and interconnected to other partners in supply networks through their relationships. Firms react to converging behavior in supply networks, which means a firm that has strong relationships causes its partners to discount the possibility that it will appropriate their idiosyncratic investments, and relational bonds increase the willingness to make RSIs (Relationship-specific Investments) because firms do not want to jeopardize a difficult-to-replace relationship (Palmatier et al., 2007). Alternatively, with increased potential for the disintegration of the relationship, the more dependent organization feels less need to be compliant. In addition, cohesiveness is also lower, and individual firms would tend to divergent behavior as they make adjustments to the strategies made by their peers, and thus depart from the network equilibrium. Thus we present the following proposition:

Proposition 2: Firms react to partners' deviations from the long-term equilibrium by converging or diverging their own behavior towards the equilibrium over the subsequent periods.

In testing these hypotheses we need to include a number of control variables that the literature suggests effect firms and firm behavior in supply networks. Papadakis (2006) discussed the stock performance of two different SCM systems during accounting periods affected in the 921 earthquake in Taiwan. Singh et al. (2005) indicated that the average abnormal stock returns of firms experiencing disruption were about 40% within one to two years after the disruption announcement date. All of above studies have used event history analysis to illustrate the interactions among firms. Meanwhile, all these studies consider the expected profit associated with announcements, as reflected in the abnormal returns of a firm. Abnormal returns are measured using event study methodology. Although a firm's profit is influenced by several factors, and isolating the contribution of any one variable is difficult, the event study methodology provides a means and unique opportunity to assess the impact of a particular strategy on a firm's expected future profits (Nair and Filer, 2003). However, event study methodology may be inappropriate for reactions that are unobservable and occur after considerable delay, when responses may be contaminated by other events. In this chapter, we adopt Nair and Filer (2003) method to test the strength of relationships. This cointegration analysis overcomes some of the limitations associated with prior attempts at modeling firm behavior in supply networks, and allows us to illustrate the firm behavior to the other partners in supply networks.

4.2.2 *Data setting*

Although the automotive component industry comprises hundreds of independent suppliers, this research identified the seven main automotive component manufacturers that work with the Yulon Motor. These are considered the permanent and long-term relationships that Yulon Motor has, in contrast to the many short-term relationships that it maintains with other component manufacturers. Also, the choice of the component manufacturers for this research was dependent upon obtaining adequate data to conduct cointegration analysis. In addition, Tumarkin (2002) suggests that only stocks with a sufficient numbers of messages should be included in such studies, because significant noise and error are introduced by stocks followings. Therefore, the study was based on data collection on each of the eight publicly traded firms which are listed on the Taiwan Stock Exchange, with the data running from February 14, 2001 to November 31, 2005, and consisting of 1247 observations. As Yulon Motor (YML) has a complete supply chain in Taiwan, we selected this firm as the sample in the automotive assembly industry. The stock prices for the eight firms: YML, TY, RW, Juili, TY, KY, CH and Calsonic, are used as samples to observe the network relationships among the assembly manufacturers and the automotive component manufacturers (see Figure 4.1).

These firms are listed on the Taiwan Stock Exchanges. Data on these firms were obtained from the database, an annual publication of Taiwan Institute of Economic Research, a leading institute in Taiwan. To ensure data reliability, the data collected from the database were cross-checked with information obtained from the Taiwan Company Handbook. This investigation found no discrepancies in the data set. Sample was captured by interviewing a few managers at Yulon Motor in Taiwan and also was listed in Taiwan’s 500 largest wealth creator companies. In sampling, it was tried to ensure that the sample companies fulfill two minimum criteria: firstly, the annual turnover is more than one million of dollars, and secondly, the employee strength is more than 100. Appendix B lists the full names of these companies and their main products.

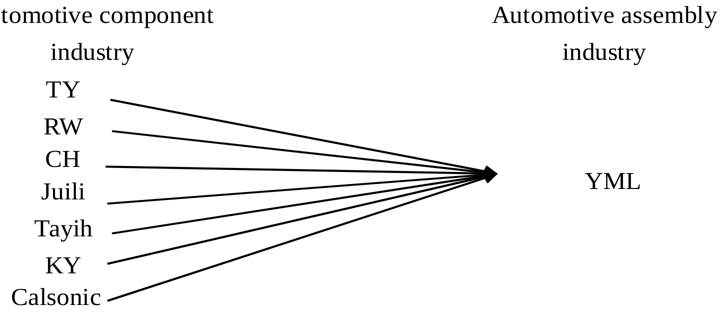

Figure 4.1 Supply network of the automotive industry

Table 4.1 shows the background of the automotive component manufacturers. TY started to produce automotive parts in 1976 and is focused on obtaining orders for higher value-added products, including instrument panels and chroming parts in the OEM market.

Table 4.1 Overview of the automotive component manufacturers

	OEM	Aftermarket
Plastic parts	TY	TY
Stamping mold	RW	
Forging	CH	-
Metal stamping mold Parts	Juili	Juili, KY
Lamps	Taiyih	-
Air Conditioners	Calsonic	-

Additionally, TY has over 80% market share for plastic parts in Taiwan. RW produces pistons, connecting rods, steering system parts. Juili produces metal stamping molds, welding materials, inspection jigs. Taiyih has over 85% market share for automotive lamps in Taiwan. KY was the first producer in sheet metal parts to enter the aftermarket in 2006. CH produces forged products for automobile parts. Calsonic undertakes technical cooperation with

Calsonic-Kansei, and focuses on the OEM market of the car air-conditioning systems. All of these automotive component manufacturers have built long-term cooperative relationships with YML, and TY, Juili and KY were the first suppliers of aftermarket in the North American market. Data on these firms were obtained from the Taiwan Economic Journal Database. The data set adopts the adjusted daily stock price.

4.3. Taiwan’s automotive industry

In Taiwan, the structure of the automotive industry consists of upstream, midstream, and downstream segments working together cooperatively in a consolidated chain. In 2005, Taiwan’s automotive manufacturing industry currently produces about 444,470 vehicles per annum and accounts for 5.50% of the global output. It consists of four vehicle producers: Kuozui Motors, Ltd., Yulon Motor Co., China Motor Co. and Ford Lio Ho Motor Co., Ltd. The majority of these firms have contractual joint ventures with foreign companies, mostly from Japan, and the export areas are in China and American. Linking the manufacturers to end customers is a large number of dealerships. Servicing these core groups are another parties such as designers, marketing consultants and logistics providers. Consequently, the assembly industry and automotive component manufacturing industry not only are the main parts of the automotive industry, but also the midstream of automotive supply chain. Additionally,

Table 4.2 shows both industries sell their products to venders, agents, and automotive manufacturing companies, in the ratio of 69% domestically and 31% internationally (Taiwan Institute of Economic Research, 2005/12).

In addition, the automotive component manufacturers are original equipment manufacturers (OEM) which follow the automotive assembly plans to make automotive parts.

There are about 2,500 automotive component companies in Taiwan, and the majority of them are small- to medium-sized enterprises (SMEs).

Table 4.2 Product value of Taiwan's automotive component and assembly industry

(In millions of US dollars)

	2001	2002	2003	2004	2005 (Q1~Q3)
①Automotive assembly industry	4,300	5,200	6,400	7,200	5,800
(%)	(54.7)	(54.7)	(57.7)	(56.7)	(58)
②Automotive component industry	3,500	4,300	4,700	5,500	4,200
(%)	(45.3)	(45.3)	(42.3)	(43.3)	(42.1)
①+②	7,800	9,500	11,200	12,700	10,000

Source: TTVMA, Ministry of Economic Affairs, Taiwan Institute of Economic Research (2005/12)

Taiwan automotive components firms confronted considerable difficulties at home. In the early years of growth, firms in this segment of the automotive sector benefited from strong government support and extensive technical linkages with Japanese firms. Subsequently, OEM firms remained reliant on foreign partners for advanced technology, and the small market constrained growth. Rising labor costs from the 1980s onwards, the rapid development of China, and accession into the World and Trade Organization (WTO) have forced Taiwanese automotive assembly manufactures, such as YML to begin searching for new survival strategies. As in many advanced industrial nations, moving offshore is one of the most popular strategies for promoting sustained growth and taking advantage of flexible supplier networks, strong operations management capability, obtaining orders for higher value-added products and making long-term relationships with internationally branded automakers (Berger and Lester, 2005, p. 100). Furthermore, Taiwanese foreign investors began relocating extensively in China in the 1990s to lower production costs. Taiwanese automotive components firms then followed, relocating labor- and scale-intensive assembly activities in China while retaining knowledge-intensive and small batch production within Taiwan. Relocation in China also helped Taiwanese suppliers to take advantage of Chinese supply networks, enabling them to connect with Japanese and American assembly manufacturers operating in the country (Li and Sadoi, 2008).

