

# 如何透過統治機制形塑蛛網型供應鏈網絡

## HOW TO INTEGRATE SUPPLY CHAIN AS SPIDER-WEB NETWORK THROUGH GOVERNANCE MECHANISM

**黃銘章**

靜宜大學企業管理學系（所）教授

**劉紫娟\***

中原大學企業管理學系博士班研究生

**嚴奇峰**

中原大學企業管理學系（所）教授

**邱秋燕**

靜宜大學研發處組員

**Ming-Chang Huang**

*Professor, Department of Business Administration*

*Providence University*

**Tzu-Chuan Liu**

*Ph. D Student, Department of Business Administration*

*Chung Yuan Christina University*

**Ghi-Feng Yen**

*Professor, Department of Business Administration*

*Chung Yuan Christina University*

**Chiu-Yen Chiu**

*Senior Clerk, Office of Research and Development*

*Providence University*

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\*通訊作者，地址：420 台中市豐原區安康路 100 號，電話：(04)2527-1180 轉 1110  
E-mail：tzuchuan0614@gmail.com，傳真：(04)2529-1288

## 摘要

產業的競爭與供應網絡的相互抗衡有關，此現象也就是 Gomes-Casseres (1994) 所提及的集團與集團之間的競爭。然而，供應鏈整合並非憑空而來，必須有適當的作法加以整合。本文以交易成本理論及社會網絡方法探討統治機制如何將供應鏈轉變為妥善整合的蛛網網絡。本研究以台灣中衛生產體系作為實證對象，從中心廠 55 份有效問卷的資料進行線性迴歸分析，研究結果顯示：夥伴的選擇、專屬租的管理、創造共識與關係規範對網絡整合有正向的影響，而有助於朝向蛛網網絡轉化，至於監控夥伴貢獻與行為則無顯著影響。

**關鍵詞：**供應鏈整合、蛛網網絡、統治機制

## ABSTRACT

Industry-specific competition exists between supply chain networks. Gomes-Casseres (1994) referred to this phenomenon as group vs. group competition. Supply chain integration does not occur in a vacuum. Based on transaction cost theory and social network approach, this study explains how a supply chain can become a well-integrated spider-web network through governance mechanisms. The results of a linear regression analysis of 55 central firms' surveys which are listed in Taiwanese Central-Satellite Production System indicate that selecting partners, managing rent appropriation, creating shared value and relational norms have positive effects on supply chain integration and further in transforming into a spider-web network, whereas monitoring the partner's contributions and behavior has no significant effect.

**Keywords:** Supply Chain Integration, Spider-Web Network, Governance Mechanism.

## 1. Introduction

Most firms are embedded in networks of cooperative and competitive relationships with other organizations (Gulati, 1998; Ritter & Gemünden, 2003). An enterprise achieves competitive advantage not by itself, but by cooperating effectively with partners. The competition between supply chain networks in a particular industry (Bagchi, Ha, Skjoett-Larsen, & Soerensen, 2005; Svahn & Westerlund, 2007) is referred to as group vs. group competition (Gomes-Casseres, 1994) or chain vs. chain (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). However, a supply chain is a loosely coupled system that is characterized by the competing forces of cooperation vs. competition and of learning from others vs. protecting valuable assets (Kale, Singh, & Perlmutter, 2000; Wong, Tjosvold, & Zhang, 2005). A supply chain network is composed of vertical and horizontal relationships that are intentionally developed by limited numbers of actors for specific purposes (Svahn & Westerlund, 2007). The supply chain structure is an evolutionary outcome that is generated by rules that guide the cooperative decisions of firms (Kogut, 2000). Thus, skillfully managing and structuring networks of alliance networks can have significant strategic consequences (Wong et al., 2005; Koka & Prescott, 2008).

Griffith and Myers (2005) proposed that effective management of supply chain relationships depends on the ability of managers appropriately fit, or align, organizational elements with environmental opportunities and threats. The way in which central firms manage their relationships with satellite firms (suppliers) within their supply chain is therefore a central issue for understanding the competitive advantages of the supply chain as a whole. However, central firms may differ in their ability to handle network relationships. Hence, varying the degree of integration of supply chains may alter result the ability of such firms to manage their network (Wu, Choi, & Rungtusanatham, 2010). Despite increased awareness of the importance of supply chain management, few conceptual or empirical studies of the development of supply chain networks have been carried out. Although some studies have systematically addressed issues related to supply chain integration, most have focused on the integration of vertical supply chain relationships (Jaspers & van den Ende, 2006; Lee, Kwon, & Severance, 2007; Quesada, Rachamadugu, Gonzalez, & Martinez, 2008), which Quinn (2000) referred to as starburst organization, rather than on horizontal ties among suppliers.

Supply chain integration do not integrate automatically (Bagchi et al., 2005). Reduced perceived risk of opportunistic behavior (information hold-up, lock-in) by partners is a precondition of supply chain integration. The safeguarding of valuable assets and the joint creation of value are the main purposes of supply chain management, which emphasizes governance structures. A major claim of transaction cost theory is that firms must adequately control partners in order to constrain opportunism (Lui & Ngo, 2004). Governance refers to formal and informal rules of exchange among partners (Griffith & Myers, 2005). Its purpose is to deter opportunistic behavior and to align the actions of every partner with the overall goal of the supply chain network. However, in addition to safeguarding assets, another purpose of strategic alliances is the joint creation of value (Dyer, 1997; Zajac & Olsen, 1993). Excessive formal control can result in inflexibility, preventing cooperative relationships. Most prior research that is based on transaction cost theory advocates formal mechanisms and ignores the role of relational mechanisms in supply chain integration. Beyond their safeguarding role, central firms must encourage cooperation among satellite members to ensure common advantages. Understanding the process of industrial networks and characterizing network-oriented behavior are important issues in research into network environments (Lindgreen & Wynstra, 2005). Supply chain integration requires the formation of new roles and relationships (Numan & Samuels, 1995), and depends on both formal and relational governance mechanisms to increase the competitive advantages of the overall network. This study addresses the important issues of facilitating, enabling and measuring supply chain integration, and specifically, of how management mechanisms can promote the integration of a supply chain.

Drawing on transaction cost theory and the network perspective, this investigation examines how a central firm coordinates, directs and manages satellite firms to construct highly integrated supply chains, such as spider-web networks. A spider web network is defined as a maximally integrated network (Dyer, 2000; Gulati & Gargiulo, 1999). Central firms can coordinate with their partners via different management mechanisms to achieve varying degrees of supply chain integration. This study provides a theoretical explanation of the relationship between governance mechanisms and the degree of supply chain integration. The arguments that are presented here follow from two broad theoretical approaches in the strategic management literature-transaction cost theory and the network view of firms.

To elucidate how management mechanisms influence integration, this study focuses on buyer-supply collaboration, because such collaboration is associated with a very strong interdependence of production and exchange relationships among firms. Empirical data concerning a well-structured central-satellite production system in Taiwan were collected. Numerous small-to-medium-sized enterprises in Taiwan are satellite firms that provide parts and materials for central firms by outsourcing production to form central-satellite production systems. Therefore, satellite firms enjoy stable orders, and central firms also have stable suppliers. This interdependence is an important source of industrial competitive advantage for firms in Taiwan.

The remainder of this paper is organized as follows. Following a review of the relevant literature, theoretical explanations of why supply chain network governance affects the degree of supply chain integration will be proposed. The methodology and the analysis implications of the findings are discussed and then presented. Finally, the conclusions are drawn.

## **2. Literature Review and Hypotheses Development**

### **2.1 Transaction cost theory, network view and supply chain governance**

Opportunism is, according to transaction cost theory, an attempt by decision-makers to serve their self-interest (Williamson, 1975; Rindfleisch & Heide, 1997; Leiblein, 2003; Tsang, 2006). Transaction-specific supply chain investments typically involve transaction costs. Transaction cost theory is extensively applied to elucidate the relationships between supply governance mechanisms and the outcome of alliances. Transaction cost theory emphasizes a formal mechanism (detail contract, monitoring) for deterring opportunism and facilitating cooperation among partners (Dyer, 1997; Faems, Janssens, Madhok, & Van Looy, 2008). Tsang (2006) argued that theoretical behavioral assumptions do not accurately capture reality. Some critical conditions facilitate opportunistic behavior. Opportunistic behaviors may occur in the following two important situations. The first is when partners lack common norms and shared values. Ouchi (1980) noted that common values and beliefs support common interest and prevent opportunistic behavior. Conflict generally arises from variations in values, organization culture and goals among partners. The second involves asymmetrical information between partners. Williamson (1985) noted

that the incomplete disclosure of information leads to opportunism. Usually, information is not symmetrically distributed among parties to a transaction, and this informational asymmetry causes opportunism (Mishra, Heide, & Cort, 1998).

Dyer and Nobeoka (2000) described two dilemmas that are associated with collaboration in a network setting. The first involves motivating self-interested members of a network to participate by opening sharing valuable knowledge with other members. The second dilemma is the free-rider problem. Effective governance is required to prevent undesirable spillover and free riding. To facilitate cooperation among supply chain partners, governance seeks to increase the transparency of collaborators (Parkhe, 1993); maintain adequate control (Rindfleisch & Heide, 1997; Pangarkar & Klein, 2004) and prevent potential opportunistic behavior by partners. The basic safeguard model assumes that firms implement governance mechanisms to protect against opportunism and reduce transaction costs (Mesquita, Anand, & Brush, 2008).

A network is a set of connected actors. It combines various actors, activities and resources (Håkansson, 1989) and is the pattern of relationships among firms and institutions (Kogut, 2000). Firms are embedded in a dynamic network of social relations. Networks are associated with various particular benefits, including improvements in the sharing of information and knowledge (Kogut, 2000; Hung, 2002; Lazzarini, Claro, & Mesquita, 2008). The main tasks of the central firm are to develop and manage its network by distributing or controlling resources and information as well as by stabilizing relationships among alliance members to ensure that the needs of the customer are met (Weberster, 1992). Different networks depend on various management strategies and approaches (Svahn & Westerlund, 2007).