The automotive component industry has also developed as local producers have made steady quality and technical gains and tap into the international aftermarket (AM) demand. In year, Taiwan automotive component manufacturers produced between 85% to 90% of the collision parts in global aftermarket. According to figures compiled by the Taiwan Transportation Vehicle Manufacturers Association, Taiwan firms held over 80 percent of aftermarket collision parts market in North America in 2008, accounting for about 15% of the overall automotive market in North America. In Taiwan, TY is the world's largest manufacturer of aftermarket plastic body parts. TY's international clients include Ford, GM-Opel, Mazda, Mitsubishi, Honda, Nissan, Toyota and Volkswagen (TY website). Taiwan aftermarket component manufactures are currently migrating up the global value chain by focusing on logistics and having integrated capital and intensive technology (Berger and Lester 2005, p. 100; TY website). In this research, we focus on supply networks among automotive component and assembly manufactures.

4.4. Methodology

In empirical analysis, when historical data are non-stationary, cointegration analysis is commonly used to investigate co-movements. However, most of the studies that use this method have some weaknesses, and thus this chapter employs the method in Johansen (1988) to estimate the cointegration vector, and assumes that all the variables in the model are endogenous. The study adopts the perspective of Nair and Filer (2003) to evaluate whether supply networks include long- term relationships in the Taiwanese automotive industry.

To ensure that products are sufficiently profitable when launched, many firms subject them to target costing. The profit margin is a good measurement which can evaluate a firm’s ability to control the costs incurred to generate revenues and can also reflect its operating efficiency (Fairfield and Yohn, 2001). Consequently, the study uses the profit margin as a variable in the cluster analysis was used to produce the number of acceptable groups. This method of cluster analysis was very different from the joining (Tree Clustering). The study adopted k-means clustering algorithm to produce exactly k different clusters of greatest possible distinction. It should be mentioned that the best number of clusters k leading to the greatest separation (distance) is not known as a priori and must be computed from the data. The purpose of the study is to detect supplier segments, for example, groups of respondents that are somehow more similar to each other (to all other members of the same cluster) when compared to respondents that belonged to other clusters. In addition to identifying such clusters, it was usually equally of interest to determine how the clusters are different, for example, determine the profit margin or dimensions that vary and how they vary in regard to members in different clusters. In addition, before undertaking a cointegration test, a non-stationarity test must be performed.

4.4.1 Unit root test

The stationary linear combination may be interpreted as a long-run equilibrium relationship among the variables (Engle and Granger, 1987). Therefore, before undertaking tests of cointegration nonstationarity tests must be performed. Such tests include Dickey and Fuller (1981) who indicated that there are three models that can test for this, and this paper uses the ADF test, as follows. In addition to the nonstationarity condition, tests of cointegration also require that the system variables be integrated of the same order. For example, suppose the researcher detects nonstationarity in the level of a variable, but subsequently finds stationarity in the first difference of the series; they would conclude that the series is integrated of order 1, denoted I(1). Therefore, before testing for cointegration the researcher must be assured that the variables involved are all nonstationary (i.e., not I(0)) and integrated of the same order.

The model used in this chapter includes a drift and a time trend.

$$\Delta y_t = a_0 + r y_{t-1} + \sum_{i=2}^{p} \beta_i \Delta \mathrm{y}_{t-i+1} + \varepsilon_t \qquad \text{(Eq. 4-1)}$$

The null hypothesis for the ADF test is: H_0 : r =0, with the alternative H_1 : -2<r<0. We also adopt the Dickey and Fuller (1981) unit root test for nonstationarity. Our specification contains a constant term and a time trend. The estimation might be biased if the lag length is pre-designed without rigorous determination. Hence, the study uses Akaike's information criterion (AIC) to determine the optimal number of lags based on the principle of parsimony". The econometric software package EViews 4 is used for the empirical analysis.

4.4.2 Cointegration analysis

Nair and Filer (2003) indicated that previous studies examining the dynamic competitive equilibrium in a strategic group are based on short-term analyses and methodologies inappropriate to assessing long-term phenomena. Therefore, Nair and Filer thought that competitive equilibrium should be specific to long-term phenomena and that the cointegration analysis can be used to analyze dynamic competitive equilibrium.

Next, we apply the more powerful Johansen Multivariate Maximum Likelihood cointegration test to investigate the long-run relationship. However, this method contains some drawbacks, so we employ the method presented in Johansen (1988), which we introduce as follows.

The hypothesis is formulated as the restriction for the reduced rank of Π :

$H_0(r): \Pi = \alpha\beta'$ for the reduced form error correction model (ECM):

$$\Delta \mathrm{Y}_t = \Gamma_1 \Delta \mathrm{Y}_{t-1} + \ldots + \Gamma_k \Delta \mathrm{Y}_{t-(k-1)} + \prod Y_{t-1} + \psi D_t + \in_t \qquad \text{(Eq. 4-2)}$$

Where $\in_t$ is white noise, and α and β are both $p \times r$ matrices, and represent the speed of the adjustment parameter and cointegration vector, respectively.

The likelihood ratio test statistic for the hypothesis that there are at most r cointegrating vectors (i.e. H(r): $\text{rank}(\Pi) \leq r$ is: -2 ln Q (H(r)/ H (p) $= -T \sum_{i=r+1}^{p} \ln(1 - \hat{\lambda}_i)$. This chapter adopted Nieh and Lee’s (2001) method, which is based on both Johansen (1988) and Johansen (1994). There are total five Johansen VAR models with ECM, which are summarized in the following forms:

H_0(r): $\Delta \mathrm{Y}_t = \Gamma_1 \Delta Y_{t-1} + \ldots + \Gamma_{k-1} \Delta \mathrm{Y}_{t-k+1} + \Pi \mathrm{Y}_{t-1} + \alpha\beta' \mathrm{Y}_{t-1} + \psi D_t + \in_t$ (Eq. 4-3)

H_1^*(r): $\Delta \mathrm{Y}_t = \Gamma_1 \Delta \mathrm{Y}_{t-1} + \ldots + \Gamma_{k-1} \Delta \mathrm{Y}_{t-k+1} + \Pi \mathrm{Y}_{t-1} + \alpha(\beta', \beta_0)(\mathrm{Y}'_{t-1}, 1)' + \psi D_t + \in_t$ (Eq. 4-4)

H_1(r): $\Delta \mathrm{Y}_t = \Gamma_1 \Delta \mathrm{Y}_{t-1} + \ldots + \Gamma_{k-1} \Delta \mathrm{Y}_{t-k+1} + \Pi \mathrm{Y}_{t-1} + \alpha\beta' \mathrm{Y}_{t-1} + \mu_0 + \psi D_t + \in_t$ (Eq. 4-5)

H_2^*(r): $\Delta \mathrm{Y}_t = \Gamma_1 \Delta \mathrm{Y}_{t-1} + \ldots + \Gamma_{k-1} \Delta \mathrm{Y}_{t-k+1} + \Pi \mathrm{Y}_{t-1} + \alpha(\beta', \beta_0)(\mathrm{Y}'_{t-1}, 1)' + \mu_0 + \psi D_t$

$+ \in_t$ (Eq. 4-6)

H_2(r): $\Delta \mathrm{Y}_t = \Gamma_1 \Delta \mathrm{Y}_{t-1} + \ldots + \Gamma_{k-1} \Delta \mathrm{Y}_{t-k+1} + \Pi \mathrm{Y}_{t-1} + \alpha\beta' \mathrm{Y}_{t-1} + \mu_0 + \mu_1 t + \psi D_t$

$+ \in_t$ (Eq. 4-7)

To analyze the deterministic term, Johansen decomposed the parameters μ_0 and μ_1 in the directions of α and $\alpha_\perp$ as $\mu_i = \alpha\beta_i + \alpha_\perp r_i$, and thus the researchers have $\beta_i = (\alpha'\alpha)^{-1} \alpha' \mu_i$ and $r_i = (\alpha_\perp' \alpha_\perp)^{-1} \alpha_\perp' \mu_i$. The nested sub-models of the general model of null hypothesis $\prod = \alpha\beta'$ are therefore defined as:

H_0(r): Y=0

H_1^*(r): Y=$\alpha\beta_0$

$H_1(r)$: $Y=\alpha\beta_0+\alpha\perp r_0$

$H_2^*(r)$: $Y=\alpha\beta_0+\alpha\perp r_0+\alpha\beta_1 t$

$H_2(r)$: $Y=\alpha\beta_0+\alpha\perp r_0+(\alpha\beta_1+\alpha\perp r_1)t$

Johansen (1994) emphasized the role of the deterministic term, $Y=\mu_0+\mu_1 t$, which includes constant and linear terms in the Gaussian VAR. Johansen (1994) tested the hypotheses H (r) and H^*(r) for the five different models is presented in the following order:

$H_0(0) \rightarrow H_1^*(0) \rightarrow H_1(0) \rightarrow H_2^*(0) \rightarrow H_2(0) \rightarrow H_0(1) \rightarrow H_1^*(1) \rightarrow H_1(1) \rightarrow H_2^*(1) \rightarrow$

$H_2(1) \ldots \rightarrow \ldots \rightarrow \ldots \rightarrow H_0(p-1) \rightarrow H_1^*(p-1) \rightarrow H_1(p-1) \rightarrow H_2^*(p-1) \rightarrow H_2(p-1)$

Applying the idea of Nieh et al. (2005), the decision adopt Johansen (1994) and Johansen (1988) methodologies for a long-term relationship of YML and YML’s suppliers (automotive component manufacturers) with the consideration of a linear trend and a quadratic trend in stock price.