Like opportunism safeguarding, the joint creation of value is another crucial task of a supply chain. Jones, Hesterly, and Borgatti (1997) argued that research that is based on transaction cost theory does little to elucidate how network governance solves the fundamental problems of adapting, coordinating and safeguarding exchange. Transaction cost theory tends to focus on the loss of transaction-specific quasi-rent owing to opportunism by partners (Madhok & Tallman, 1998). Network governance solves coordination and safeguarding problems using social mechanisms to create shared value, goodwill trusts rather than bureaucratic rules, standardization or legal resources (Jones et al., 1997).

## 2.2 Integration of supply chain and spider-web supply network

In a network that is formed by rules of cooperation, firms are distinguished by their positions in the structure (Kogut, 2000). The degrees of network connections and embeddedness determine the extent of supply chain integration. Supply chain management covers flows of material, money and information (Ballou, Gilbert, & Mukherjee, 2000; Fabbe-Costes & Jahre, 2008). Van Donk and Van der Vaart (2005) proposed four dimensions for measuring supply chain integration - flow of goods, planning and control, organization, and flow of information. Supply chain management is intended to generate customer value by producing mutual advantage among suppliers, manufacturers and distributors in the supply of low-cost, high-quality products and services. Integration in a supply network requires a common standard of behavior and language, as well as synchronized flows of information and material among all actors (Svahn & Westerlund, 2007). Information sharing and interdependence, which are responsible for material flow, common standards and other factors, are two important dimensions of supply chain integration (Gulati, 1998; Simatuoang, Wright, & Sridaran, 2002; Samaranake, 2005; Léger, Cassivi, Hadaya, & Caya, 2006; Lummus, Vokurka, & Krumwiede, 2008). However, relationships among members may be vertical (such as those between a manufacturer and its suppliers) or horizontal (such as those among suppliers). The integration of a supply chain depends on vertical and horizontal information sharing and vertical and horizontal interdependence between suppliers (Huang, Chiu, & Hung, 2006).

## 2.3 Information Sharing

Information sharing makes supply chain partners work together through collaborative planning, problem solving and other joint actions. Market information is critical for improving the value of firms (Lindgreen & Wynstra, 2005). Information sharing involves a bilateral expectation members of the chain are expected proactively to provide information that is useful to their partners and supportive of their ongoing relationships (Heide & John, 1990; Griffith & Myers, 2005). The sharing of information is a critical characteristic of supply chain integration (Lee, et al., 2007), particularly in just-in-time (JIT) or build-to-order production (Fredriksson & Gadde, 2005). Network output depends on the management of knowledge and the orchestration of mobility of information (Dhanaraj & Parkhe, 2006). Information should be readily available to all companies in a highly integrated supply chain, and business processes should be structured to exploit information fully (Trkman, Štemberger, Faklič, & Griznik, 2007). Without process integration or

cooperative relationships between manufacturers and downstream firms, manufacturers cannot easily obtain accurate market information, undermining their capacity to respond rapidly and flexibly to customer demand (Sha, Chen, & Chen, 2008).

### **2.3.1 Vertical Information Sharing**

The sharing of information must be coordinated to ensure coherency (Simatuoang et al., 2002). An empirical study by Larson (1992) suggested that intensive information exchange promotes operational integration between suppliers and buyers. Fredriksson and Gadde (2005) observed that the production process used by the Volvo Car Corporation depend strongly on an exchange of information among suppliers. Two parties that depend on information exchange can help diverse members of their supply chain to cooperate efficiently and effectively (Fawcett, Osterhaus, Magnan, Brau, & McCarter, 2007).

### **2.3.2 Horizontal Information Sharing**

Supply chain members frequently have access to different private information, which they rarely share with others (Simatuoang et al., 2002). Horizontal information exchange has long been neglected by a priori investigations of strategic alliances and supply chain management. Supply chain management focuses on intra-organization cooperation because partners have interdependent relationships. A systematic approach of analyzing relationships between supply chain partners is required (New & Payne, 1995).

## **2.4 Interdependence**

Multiple ties between partners engender their interdependence (Koka & Prescott, 2008). Interdependence is directly related to joint problem solving (on which quality improvement, for example,). Joint activity increases interaction among partners, which improves information sharing. Such ties enable firms to learn more about the operations of their partners, facilitating knowledge transfer (Larson, 1992). Such transfers facilitate the institution of similar processes and routines among other partners, improving effectiveness (Koka & Prescott, 2008).