4.4.3 Error correction analysis

The discovery of cointegration among variables indicates the presence of a stable, long-run relationship. Therefore, we can estimate this relationship and examine the adjustment to deviations from this equilibrium. Engle and Granger (1987) formalized this intuition by developing a representation theorem connecting the moving average, autoregressive and error correction representations for cointegrated systems. The resulting model, known as a vector error correction model (ECM), is a generalization of a vector autoregression to allow for variables which contain I (1) processes. Since the ECM can capture both the short-run dynamic and the long-run equilibrium relationship among variables, in this paper we adopt it to examine the relationship among firms’ stock prices. Therefore, consider the following equation system:

$$\Delta A_{jt} = \beta_0 + \beta_{j\varepsilon}(\varepsilon_{t-1}) + \sum_{j=1}^{m}\sum_{i=0}^{n_j}\beta_j \Delta A_{jt-i} + \sum_{j=1}^{m}\sum_{i=0}^{n_j}\beta_{ji}\Delta C_{jt-i} + \in_{jt} \qquad \text{(Eq. 4-8)}$$

The error correct term, ε_{t-1}, represents the previous period's disequilibrium ($A_{jt-1} - \alpha_1 C_{jt-1}$). ε_{at} and ε_{ct} are stationary random processes intended to capture other pertinent information not contained in the lagged values of A_{jt} and C_{jt}. Nonetheless, we use Akaike's information criterion (AIC) to determine the optimal number of lags based on the principle of "parsimony". The short-run parameters β_{ji} along with estimates of the error correction term (ECT) can be obtained through maximum likelihood estimation. The ECT consists of the speed of adjustment parameters $\beta_{j\varepsilon}$, which exists of a long-run relationship among the stock prices of the automotive assembly and component manufacturers, and is validated from the statistically significant finding of the speed of adjustment coefficients.

Nair and Filer (2003) indicated that the speed of adjustment parameters can be interpreted as follows. A negative $\beta_{j\varepsilon}$ is indicative of converging behavior by the firm. Therefore, the cointegration relationship within the group acts as an equilibrium relationship for these firms. However, if the firm responds to the positive deviation from the equilibrium in the subsequent periods by making this deviation even larger this produces a positive $\beta_{j\varepsilon}$, indicating that a firm is referencing its peers and yet diverges from them. Such nonconforming behavior may be characterized as differentiating or entrepreneurial.

4.5. Results

We perform the k-means clustering algorithm to produce exactly three different clusters of greatest possible distinction, and the automotive component manufacturers are further divided into three groups. Table 4.3 shows that TY, RW and CH are the first group, Juili and Tayih are the second group, and KY and Calsonic are the third group.

Table 4.3 Cluster analysis of automotive component manufacturers

Firm Stock	TY	RW	CH	Juili	Tayih	KY	Calsonic
Clusters	1	1	1	2	2	3	3

The characters of group 1: Margins are higher so, rather than minimization of cost, the focus is on short lead times and flexibility to profit from the high, but short lived margins (Chesbrough and Teece, 1996). Firms in the group 1 primary concern innovative product to cause speed, flexibility, or agility to the market. Firms also focus simply on cost and are concerned with being lean.

The characters of group 2: Margins of group 2 is inferior to group 1. Firms in the group 2 stemmed from two important sources: international process characteristics and external market condition. Meanwhile, low variety or high volumes, creating fairly stable production, as they main concern. For example, in previous discuss, Juile attempts to supply metal stamping molds, welding material, inspection jigs to Japan, American, Canada and Southeast Asia.

The characters of group 3: Margins of group 3 is inferior to group 2. Margins for such products are typically low so minimization of cost through, for example, achieving low inventories and high production runs, is the primary target. Firms operate should not merely seek to be cost efficient, or fast, or flexible but achieve all of these at the same time although not to the same extent (Hayes and Pisano, 1994). KY is the first suppliers of aftermarket in the North American market.

4.5.1 Unit-root test

We perform the Dickey- Fuller unit roots for nonstationarity. Our specification contains a constant term and a time trend. Dickey- Fuller derived test statistics which test the null hypothesis that y_t is indeed nonstationary. Table 4.4 shows that all the firms' stock prices do not reject the unit root test at least a 5% significance level. However, the results from Dickey-

Fuller unit roots test reveal for the first difference of each variable are stationary.

Table 4.4 Tests for the order of integration based on the Dickey-Fuller test

Variables	R(0)	R(1)
TY	-1.05	-19.28*
RW	-2.24	-16.74*
CH	-1.92	-33.61*
Tayih	-1.20	-18.12*
Juili	-4.02	-15.00*
KY	-1.15	-15.65*
Calsonic	-1.25	-16.46*
YML	-1.34	-16.98*

Notes:

1. The unit root test is based on the AIC with fours lags, and the 5% and 1% critical values are -3.45 and -4.04, respectively.
2. * denotes rejection of the hypothesis at the 5% critical value

4.5.2 Cointegration analysis

Table 4.5 presents the empirical findings from the Johansen methodology for the long-run relationship with the consideration of a linear trend and a quadratic trend in stock price for each partnership network. YML and YML’s component manufacturers are divided into three groups of high, medium and low profit margin. For the first group, the results indicate that the firm’s stock price has one cointegration relationship with the trance value of $T_0(r)$ (44.26) exceeds the critical value of 39.89 at 95% of the null of rank=0. In addition, these empirical finding again suggests that there exists one cointegration vector among the three groups’ stock prices for each supply network according to the trance values exceeds the critical values. When each group has a cointegration relationship it means that there is a comovement phenomenon among the assembly company (YML) and YML's component manufacturers (TY, RW, CH, Juili, Tayih, Kaiyih, Calsonic) in supply networks.

Table 4.5 Determination of cointegration rank in the presence of a linear trend and a quadratic trend

YML and YML's suppliers(component manufacturers)										
YML TY RW CH										
	Model 1 $H_0(R)$		Model 2 H_1^* (R)		Model 3 H_1 (R)		Model 4 H_2^* (R)		Model 5 H_2 (R)	
Rank	$T_0(r)$	Critical Value	T_1^* (r)	Critical Value	$T_1(R)$	Critical Value	T_2^* (r)	Critical Value	$T_2(r)$	Critical Value
r=0	42.26^*	39.89	54.20^*	53.12	52.67^*	47.21	56.83	62.99	42.26^*	39.89
r≤1	20.23	24.31	28.95	34.91	27.63	29.68	30.41	42.44	20.23	24.31
YML Juili Tayih										
r=0	28.87^*	24.31	32.58	34.91	30.77^*	29.68	44.19^*	42.44	43.23^{**}	40.49
r≤1	8.67	12.53	11.93	19.96	11.20	15.41	13.19	25.32	12.32	23.46
YML KY Calsonic										
r=0	24.31^*	24.31	40.88^*	34.91	39.79^*	29.68	44.51^*	42.44	42.82^*	40.49
r≤1	8.74	12.53	11.20	19.96	10.42	15.41	13.55	25.32	12.62	23.46

Notes:

1. $T_0(r)$, T_1^* (r), $T_1(r)$, T_2^* (r), and $T_2(r)$ denote the likelihood ratio test statistics for all the null hypotheses of H(r) versus the alternative of H(p) which include all the cases.

2. The numbering of the rank is from left to right and top to bottom and decide to reject a hypothesis if all hypotheses with smaller number are also rejected.

3. * (**) denotes rejection of the hypothesis at the 5% (1%) level

4. VAR length is selected based on the smallest number of AIC.

Thus, overall the results show that all the nonstationarity series in the three groups of YML with YML's component manufacturers were cointegrated. The results tend to support proposition 1, that firms in supply networks should have significant long-term relationships.