### **2.4.1 Vertical interdependence**

Supplier-customer business relationships require the coordination of various exchange and production activities that increase interdependence (Holm, Erriksson, & Johanson, 1999). Synchronizing interdependent processes is a prerequisite for the mutual benefit of firms that engage in supply chain collaboration (Simatuoang et al., 2002). This close interaction supplements information exchange between the assembly firm and suppliers (Fredriksson & Gadde, 2005). The integration of activities that are traditionally considered to be the responsibility of the buyer can break down organizational boundaries (Heide & John, 1990).

### **2.4.2 Horizontal interdependence**

Dyadic dependence relations between firms in business markets do not exist in isolation. Most firms are engaged in various series of important business relationships. Firms in such business markets have direct and indirect network relationships with each other (Holm et al., 1999). Doing business in a network context involves an increasing number of joint business decisions and actions among supply chain partners (Léger et al., 2006). The common buyer (central firm) ultimately benefits from enhanced knowledge sharing and improved capacity in its supplier base, which motivate collaboration among suppliers (Lazzarini et al., 2008).

The purpose of supply chain management is to remove barriers to communication by coordinating, monitoring and controlling processes (Power, 2005). Two important elements of supply chain integration are the buyer-supplier relationship and the supplier-supplier relationship, both of which demand information sharing and interdependence. Another is collaboration between suppliers and buyers to establish and maintain organizational relationships, which involve the integration of interactive organizational relationships and joint action among the firms in the organization. Therefore, the integration of a supply chain can be defined as the amount of information that flows among firms in a given period and the level of interdependence among members. Figure 1 presents various levels of supply chain integration.

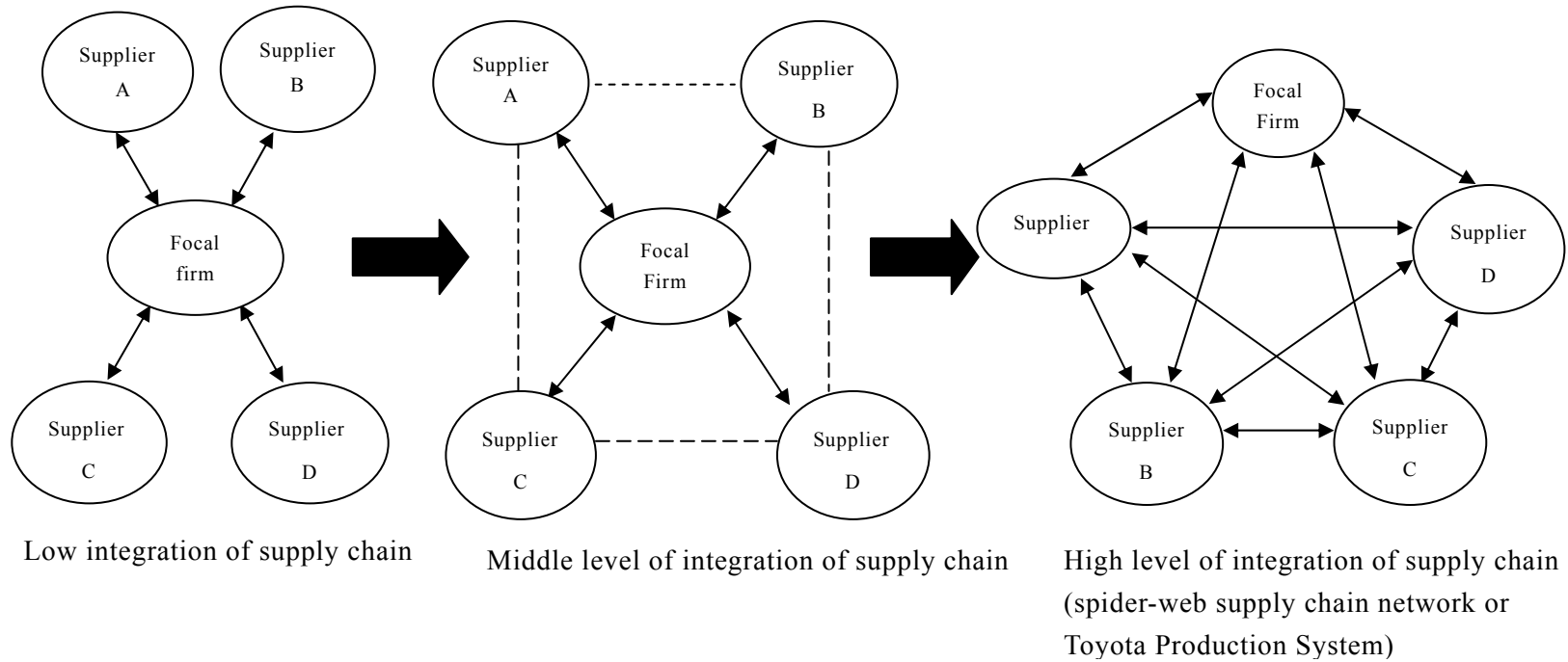


Figure 1 Evolution of different level of supply chain integration

Note: Solid line indicates high knowledge sharing and interdependence. Dashed line indicates low level of information sharing and interdependence.

Source: Adapted from Huang et al. (2006)

## 2.5 Governance and integration of supply chain

Wu et al. (2010) commented that in a buyer-supplier-supplier relationship triad, the buyer influences the suppliers' behaviors and the relationships between them. To enable the transfer, absorption and combination of complementary capabilities required for effective collaboration, firms expose critical resources and capabilities in alliances with partner firms. Hence, information sharing may OR have both advantages and disadvantages (Madhok & Tallman, 1998). Parkhe (1993) indicated that firms can design mechanisms to discourage cheating. Ouchi (1979) proposed three governance mechanisms, which were result control, behavior control and culture control (social control). Formal controls are the written regulations, objectives and processes, which are associated with concrete standards for judging behavior, and evaluating performance. Social controls are the organizational values, rules and culture that encourage specific behaviors.

Gulati (1998) noted that alliance management involves increasing the elasticity of the alliance, creating trust among partners, encouraging information exchange among partners, managing conflicts among, and the expectations of, partners, as well as other tasks. The step in promoting cooperation in the supply chain is the selection of appropriate partners. Following the formation stage, behavior is controlled by exploiting the common culture and monitoring as control mechanisms. Finally, the distribution benefits must be controlled, to ensure that partners perceive that benefits are shared fairly. Central firms should ensure the fair distribution of value and mitigate concerns in this area. Therefore, supply chain can be highly integrated by selecting appropriate partners, monitoring partners' behaviors, managing appropriation of rents and creating shared values and social norms.

## 2.6 Selecting partners

Selecting partners is crucial to the success of a supply chain alliance, especially in the alliance formation phase. Previous research has indicated that the following traits positively affect supply chain performance; partner complementarity (Brouthers, Brouthers, & Wilkinson, 1995; Das & Teng, 1998; Kale & Singh, 2009; Shah & Swaminathan, 2008), partner commitment (Kale, & Singh, 2009), compatibility of partners in terms of culture and goals (Brouthers et al., 1995; Kale & Singh, 2009; Shah & Swaminathan, 2008), similar levels of risk among the partners (Brouthers et al., 1995). The term "selecting" refers to the idea that network members tend to constitute a subset of frequently interacting

partners rather than an entire industry (Jones et al., 1997). The complementary skills and the mutual fit of the partners are essential to the success of an alliance (Brouthers et al., 1995; Das & Teng, 1998). The resource-based view suggests, and many empirical studies support the fact, that greater complementarity among partners corresponds to great likelihood of success (Kale & Singh, 2009). The ability and commitment of partners are also critical to the full realization of jointly anticipated value. The process of selecting partners can identify potentially synergistic resources as well as safeguard against opportunism (Madhok & Tallman, 1998). Only a firm that is willing to share information can be selected (Dyer, 1997). In identifying the right partner, all potential partners must be evaluated in terms of skill, technology, experience in such an alliance and overall organizational culture.

Selecting partners involves supplier verification. Heide and John (1990) defined supplier verification as the sum of efforts undertaken by a buyer *ex ante* to confirm the ability of a supplier to perform as expected. Verification reduces the risk associated with uncertainties in the performance of a partner in a particular role. Madhok and Tallman (1998) noted that over-economizing on the transaction-specific expenditures that are associated with the search for the “right” partner may inhibit the pursuit of value if doing so reduces partner compatibility and negatively influences the quality of the partnership. With respect to supply chain relationships, capability is the major factor in supplier selection. Capability may be defined in terms of quality (Dyer, 1996; Wong et al., 2005), price/cost, lead-times (Dyer, 1996; Mohr & Spekman, 1994) and product design. Wu et al. (2010) suggested that the ability of suppliers to work together is an important factor in selecting partners. Thus, the selection of partners affects the success of supply chain integration. The following hypothesis is proposed.

H<sub>1</sub>: The selection of partners positively affects the degree of integration of a supply chain network.

## **2.7 Monitoring partner’s contributions and behaviors**

Williamson (1985) noted that the incomplete disclosure of information leads to opportunism. Under information asymmetry, a partner may exhibit opportunistic behavior without being found out (Kabadayi & Ryu, 2007). Behavioral uncertainty increases information asymmetry *ex ante* or *ex post*, which affects task performance (Rindfleisch & Heide, 1997; Mishra et al., 1998; Wathne & Heide, 2000). Monitoring reduces

informational asymmetry and increases the predictability of exchanges between supplier and buyer, by helping the actors know more about how the other actors operate their businesses.

Ouchi (1979) defined control as a process that involves both monitoring and evaluating behavior and output. Suppliers can opportunistically exploit the inability of a customer to evaluate quality accurately (Mishra et al., 1998). Monitoring is an iterative process: when something is not proceeding as required, the conductor must plan a fix, organize resources and direct actors to perform the fix, and monitor the effect of the change (Svahn & Westerlung, 2007). Monitoring increases (a firm's ability to detect opportunism and ultimately improves its ability to reward and sanction partners according to their behavior (Kobadayi & Ryu, 2007). Monitoring deters opportunistic and cheating behaviors of partners (Li & Filer, 2007). Kogut (2000) suggested that the Toyota supplier system is successful because monitoring and sanction mechanisms form a cycle of positive returns that are associated with the transfer of technology. Control and monitoring are the main mechanisms that govern supply chain integration. Hence, we propose the following hypothesis.