4.5.3 Estimation of the vector error correction model

As we can see in Table 4.6, with the exception in YML with its suppliers of Calsonic, all the coefficient of long-run equilibrium terms are statistically significant at least at the 10% significant level. Table 4.6 also provides the estimates of the speed of adjustment parameter along with the corresponding results from t-test of significance. First, the model for the high profit margin group contains three significant speed of adjustment parameters: that of TY (0.020), RW (0.002) and CH (-0.003). In addition, both TY and RW estimates are positive, suggesting that any action by the firm leads to a positive deviation from the long-run relationship results in the firm continuing to diverge in the sequential periods. YML itself display convergent behavior (-0.004), but the estimate is insignificant. Second, two of three for the medium profit margin group contains two significant speed of adjustment parameters: that of juili (0.004) and Tayih (0.013). Additionally, Juili and Tayih of estimates are positive. YML itself does display convergent behavior (-0.001), but the estimate is insignificant. Finally, the model for the low profit margin group contains only one significant speed of adjustment parameter: that of KY (-0.003). In addition, YML itself does display convergent behavior (-0.002), but the estimate is insignificant. The results tend to support proposition 2, that when partners have a long-term equilibrium, individual firms tend to converge or diverge behavior towards the equilibrium.

Table 4.6 Error correction model

	dYML	*dTY*	*dRW*	*dCH*
EC_{t-1}	-0.004	0.020^{***}	0.002^{*}	-0.003^{*}
dYML(1)	0.005	0.001	0.013	0.013
dTY(1)	0.017	0.068^{**}	0.005	-0.009
dRW(1)	-0.043	-0.121	0.042	0.139^{**}
dCH(1)	-0.082	0.078	0.022	0.041
F-stst	1.608	4.743^{**}	2.864^{**}	5.581^{**}
	dYML	*dJuili*	*dTayih*	
EC_{t-1}	-0.001	0.004^{**}	0.013^{**}	
dYML(1)	-0.010	-0.010	-0.032	
dJuili (1)	-0.050	0.084^{**}	0.000	
dTayih(1)	0.017	0.007	0.009	
F-stst	0.010	7.698^{**}	4.361^{**}	
	dYML	*dKY*	*dCalsonic*	
EC_{t-1}	-0.002	-0.003^{**}	0.000	
dYML(1)	-0.030	0.002	0.025	
dKY(1)	-0.022	0.079^{**}	0.046	
dCalsonic(1)	0.048	-0.046^{*}	0.022	
F-stst	1.411	11.696^{**}	1.146	

Note: 1. (*), (**) and(***) denote significant at 10%, 5% and 1%, respectively. The significance test in a 10%, 5% and 1% critical value for the traditional t-test with d.o.f. of 4 and 3 are (1.5332, 2.1318, 3.7469) and (1.63, 2.35, 4.5407), respectively.
2. The model is adopted model 1 of Johansen (1994) tested and estimated with one lag of the endogenous variables.
3. (*) and (**)denote significant at 5% and 1%. The 5% and 1% critical values for F-statistic with d.o.f of 3 and 2 are (2.61, 3.00) and (3.80, 4.63), respectively.
4. VAR assumes no deterministic trend and no intercept in CE (model 1 of table 4.5).

4.6. Discussion

This paper had two aims: first, to explore the long-term relationships among the assembly companies and their component manufacturers; and second, we investigated the strength of relationships with the other partners. Next, we discuss how the work addressed these two aims.

4.6.1 Cointegration in the supply network relationships

We found that all firms' stock prices are nonstationary. These nonstationary series display no long-term mean reversion, and shocks to the series tend to die out slowly over time. The purpose of the paper was to examine long-term relationships among the assembly companies and the component manufacturers. Our cointegration analysis finds that firms have significant long-term relationships in supply networks. These results lead to the conclusion that relationships among automotive component and assembly manufactures have been transformed. First-tier component firms have become more involved with their customers and tend to provide black box parts or systems. It is also important to understand what integrates the pieces of the network - the "glue" that holds it together. In this case the "glue" consists primarily of the information technologies that are the heart of modern retailing. Venkatraman and Henderson (1998) provides scenarios how e-integration can support network resource configuration. First, IT can support sourcing standard models or components in the form of electronic data interchange (EDI), Web site, and trading process network. Second, IT is the backbone of process outsourcing, where firms outsource their information intensive business process, such as accounting, to external specialists without loss of control. In some cases, effective integration requires updating information on even a daily basis. While coordination activities had been crucial, their importance across vehicle systems has increased dramatically over the past twenty years with the introduction of advanced electronics that impact multiple systems (Novak and Stern, 2009). Third, IT can provide electronic exchange platforms, such as B2B, to support resource coalitions where firms become part of a dynamic network of complementary capabilities.

Briefly, the characteristic of IT in dynamic network was included full-disclosure information systems, which denoted participants agreed on a general structure of payment for value added and then hooked themselves together in a continuously updated information system so that contributions can be mutually and instantaneously verified (Miles and Snow, 1986).

4.6.2 *Estimates of adjustment behavior*

Once we identified the presence of long-term interdependence within the groups, we examined the exact nature of the cooperative relationships. The finding of ECM indicates that the firms are referencing each other in a consistent way, and this may result in convergent or divergent behavior. In one (out of seven) instances, a firm demonstrated an error correction process that was significant and converged towards the group equilibrium. Woo and Ennew (2004) noted that maintaining long-term relationships requires institutionalization and adaptation, as well as coordination. This point is support by Smyth and Pryke (2008), who pointed out that collaborative relationships operate both in frameworks and within networks of contacts, e.g. relational contracting in partnering, SCM and other procurement-driven initiatives.

However in three instances we found positive and significant results, suggesting that some firms displayed behavior that was divergent with others. According to Woo and Ennew (2004, p.1255), short-term relationships develops through product or service exchange, information exchange, financial exchange, and social exchange between the buyer and suppliers. Moreover, it is without doubt that supply chain collaboration activities can lead to product innovations. More specifically, partners amalgamate with other firms to construct a financial vision, and some firms are absorbed into others due to the cost factors surrounding the supply chain collaboration relationship. In the context of this chapter, global automakers transfer their production to East Asia in order to reduce their costs, and this causes local region component manufacturers to reduce their reliance on local automotive assembly manufactures. For example, Tayih has successfully tapped into the global component manufacturers and tier-one automotive parts supply chains, while TY and Juili produce automotive parts for OEM and the aftermarket in the North American market. Table 4.7 shows that TY and Juili continuously increased their production value in the aftermarket from 2000 to 2003.

Table 4.7 The production value of TY and Juili in the aftermarket

		2000		2001		2002		2003	
		Aftermarket	OEM	Aftermarket	OEM	Aftermarket	OEM	Aftermarket	OEM
TY	Average monthly revenue	4.47	3.65	4.90	2.67	5.39	3.25	6.02	4.16
	RR (%) ①	32.26	25.98	36.08	19.65	37.95	22.89	35.86	24.74
Juili	Average monthly revenue	5.75	1.17	4.91	1.21	5.58	1.01	6.39	1.15
	RR (%) ①	80.12	16.26	77.88	19.26	82.57	15.01	83.91	15.12

Note: In millions of US dollars, exchange rate calculation according to Central Bank of China (Taiwan)

① ratio to total revenue, RR: revenue divided by total revenue

4.7. Summary

This chapter provides empirical evidence of the strength of relationships and at the same time examines firm behavior in supply networks. It found that long-term relationships are a driver of complementary resources and sustained competitive advantage (Dyer and Singh, 1998). In addition, firms tend to follow relational and organizational norms to ensure that they are consistent in their behavior (Cannon et al., 2000; Palmatier et al., 2007). Womack et al. (1990) on the global automotive industry showed the significance of establishing a basic contract to ensure the long-term commitment of all parties during both product development and operation, and to allow sensitive information and knowledge to be exchanged. Luo and Kim (2009) indicated that Japanese automotive suppliers emphasize the focus on quality, cost and delivery in their current product portfolio for current customers, and their reluctance to develop radical new products and explore new customer base. Explanations include: the reliance on the pull of the automakers, slow-paced “corporate DNA” formed in the historical and deep involvement in the automotive business for long-term transactional relationships with customers.

On the other hand, this chapter’s examination of short-term relationships shows that some firms construct a financial vision and are absorbed into others due to the cost factors surrounding the supply chain collaboration relationship. However, there are two reasons that explain this. First, firms often establish relationships based on contracts to deal with arm’s length relationships and seek to maximize their own bargaining powers (Singh et al., 2005). Automotive components manufacturers in the West have traditionally been strong adherents to the contractual model, especially in the aftermarket, this causes component manufacturers to reduce reliance on automotive assembly manufactures. Second, aftermarket suppliers not only offer an opportunity to provide replacement parts, but also follow the requirement for continual cost reductions. Such financial exchanges cause firms to have divergent behavior.