H<sub>2</sub>: The perceived ability of a central firm to monitor the contributions and behaviors of partners positively affects the extent of integration in the supply chain.

## **2.8 Managing appropriation of rents**

Benefit is not a new issue in the field of supply chain collaboration. Benefit sharing refers to buyers and sellers' gaining value from their business relationships and, consequently choosing to maintain those relationships (Lindgreen & Wynstra, 2005). Gomes-Casseres (1994) mentioned that interfirm cooperation is not automatic. A partnership must be structured to incentivize performance. Cooperation and coordination in a network raise questions of whether rents accrue in the network and to whom (Kogut, 2000). Mobility of information, knowledge and know-how within a network promotes value creation (Dhanaraj & Parkhe, 2006). The contribution of unique and valuable resources by partners to the supply chain can trigger rent appropriation and unintended spillover, which can result in partner opportunism and problems of free riding (Williamson, 1985; Gulati & Singh, 1998; Yan & Gray, 2001; Zhang & Rajagopalan, 2002; Dhanaraj & Parkhe, 2006). Sharing information threatens the governance of firms in such relationships (Griffith & Myers, 2005). According to Gulati and Singh (1998), rent appropriation relates

to the ability of partners to capture their fair share of the rent in an alliance. Empirical studies suggest that a party to an alliance should choose a form of governance that effectively balances the creation of value by the enterprise with rent appropriation (Park & Russo, 1996; Gulati & Singh, 1998; Zeng & Chen, 2003). If cooperation results in the benefiting of one party at the expense of the others, then the coalition is likely to falter (Fain, Nagar, & Srivattava, 2006). Central firms must convince suppliers to collaborate and so must ensure that the value pie is distributed equitably and perceived as being so distributed by network members (Dhanaraj & Parkhe, 2006). The motivation of the central firm is critical to the sharing of value (Wagner & Lindemann, 2008).

The value pie can be enlarged by collaboration (Wagner & Lindemann, 2008). A new challenge in the management of a coalition in a supply chain is the design of an allocation method to distribute the rewards of cooperation to the benefit of all parties (Ballou et al., 2000). Coordination is required to guide the value-creating activities of actors in the network toward common objectives (Svahn & Westerlund, 2007). However, parties in an alliance sometimes lack adequate information regarding the trustworthiness of other parties or the assurance of a shared gain. Therefore, they may rely on fairly formal procedures that govern decision-making which a supplier perceives to determine the extent to which it should commit to a joint activity (Luo, 2008). Suppliers may also try to oust each other to improve their own positions in the supply chain (Kamp, 2005). Dyer (1997) defined safeguards as control mechanisms that are intended to enhance the perceived fairness of the sharing of benefits among partners. Thus, “fairness” is an important research topic in the literature on alliances (Das & Teng, 2002). A beneficial relationship among firms can be observed in the interaction among partners, which is greatest when all organizations perceive the benefits of interacting (Schmidt & Kochan, 1977).

Gomes-Casseres (1994) indicated that the cooperation of firms may be involuntary. Partnerships always are structured to incentivize performance. The continuation of a cooperative relationship depends on the expected benefit. Greater motivation by the central firm of its suppliers to collaborate by promising a share of the project benefits corresponds to the enjoyment of a larger share of the value pie by suppliers (Wagner & Lindemann, 2008). The perceived fairness of shared benefits is critical to commitment to the supply chain partnership. When supply chain members synchronize their decisions about value creation to ensure the seamless flow of goods and services, and when they coordinate the shared benefits that are associated with improved logistics, they are likely to realize

complementarity (Simatuoang et al., 2002). Central firms may select suppliers according to their track record of performance and give incumbents the first opportunity to win new business. Such a situation differs from one characterized by arms-length transactions (Dyer, 2000). The following hypothesis is proposed.

H<sub>3</sub>: The perceived fairness of rent distribution positively affects the integration of a supply chain network.

## 2.9 Creating shared value and relational norms

Jones et al. (1997) defined network governance as coordination that is characterized by informal social systems rather than by bureaucratic structures within firms and formal contractual relationships between them. A culture of cooperation among partners is a key factor in the success of an alliance (Brouthers et al., 1995). Most a priori have neglected how organizational cultures can promote the open sharing of information. Organizational culture affects the willingness of organizational members to share information (Fawcett et al., 2007). Ouchi (1980) noted that common values and beliefs provide an overlap of interest that minimizes opportunistic behavior. Shared value is the extent to which partners have common beliefs about which behaviors, goals and policies are important or unimportant, and right or wrong (Ballou et al., 2000). Shared value includes the collective goals and aspirations of organization members, to which Jones et al. (1997) referred as “macroculture”. Culture can be developed through a socialization process (Jones et al., 1997; Martinez & Jarillo, 1991). When members of an organization have similar perspectives on how to interact with each other, they can avoid potential misunderstandings in their communications and freely exchange ideas or resources (Tsai & Ghoshal, 1998; Li, 2005). Macroculture coordinates interdependent activities among independent entities to enable complex tasks to be completed (Jones et al., 1997). Central firms must allocate effort and resources to socializing supply chain partners to establish shared values that facilitate chain-wide cooperation.

Companies tend to optimize their own performance and, in doing so, may disregard the supply chain as a whole (Trkman et al., 2007). Within interorganizational exchange relationships, norms have been found to be essential to governance (Heide & John, 1990; Griffith & Myers, 2005; Léger et al., 2006; Liu, Tao, Li, & EI-Ansary, 2008). All relational behaviors theoretically promote effective interorganizational coordination (Yilmaz, Sezen, & Ozdemir, 2005). Organization culture is a mixture of group norms, selection, social

interaction and training (Fryxell, Dooley, & Vryza, 2002). Social control mechanisms do not necessarily result in social control. Griffith and Myers (2005) suggested that effective business operations depend on integrating cultural norms of solidarity into relationship governance. Gerwin (2004) also noted that coordination through a network of social relations is based on norms of trust and reciprocity, and on building a social relations network that promotes joint effort in completing external tasks. The general purpose of socialization may be to promote the convergence of goals (Wathne & Heide, 2000) as well as to align the values and interests of the partners (Chalos & O'Connor, 2004). Wu et al. (2010) utilized the extent to which a buyer encourages suppliers to help each other as an indicator of that buyer's influence. Mehri (2006) found that workers at Toyota learn formal and informal rules through social mechanisms of control. This culture of rules coerces employees to share attitudes, values and goals, defined by the group, the team or the entire corporation, which leads to the establishment of social norms and social control. Dyer and Nobeka (2000) also reported that Toyota has established norms within its supply chain network that prevent members from (a) protecting or hiding valuable knowledge and (b) free-riding. Socialization improves exchange performance by focusing on the shared values of partners and relying on peer pressure and social sanctions to mitigate shirking and opportunism (Liu et al., 2008).

The norm of information sharing is determined by the collective goals of the two parties (Kabadayi & Ryu, 2007), rather than on the individual goals of each. Goal divergence is a critical source of behavioral uncertainty that induces opportunistic behavior. Das and Teng (1998) indicated that partners in a strategic alliance face risks to their relationship because they may not exhibit a spirit of cooperation. For example, opportunistic behavior is a typical source of relationship risk. Jones et al. (1997) also found that the embeddedness of a structure may impose social restrictions, including loss of reputation, collective sanctions and restricted access to exchange. Opportunism increases the overall cost incurred by a cooperative network. Information sharing, which is related to relational norms, is also necessary because buyers and suppliers generate value in the co-creation process. When organizational members have the same perceptions of how to interact with one another, they can prevent possible misunderstandings in their communications and have more opportunities to exchange ideas or resources freely (Tsai & Ghoshal, 1998; Liu et al., 2008). The following hypothesis is proposed.



H4: The perception of shared value and relational norm creation positively influences the integration of a supply chain network.

Figure 2 shows the conceptual framework of the study.

### 3. Methodology

#### 3.1 Data collection

Developing an integrated supply chain takes time. In this investigation, the Firm List of Taiwan's Central-Satellite Factory System in the Year 2004, published by the Taiwan Central-Satellite Factory System Development Center, a unit of the Industry Development Bureau, Ministry of Economic Affairs, Taiwan, is used as the source of the sample set of firms. The central-satellite factory system in Taiwan is a cooperative supply chain network that is promoted by the Taiwanese government. In 2004, it included 143 central firms and 1440 satellite firms. Long-term supply contracts ensure that satellite firms have stable orders and can concentrate on improving R&D and production efficiency. Central firms have efficient sources of supply and concentrate their resources on enhancing the efficiency of assembly, new product development and marketing. The central-satellite factory system is a highly interdependent strategic alliance. When the activities of various firms are highly complementary, extensive interaction across boundaries is required (Fredriksson & Gadde, 2005). The Central-Satellite Factory System in Taiwan provides an appropriate context for analyzing supply chain integration.