The results show that supply networks are complex; they often play out over long periods, and may result in different behavior. We chose the Cointegration analysis because it is well suited to examining the dynamic competitive equilibrium in a strategic group to assessing long-term phenomena over time (Nair and Filer, 2003). It also allows us to examine the occurrence of long-term and short-term relationship in an automotive supply network. Large-scale survey and case studies are inappropriate or impractical to pursue the objectives of the study. Large-scale survey would have to entail longitudinal data collection to capture the evolutionary nature of the supply networks and that would also be extremely difficult, if not impossible, to execute. Case studies would lack external validity, and when conducted in a longitudinal context long enough to capture the evolutionary decision-making patterns, the amount of data would simply be unmanageable (Nair et al., 2009). Unlike most studies in the literature, which only estimate the contemporaneous relationships, this paper also explored the strength of relationships in an automotive supply networks. This paper supports the findings of most of the previous studies that significant long-term relationships exists in supply networks, and that such networks need long-term cooperation and the development of mutually beneficial and interdependent relationships (Chan et al., 1997; Kale et al., 2002).

CHAPTER 5 SUMMARY AND CONCLUSION

5.1. Conclusions

This study provides empirical evidence on linkage performance within the framework of SCM. We make conclusions of this thesis bellow statement:

In Part Ⅰ study of chapter 4, the key objective is to examine how the technological innovations influence financial effect on the innovation company as well as on its chain partners. In particularly, we examine three key topics including: (1) the magnitude of financial effect correlations on chain partners prior to the technological innovations; (2) the immediate impact of technology innovations (TI) on the company's stock price, and its subsequent impacts on the prices of its partners on the supply chain; and (3) the time effects of the financial advantages of technology innovation on the company. The results show: first, a significant positive stock price effect resulting from supply chain collaboration, even though the correlation of the TSMC chain was slightly higher than UMC chain; secondly, the innovation impact on returns for a company will affect its own company's stock price and its SR of supply chain partners'; third, the effect exhibited a time (3 months) delay until the beneficial impacts over technologically non-innovative competitors was realized and only lasted for the time period between their adaptations of the similar innovative technology, 6-months.

However, the purposes of the part II study in chapter 4 are: (1) to examine why firms form networks and to explore whether firms in supply networks should have long-term relationships; (2) if firms have formed a network and maintained long-term relationships, then we investigate the strength of relationships with partners and illustrate firm behavior form a single supply network. The results provides: first, long-term relationships are a driver of complementary resources and sustained competitive advantage (Dyer and Singh, 1998). In addition, firms tend to follow relational and organizational norms to ensure that they are consistent in their behavior (Cannon et al., 2000; Palmatier et al., 2007); second, this chapter's examination of short-term relationships shows that some firms construct a financial vision and are absorbed into others due to the cost factors surrounding the supply chain collaboration relationship. However, there are two reasons that explain this; third, supply networks often play out over long periods, and may result in different behavior; forth, the study also supports the findings of most of the previous studies that significant long-term relationships exists in supply networks, and that such networks need long-term cooperation and the development of mutually beneficial and interdependent relationships (Chan et al., 1997; Kale et al., 2002).

As concluded in the previous section, we then discussed how the study addressed the main objectives.

Developing strategic relationship

The higher the correlation of SR, the higher the collaboration between upstream and downstream of the chain partners is. The study showed that there is a significant pair-wise positive correlation among IC chain. At the same time, significant long-term relationships exists in supply networks, and that such networks need long-term cooperation and the development of mutually beneficial and interdependent relationships (Chan et al., 1997; Kale et al., 2002).

Robust IC supply chain

Mutual cooperation among chain relationship is the goal for developing a collaborative supply chain. Fichman and Levinthal (1991) denoted a relationship endures over time, a supplier and a buyer stand to develop idiosyncratic interaction routines that allow them to communicate and collaborate more effectively. The results of our study show that TSMC developed a collaborative relationship with its upstream and maintained a supply network from upstream and longitudinal supply perspectives. This point is agreed with Dyer and Singh (1998) who indicated long-term relationships are a driver of complementary resources and sustained competitive advantage. Therefore, this study suggests that a firm can benefit from harnessing complementarities in supply chain relationship, and that such benefits can accrue more strongly to firms that foster durable linkages.

From our reading of the literature and previous empirical evidence of supply chain linkage performance, the starting point for such a perspective has to take into account two aspects: innovative-unique and functional products and product complexity (Lamming et al., 2000) in the task of managing supply chain.

Innovative-unique and functional products

Companies who supplied what could be characterized as innovative-unique products, and who possessed unique knowledge and technologies, appeared to differ significantly from others in the ways they managed their networks in terms of strategy and process priorities. The electronic product of IC industry was both innovative in the sense of being new and unique in the sense that it was being described as core.

Product complexity

The findings show that the supply networks of relatively complex products were much broader upstream than supply networks of less complex products generally as a result of the large number of components. However, technical product and material standards, regulations in their business environment, coupled with very high levels of process technology, made supply important but complex to control, for example automotive industry.

5.2. Summary of contributions

This study provides empirical evidence on linkage performance within the framework of SCM. We make contributions of this thesis bellow statement:

In Part Ⅰ study of chapter 3, the managerial implications are as follows. First, the supply chain integration is inevitable, their coordination and collaboration will have impacts on their financial effects. Thus, each company must be careful in selecting their chain partners. Second, an innovative firm may strengthen the linkages with upstream suppliers and downstream customers on the supply chain through substantial technology investments and critical innovations. The mutual benefit relation with innovations may offer concrete competitive advantages for the chain as a whole. Third, the innovation technology will impact the company's financial effect even though this will only last till competitors adopt the similar technology. For enterprises to survive and prosper, they need to retain competitive advantages. They also need to learn how to protect the innovation beyond the need to capture and leverage this knowledge. There must be a culture of continuous improvement or a rise on a particular S curve, as well as incentives to move to a new S curve (Roy et al., 2004). The collaborative partners of semiconductor industry supply chain should create effective linkages between technological arrangements (Geels, 2004) and upgrade their technology innovation activities enhance the value derived from each other.

Consequently, in Part II study of chapter 4, the results of this chapter can help managers and academics better understand why firms form long-term relationships in supply networks, and illustrate firms' strategies with regard to convergent (divergent) behavior. Moreover, the article contributes to the supply chain management literature by undertaking an extensive examination of dynamic behavior by firms that are embedded in supply networks as buyers and suppliers in the automotive industry. The role of incentive structures in shaping behavior in the supply network level is presented. More specifically, the reason why the interaction between suppliers is much more complicated is because automotive component manufacturers are from multiple sources, and the assembly firms make contracts with component manufacturers over a long period before the vehicles are sold to the market. It is thus important for collaborative partners in the automotive industry to develop and maintain long-term relationships, as by doing so they are able to obtain more benefits and become more competitive.

5.3. Further research

The presented the financial effect correlation on the direct supply chain configuration, which integrates and links immediate upstream provider and downstream customer to effectively and efficiently respond to end users. Yet, there are still several reasons should be considered. The collaborative partners of semiconductor industry supply chain should upgrade their technology innovation activities and enhance the value derived from each other. One of which is the continuous technology progress, it needs to consider and to gather enough evidence that innovation needs adopting product differentiation, particularly more knowledge-intensive products as the dominant competitive strategy. Future work should explicitly take continuous technology innovation activities associated with collaboration partners into account.

Additionally, in the second part study of chapter 4, the thesis focuses on exploring the effect on relationships within a network configuration. Future work should explicitly take relational contracting in partnering, SCM and other procurement-driven initiatives into account, which is support by Smyth and Pryke (2008) who pointed out that collaborative relationships operate both in frameworks and within networks of contacts. Tsay et al. (1998) indicated that contracts are an important area of study in disciplines other than supply chain management such as in law and economics, and there are several useful definitions. An important rationale for a contract that is not typically modeled is that it makes the terms of a relationship explicit. It would be interesting to find supply chains and take relational contracting in partnering where the dynamics of business environment parameters are dependent on time and have such a significant influence.

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REFERENCES

Agrawal J, Kamakura, WA (1995). The economic worth of celebrity endorsers: an event study analysis. J. Marketing. 59(3): 56-62.

Andel T (2001). The consumer electronics challenge. Material Handling Manage. 56(3): 48-49.

Arin˜ o A, de la Torre J. (1998). Learning from failure: towards an evolutionary model of collaborative ventures. Organ. Sci. 9: 306-325.

Ballou RH (2004). “Business Logistics/Supply Chain Management: Planning, Organizing, and Controlling the Supply Chain (5th ed)”. NJ: Prentice Hall.

Balthasar A, Bättig C, Thierstein A, Wilhelm B (2000). Developer: key actors of the innovation process. Types of developers and their contacts to institutions involved in research and development, continuing education and training, and the transfer of technology. Technovation. 20(10): 523-538.

Berger S, Lester RK (2005). “Global Taiwan: Building Competitive Strengths in a New International Economy”, NY: ME Sharpe.

Booz, Allen and Hamilton (1982), “New Product Management for the 1980’s”. NY: Booz-Allen and Hamilton.

Bowersox DJ, Closs DJ, Cooper MB (2002). “Supply chain logistics management”. New York: McGraw-Hill/Irwin.

Bowersox DJ, Closs DJ, Stank TP (2003). How to master cross-enterprise collaboration. Supply Chain Manage Rev. 7(4): 18-27.

Box, GEP, Jenkins GM (1976). “Time Series Analysis: Forecasting and Control”. San Francisco: Holden-Day.

Boyer R, Freyssenet M (2002). “*The productive models*”. New York: Palgrave Macmillan.

Bresser, RKF (1988), Matching collective and competitive strategies. Strateg. Manage. J. 9: 375-385.

Brillinger (1981). “Time series Data Analysis and Theory”. New York: McGraw-Hill.

Cannon JP, Achrol RS, Gundlach GT (2000). Contracts, norms, and plural form governance. J. Acad. Mark. Sci. 28: 180-94.

Carr AS, Pearson JN (1999). Strategically managed buyer-seller relationships and performance outcomes. J. Oper. Manage. 17(5): 497-519.

Chan S, Kensinger J, Keown A, Martin, J (1997). Do strategic alliances create value? J. Financ. Econ. 46: 199-221.

Chattfield, C (1975). “The Analysis of Time Series”. An introduction. New York: Chapman and Hall.

Chen IJ, Paulraj A (2004a). Understanding supply chain management: Critical research and a theoretical framework. Int. J. Prod. Res. 42(1): 131-163.

Chen IJ, Paulraj A, Lado AA (2004b). Strategic purchasing, supply management, and firm performance. J. Oper. Manage. 22(5): 505-523.

Chesbrough HW, Teece DJ. (1996). When is virtual virtuous? Organizing for innovation. Harvard Bus. Rev. 74(1): 65-73.

Choi TY, Krause DR (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. J. Oper. Manage. 24(5): 637-652.

Choi TY, Wu Z (2009). Triads in supply networks: Theorizing buyer supplier- supplier relationships. J. Supply Chain Manage. 45(1): 8-25.

Choi TY, Wu Z, Ellram L, Koka B (2002). Supplier-supplier relationships and their implications on buyer-supplier relationships. IEEE Trans. Eng. Manage. 49(2): 119-130.

Christopher M. (1998). Logistics and Supply Chain Management, 2nd ed., London: Prentice Hall.

Corbett CJ, Blackburn JD, Van Wassenhove LN (1999). Partnerships to improve supply chains. Sloan Manage. Rev. (4): 71-82.

Coughlan A T, Anderson E, Stern LW, El-Ansary, AI (1996). “Marketing channels”. New Jersey: Prentice Hall.

Coyle JJ, Bardi, EJ, Langley CJ, (2003). “The management of business logistics: A supply chain perspective”. Canada: South-Western Thomson Learning.

Croom S, Romano P, Giannakis M (2000). Supply chain management: An analytical framework for critical literature review. Eur. J. Purchasing Supply Manage. 6(1): 67-83.

D’avanzio RH, von Lewinski H, Van Wessenhove LN (2003). The link between supply chain and financial performance. Supply Chain Manag. Rev. 7(6): 40-47.

da Silveira GJC, Caglian R (2006). The relationship between interorganizational information systems and operations performance. Int. J. Operations Product. Manage. 26(3): 232-253.

Damanpour F (1991). Organizational innovation: a meta-analysis of effects of determinants and moderators. Acad. Manage. J. 34 (3): 555-590.

Das TK, Rahman N (2001). Partner misbehaviour in strategic alliances: Guidelines for effective deterrence. J. of General Manage. 27(1): 43-70.

Dickey DA, Fuller WA (1981). Likelihood ratio statistics for autoregressive time series with a unit root. Econometrica. 49: 1057-1072.

Dickey DA, Pantula SG (1987). Determining the order of differencing in autoregressive processes, J. Bus. Econ. Statist. 5: 445-461.

Drucker PF (1985). “Innovation and Entrepreneurship: Practice and Principles”, London: Heinemann.

Drucker PF (1997). Toward the new organization. Executive Excellence. 14(2):7-8.

Dyer JH (2000a). “Collaborative Advantage: Winning Through Extended Enterprise Supplier Networks”, NY: Oxford University Press.

Dyer JH, Nobeoka K (2000b). Creating and managing a high-performance knowledge-sharing network: The Toyota case, Strateg. Manage. J. 21(3): 345-367.

Dyer JH, Singh H (1998). The relational view: Cooperative strategy and sources of inter organizational competitive advantage. Acad. Manage. Rev. 23(4): 660-679.

Easton G, Araujo L (1986). Networks, Bonding and Relationships in Industrial Markets, Ind. Market. Purchasing. 1(1): 5-25.

Ebers M, Jarillo JC (1998). The construction, forms, and consequences of industry networks. Int. Stud. Manage. Organ. 27(4): 3-21.

Engle RF, Granger CWJ (1987). Cointegration and error correction: Representation, estimation, and testing. Econometrica. 55: 251-76.

Fairfield PM, Yohn TL (2001). Using asset turnover and profit margin to forecast changes in profitability. Rev. Account. Stud. 6: 371-385.

Fang LY, Wu SH (2006), Accelerating innovation through knowledge co-evolution: a case study in the Taiwan semiconductor industry. Int. J. Tech. Manage. 33(2-3): 183-195

Fawcett SE, Calantone RJ, Roath A (2000). Meeting quality and cost imperatives in a global market. Int. J. Physical Distribution Logist. Manage. 30(6): 472-490.

Fichman M, Levinthal DA (1991). History dependence and professional relationships: ties that bind. Res .Sociology Organ. 8: 119-153.

Frohlich MT, Westbrook R (2001). Arcs of integration: An international study of supply chain strategies. J. Oper. Manage. 19: 180-200.

Gadde LE, Håkansson H (2001). “Supply Network Strategies”. Chichester: Wiley.

Geels FW (2004). From sectoral systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory. Res. Pol. 33(6-7): 897-920.

Geyskens I, Steenkamp JBEM, Scheer LK, Kumar N (1996). The effects of trust and interdependence on relationship commitment: A trans-Atlantic study. Int. J. Res. Mark. 13: 303-317.

Gnyawali DR, Madhavan R (2001). Cooperative networks and competitive dynamics: A structural embeddedness perspective. Acad. Manage. Rev. 26: 431-445.

Golicic SL, Foggin JH, Mentzer JT (2003). Relationship magnitude and its role in interorganizational relationship structure. J. Bus. Logist. 24(1): 57-75.

Gulati R, Nohria N, Zaheer A (2000). Strategic networks, Strateg. Manage. J. 21(3): 203-215.

Handfield RB, Nichols EL (1999). “Introduction to Supply Chain Management”. NJ: Prentice Hall.

Hanel P, St-Pierre A (2002). Effects of R&D spillovers on the profitability of firms. Rev Ind. Organ. 20: 305-322.

Harland C, Zheng J, Johnsen T, Lamming R (2004). A conceptual model for researching the creation and operation of supply networks. Brit. J. Manage. 15: 1-21.

Harland CM (1996). Supply chain management relationships, chains and networks. Brit. J. Manage., 7: S63-S81.

Hayes RH, Pisano GP (1994). Beyond world class: the new manufacturing strategy. Harvard Bus. Rev. 72(1): 77-86.

Hayes RH, Wheelwright SC (1984). “Restoring our competitive edge- competing through manufacturing”. New York: Wiley.

Hendricks KB, Singhal VR (2005). An empirical analysis of the effect of supply chain disruptions on long-run stock price performance and equity risk of the firm. Prod. Oper. Manage. 14(1): 35-52.

Hendricks KB, Singhal VR, Stratman JK (2007). The impact of enterprise systems on corporate performance: a study of ERP, SCM and CRM system implementations. J. Oper. Manage. 25: 67-82.

Hertz S (2006). Supply chain myopia and overlapping supply chains. Bus. Ind. Mark. 21(4): 208-217.

Hertzel MG, Lia Z, Officerb MS, Rodgers KJ (2008). Inter-firm linkages and the wealth effects of financial distress along the supply chain. J. Finan. Econ. 87: 374-387.

Holmen E, Pedersen AC, Jansen N (2007). Supply network initiatives - A means to reorganize the supply base? J. Bus. Ind. Mark. 22(3): 178-186.

Hunt SD, Morgan RM (1994). Relationship marketing in the era of network competition. Marketing Manage. 3(1): 18-27.

Iacobucci D, Hopkins N (1992). Modeling dyadic interactions and networks in marketing, J. Market. Res. 29(1): 5-17.

Ireland RD, Webb JW (2007). A multi-theoretic perspective on trust and power in strategic supply chains, J. Operations Manage. 25(2): 482-497.

ITIS (2005), "Industrial Technology Research Laboratory Industrial Economics and Knowledge Center". Semiconductor Industry Yearbook. Industrial Technology Intelligence Service, Taiwan.

Iyer AV, Bergen ME (1997). Quick response in manufacturer retailer channels. Manage. Sci. 43(4): 559-70.

Johansen S (1988). Statistical analysis of cointegration vectors. J. Econ. Dynam. Control 12: 231-234.

Johansen S (1994). The role of the constant and linear terms in cointegration with applications to the demand for money. Oxford Bull. Econ. Statist. 10(1): 71-81.

Johnson B (1992). "Institutional Learning, in, Lundvall B-A (ed): National System of Innovation: Towards a Theory of Innovation and Interactive Learning". London: Pinter Publisher.

Johnson JL (1999). Strategic integration in industrial distribution channels: Managing the inter-firm relationship as a strategic assets. Acad. Mark. Sci. 27(1): 4-18.

Jüttner U, Schlange LE (1996). A network approach to strategy. Int. J. Res. Mark.1 3(5): 479-494.

Kale P, Dyer J H, Singh H (2002). Alliance capability, stock market response, and long-term alliance success: The role of the alliance function. Strateg. Manage. J. 23: 747-767.

Kale P, Singh H, Perlmutter H (2000). Learning and protection of proprietary assets in strategic alliances: Building relational capital. Strateg. Manage. J. 21: 217-237.

Kale P, Singh H, Perlmutter, H (2000). Learning and protection of proprietary assets in strategic alliances: Building relational capital. Strategic Manage. J. 21(3): 217-237.

Kent Jr. JL, Flint DJ (1997). Perspectives on the evolution of logistics thought. J. Bus. Logist. 18(2):15-29.

Kogut B, Zander U (1992). Knowledge of the firm, combinative capabilities, and the replication of technology. Organ. Sci. 3 (3): 383-397.

Kotabe M, Martin X, Domoto H (2003). Gaining from vertical partnerships: Knowledge transfer, relationship duration, and supplier performance improvement in the U.S. and Japanese automotive industries. Strateg. Manage. J. 24: 293-316.

Lado AA, Boyd NG, Hanlon SC (1997). Competition, cooperation, and the search for economic rents: A syncretic model. Acad. Manage. Rev. 22: 110-141.

Lambert DM, Cooper MC (2000). Issues in Supply Chain Management. Ind. Marketing Manage. 29: 65-83.

Lamming R, Johnsen T, Zheng J, Harland C (20000). An initial classification of supply networks. Int. J. Operations Product. Manage. 20(6): 675-691.

Leiponen A (2000). Competencies, innovation and profitability of firms. Econ. Innovation New Tech. 9: 1-24.

Li LR, Sadoi Y (2008). Taiwanese automotive parts suppliers in China. Asia Pacific Bus. Rev.

14(1): 119-146.

Luo J, Kim H (2009). “Tendency Toward Specificity in Transactions and Compliance to Hierarchy: A Report on The Interviews with Japanese Automotive Suppliers”. Manufacturing Management Research Center. No. 268

Mabert VA, Venkataramanan MA (1998). Special research focus on supply chain linkages: challenges for design and management in the 21st century. Dec. Sci. 29(3): 537-552.

Maslennikova I, Foley D (2000). Xerox’s approach to sustainability. Interfaces. 30(3): 226-233.

Masters JM, Pohlen TL (19994). “Evolution of the logistics profession”. In: Robeson JF, Copacino WC, editors. The logistics handbook. New York: The Free Press.

McDermott CM, O’Connor GC (2002). Managing Radical Innovation: An Overview of Emergent Strategy Issues. J. Product Innovation Manage. 19: 424- 438.

McEvily B, Zaheer A (1999). Bridging ties: A source of interfirm heterogeneity in competitive capabilities. Strateg. Manage. J., 20(12): 1133-1156.

Mentzer JT, DeWitt W, Keebler JS (2001). Defining supply chain management. J. Bus. Logist. 22(2): 2-25.

Mentzer JT, Foggin JH, Golicic SL (2000). Collaboration: the enablers, impediments, and benefits. Supply Chain Manage. Rev. 5 (6): 52-58.

Miles RE, Snow CC (1986). Network organizations: new concepts for new forms. Calif. Manage. Rev. 28: 62-73.

Min S, Roath A, Daugherty PJ, Genchev SE, Chen H, Arndt AD (2005). Supply chain collaboration: what’s happening? Int. J. Logistics Manage. 16(2): 237-256.

Mitchell M, Stafford E (2000). Managerial decisions and long-run stock price performance. J. Bus. 73: 287-320.

Mitra S, Singhal V (2008). Supply chain integration and shareholder value: Evidence from consortium based industry exchanges. J. Oper. Manage. 26: 96-114.

Murphy PR, Wood DF (2004). “Contemporary Logistics”. (8th ed). NJ: Prentice Hall.

Nair A, Filer L (2003). Cointegration of firm strategies within groups: A long-run analysis of firm behavior in the Japanese steel industry. Strateg. Manage. J. 24: 145-159.

Nair A, Narasimhan R, Choi TY (2009), Supply networks as a complex adaptive system: Toward simulation-based theory building on evolutionary. Dec. Sci. 40(4): 783-815.

Narayandas D, Rangan K (2004). Building and sustaining buyer-seller relationships in mature industrial markets. J. Marketing. 68: 63-77.

Nelson R E (1989). The strength of strong ties: Social networks and intergroup conflict in organizations. Acad. Manage. J. 32(2): 377-401.

Nieh CC, Lee CF (2001). Dynamic relationship between stock prices and exchange rates for G-7 countries. Quart. Rev. Econ. Financ. 41: 477-490.

Nieh CC, Lin SB, Chuang HM (2005). A study on the interrelationships among the stock indexes of the upper, middle and lower stream of semiconductor industry in Taiwan. NTU Manage. Rev. 15(2): 25-42.

Nieto M (2003). From R&D management to knowledge management- An overview of studies of innovation management. Technological Forecasting Soc. Change, 70(2): 135-161.

Nonaka I, Kakeuchi H (1995). “The Knowledge Creating Company-How Japanese Companies Create the Dynamics Of Innovation”. NY: Oxford University Press.

Normann, R. (1971), “Organization innovativeness: Product variation and reorientation”, Admin. Sci. Quart. 16(2): 203-215.

Novak S, Stern S (2009). Complementarity among vertical integration decisions: Evidence from automobile product development. Manage. Sci. 55(2): 311-332.

O’Toole T, Donaldson B (2000). Managing buyer-supplier relationship archetypes. Irish Marketing Rev. 13(1): 12-20.

Oke A, Burke G, Myers A (2007). Innovation types and performance in growing UK SMEs. Int. J. Operations Product. Manage. 27 (7): 735-753.

Otto A, Kotzab H (2003). Does supply chain management really pay? Six perspectives to measure the performance of managing a supply chain. Europ. J. Operational Res. 144: 306-320.

Palmatier RW, Dant RP, Grewal D (2007). A comparative longitudinal analysis of theoretical perspectives of interorganizational relationship performance. J. Mark. 71: 172-194.

Papadakis IS (2006). Financial performance of supply chains disruptions: An event study. Supply Chain Manage. 11(1): 25-33.

Parkhe A (1993). Strategic alliance structuring: A game theoretic and transaction cost examination of inter firm cooperation. Acad. Manage. J. 36(4): 794-827.

Pathak SD, Day JM, Nair A (2007).Complexity and adaptive in supply networks: Building supply network theory using a complex adaptive systems perspective. Dec. Sci. 38(4): 547-579

Patnayakuni R, Rai A, Seth N (2006). Relational antecedents of information flow integration for supply chain coordination. J. Manage. Inform. Syst. 23: 13-49.

Persson F, Olhager J (2002). Performance simulation of supply chain designs. Int. J. Product. Econ. 77(3): 231-245.

Peterson HC, Wysocki A (1998). Strategic choice along the vertical coordination continuum: Staff Paper #98-16, Department of Agricultural Economics, Michigan State University. (pp. 1-25).

Porter ME, Fuller MB (1986). “Coalitions and Global Strategy”, In: Competition in Global Industries (ME Porter, ed.), Boston: Harvard Business School Press.

Quantitative Models for Supply Chain Management”. S. Tayur, M. Magazine and R. Ganeshan (Eds.): 299-336.

Ramcharran H (2001). Inter-Firm linkages and profitability in the automobile industry: The implications for supply chain management. J. Supply Chain Manage. 3: 11-17.

Richey RG, Tokman M, Skinner LR (2008) Exploring collaborative technology utilization in retailer supplier performance. J. Bus. Res. 61(8):842-849

Rose-Anderssen C, Allen PM, Tsinopoulos C, McCarthy IP (2005). Innovation in manufacturing as an evolutionary complex system. *Technovation*, 25: 1093-1105.

Roy S, Sivakumar K, Wilkinson IF (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. Acad. Marketing Sci. 32(1): 61-79.

Rungtusanatham M, Salvador F, Forza C, Choi TY (2003). Supply-chain linkages and operational performance: A resource-based-view perspective. Int. J. Operations Product. Manage. 23(9): 1084-1099.

Sauvage T (2003). The relationship between technology and logistics third-party provider. Int. J. Physical Distribution Logist. Manage. 33(3): 236-253.

Serapio MG, Cascio, WF (1996). End-games in international alliances. Acad. Manage. Executive. 10(1): 62-72.

Simatupang TM, Sridharan R (2002). The collaborative supply chain. Int. J. Logistics Manage. 13(1): 15-30.

Singh PJ, Smith A, Sohal AS (2005). Strategic supply chain management issues in the automotive industry: An Australian perspective. Int. J. Prod. Res. 43(16): 3375-3399.

Smits R (2002). Innovation studies in the 21st century: Questions from a user’s perspective. Technological Forecasting Soc. Change, 69(9): 861-883.

Smyth HJ, Pryke SD (2008). “Collaborative Relationships in Construction: Developing Frameworks and Networks”. Oxford: Wiley-Blackwell.

Stern LW, Reve T (1980). Distribution channels as political economies: A framework for comparative analysis. J. Marketing. 44(3): 52-64.

Stevens G (1989). Integrating the supply chain. Int. J. Phys. Distribution Mater. Manage. 19: 3-8.

Stuart IF (1997). Supplier alliance success and failure: A longitudinal dyadic perspective. Int. J. Operations Product. Manage. 17(6): 539-550.

Svahn S, Westerlund M (2007). The modes of supply net management: A capability view. Supply Chain Manage. 12(5): 369-376.

Tan KC, Kannan V, Handfield R, Ghosh, S (1999). Supply chain management: An Empirical study of its impact on performance. Int. J. Operations Product. Manage. 19(10): 1034-1052.

Tan KC, Lyman SB, Wisner JD (2002). Supply chain management: a strategic perspective. Int. J. Operations Product. Manage. 22(6): 614-631.

Tsay AA, Nahmias S, Agrawal N (1998). “Modeling Supply Chain Contracts: A Review. In

Tumarkin R (2002). Internet message board activity and market efficiency: A case study of the internet service sector using RagingBull.com. Finan. Markets, Inst. Instruments 11(4): 313-335.

Tuominen M (2004). Channel collaboration and firm value proposition. Int. J. Retail Distribution Manage. 32(4/5): 178-189.

Ulusoy G (2003). An assessment of supply chain and innovation management practices in the manufacturing industries in Turkey. Int. J. Prod. Econ. 86(3): 251-270.

Venkatraman N, Henderson JC (1998). Real strategies for virtual organizing. Sloan Manage. Rev. 40 (1): 33-48.

Vickery S, Calantone R, Droge C (1999). Supply chain flexibility: An empirical study, J. Supply Chain Manage. 2: 16-25.

Walter A, Muller TA, Helfert G, Ritter T (2003). Functions of industrial supplier relationships and their impact on relationship quality. Ind. Mark. Manage. 32: 159-169.

Wan D, Huat-Ong C, Lee F (2005). Determination of firm innovation in Singapore", Technovation. 25(3): 261-268.

Wathne KH, Heide JB (2004). Relationship governance in a supply chain network. J. Mark. 68: 73-89.

Webster FE (1992). The changing role of marketing in the corporation. J. Marketing. 56(4): 1-17.

Wernerfelt B (1984). A resource based view of the firm. Strateg. Manage. J. 5: 171-180.

Wernerfelt B (2005). Product development resource and the scope of the firm, J. Marketing. 69(2): 15-23.

Womack JP, Jones DT, Roos D (1990). "The Machine That Changed the World". New York: Harper Perennial.

Woo KS, Ennew CT (2004). Business-to-business relationship quality: An IMP interaction-based conceptualization and measurement, Eur. J. Mark. 38(9/10): 1252-1271.

Zahra SA, Nielsen AP, Bognar WC (1999). Corporate entrepreneurship, knowledge and competence development. Entrepreneurship: Theory and Practice. 23(3): 169-189.

Zantout ZZ, Tsetsekos GP (1994). The wealth effects of announcements of R&D expenditure increases. J. Financ. Res. 17: 205-216.

Zott C (2003). Dynamic capabilities and the emergence of intra industry differential firm performance: Insights from a simulation study. Strateg. Manage. J. 24(2): 97-126.

APPENDIX

Appendix A

IC Companies in Taiwan

		Abbreviation	Full Name
Design		SIS	Silicon Integrated Systems Corporation
		Realtek	Realtek Semiconductor Corporation
		VIA	VIA Technologies, Inc.
		Sunplus	Sunplus Technology Co., Ltd
		Weltrend	Weltrend Semiconductor, Inc.
		FT	Faraday Technology Corporation
		ALI	ALi Corporation
		MediaTek	MediaTek Inc.
Manufacturing	Foundry	TSMC	Taiwan Semiconductor Manufacturing Company Limited
		UMC	United Microelectronics Corporation
		VIS	Vanguard International Semiconductor Corporation
		Episil	Episil Technologies Inc.
		LSC	Liteon Semiconductor Corporation
		AMPI	Advanced Microelectronic Products, Inc.
	IDM	WINBOND	Winbond Electronics
		MXIC	Macronix International Co., Ltd.
		MOSEL	Mosel Vitelic Inc.

DRAM	PSC	Power chip Semiconductor Corp.
	NANYA	Nan Ya Plastics Corp.
	PROMOS	ProMOS Technologies Inc.
	Inotera	Inotera Memories, Inc
Packaging/Testing	ASE	Advanced Semiconductor Engineering, INC.
	SPIL	Siliconware Precision Industries Co., Ltd.
	OSE	Orient Semiconductor Electronics, Ltd.
	ChipMos	ChipMos Technologies Ltd.
	Greatek	Greatek Electronics Inc.

Appendix B

Main products and acronyms used in the Taiwan automotive industry

	Abbreviation	Full Name	Main Products
Automotive component industry	TY	Tong Yang Industry Co., Ltd.	Bumper, grill, instrument panel, spoiler, fender, hood, etc...
	RW	Right Way Industrial Co., Ltd.	Forging, piston, etc…
	Juili	Jui Li Enterprise Co., Ltd.	Metal stamping mold, welding, inspection jigs, etc…
	Tayih	Ta Yih Industrial Co., Ltd.	Lamps, mold, etc…

	KY	Taiwan Kai Yih Industrial Co., Ltd.	Automotive sheet metal parts, molds, and hardware component
	CH	Chian Hsing Forging Industry Co., Ltd.	Forging, parts, etc…
	Calsonic	Taiwan Calsonic Co., Ltd.	Condition, electrical parts
Automotive assembly industry	YML	Yulon Motor Co., Ltd.	Car assembling

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2. Cheng-Chang Lin, **Chao-Chen Hsieh** (2010), Apply scientific approach to evaluate IC industrial supply chain linkage, Scientific Research and Essay (Accept, SCI, IF= 0.324)
3. 徐茂練、黃泰林、**謝兆貞**、邱俊智 (2002), 應用模糊集合論於供應鏈資訊需求分析之研究-以國內航太產業為例, 管理與系統, 9(4), pp. 513-534。(TSSCI)

b. Conference Paper:

1. **Chao-Chen Hsieh**, Jun-Zhi Chiu (2009), Effect on supply network relationship: A long-term analysis of firm behavior, Industrial Engineering and Engineering Management (IEEM) 2009, Hong Kong. Dec. 8-11. (EI)
2. **Chao-Chen Hsieh**, Jun-Zhi Chiu (2008), Wealth effect of technological innovations on supply chains: An event study, Industrial Engineering and Engineering Management (IEEM) 2008, Singapore. Dec. 8-11. (EI)
3. **Chao-Chen Hsieh**, Jun-Zhi Chiu (2008), A concept model for strategic supply chain relationship based on commitment-trust theory, 2008 Academy of International Business- SouthEast Asia (AIB-SA) Conference, Kuala Lumpur, Malaysia, Dec.4-6.

4. **Chao-Chen Hsieh**, Jun-Zhi Chiu (2007), Knowledge-based dynamic capability in new product development, 2007 Academy of International Business- SouthEast Asia (AIB-SA) Conference, Hangzhou, China, Dec.6-8.
5. **Chao-Chen Hsieh**, Jun-Zhi Chiu (2007), A knowledge-based view of supply network: a case study of the automotive industry in Taiwan, Asian Academy of Management Conference (AAMC), Penang, Malaysia, May 21-25.
6. Lin, Cheng-Chang, **Chao-Chen Hsieh** (2005), Technology innovations within supply chain management, 11th Asia Pacific Management Conference (APMC), Tainan, Taiwan, Nov. 19-20.

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