Data were collected in two stages. In the first stage of this study, initial contacts with central firms were made by either fax or telephone. Owing to incorrect contact information or the dissolution of partnerships, only 93 central firms were contacted. In the second stage, 93 questionnaires were sent to the CEOs and managers of the purchasing departments of the central firms and their supply chains. Only 55 of the questionnaires were returned after a six-month follow-up by telephone, yielding a response rate of 59.14%. Of these respondents, 31 were employed in mechanical manufacturing-related companies; 16 were employed in electronics manufacturing-related companies, six were at food-related companies and the remaining two were in other industries. Non-response bias was evaluated by two methods. First, the  $\chi^2$  test was used to compare the ratio from response firms of the sample to the population. Table 1 presents the  $\chi^2$  test results, which

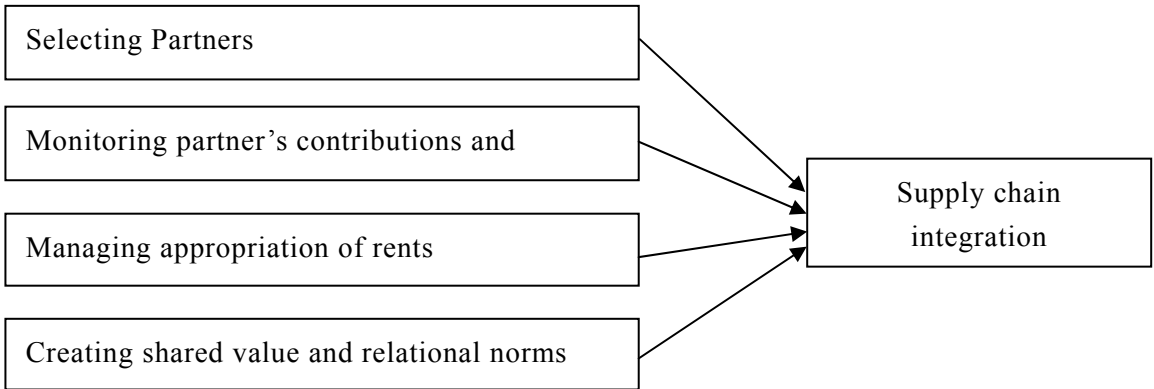


Figure 2 Conceptualized framework

Table 1  $\chi^2$  test of industry distribution of sample and population

Industry	Sample size	% of Sample	Population	% of population	
Mechanical manufacturing	31	56.36	49	52.69	$\chi^2=0.698$ (p = 0.874)
Electronic manufacturing	16	29.09	25	26.88	
Food related	6	10.91	15	16.13	
others	2	3.64	4	4.30	

indicate that the difference insignificant ( $\chi^2 = 0.698, p > 0.05$ ). Second, t-test was conducted to compare the numbers of employees and sales of early and late respondents using the method that suggested by Armstrong and Overton (1977). The differences between the numbers of employees ( $t = 0.7, p > 0.05$ ) and sales ( $t = 0.68, p > 0.05$ ) of early and late respondents were insignificant. (Table 2) These two tests verified that the sample was unaffected by non-response bias.

Harman’s single-factor test was to evaluate the likelihood of common method variance. If the data include significant common method bias, then a factor analysis of all variables in the model should yield a single factor that accounts for most of the variance (Harman, 1967; Podsakoff & Organ, 1986; Minbaeva, Pedersen, Björkman, Fey & Park, 2003; Mesquita et al., 2008). An unrotated factor analysis revealed that the first factor explained 27.56% of the data variance, which was under the 50% threshold. Therefore, the common method bias was not problematic.

Table 2 *t*-test of early and late respondents

variable	Means (early ) n=24	Means (late) n=31	t-value
Sales	85,261,143.43	154,682,143.11	0.68 (p=0.20)
Number of employees	475.21	580.32	0.70 (p=0.43)

### 3.2 Measurements

In the second stage, in-depth interviews were conducted with employees of three major automakers that were operating in Taiwan (Toyota, Nissan and Mitsubishi) and three first-tier suppliers that were recommended by these three automakers. Interviewees included purchasing managers, heads of supply chain management departments, research and production managers and directors of industrial relations. Each interview lasted 1.5-3 hours and recorded the interview content. The purpose of these interviews was to evaluate the relevance and wording of the items that were generated in the first stage.

### 3.3 Dependent variable

Supply chain integration was defined as the extent of vertical and horizontal information sharing and interdependence. In this study, supply chain integration was assessed in terms of information sharing and interdependence among partners, using a scale from 1 to 7. Information sharing was assessed with items that were adapted from the scale that was developed by Mohr and Spekman (1994) and Burt (1992), which evaluates the frequency and volume of information sharing among supply chain partners. It includes (1) the frequency of information exchange between the company and its suppliers; (2) the volume of information exchanged between the company and its suppliers; (3) the frequency of information exchange among suppliers; (4) the width of information exchange among suppliers. Interdependence is the degree to which one process depends on another to create value (Simatuoang et al., 2002). The interdependence of the technologies and businesses of firms is assumed to reflect the interdependence among partners in a supply chain. The four items in this construct were measured on a seven-point scale from 1 to 7. These four items were (1) technological interdependence between the company and

its suppliers; (2) business interdependence between the company and its suppliers; (3) technological interdependence among suppliers; (4) business interdependence among suppliers.

### **3.4 Independent variables**

Selecting partners refers to a mechanism for selecting partners with complementary skills and goals, managerial philosophies or cultures (Brouthers et al., 1995). The following three items were measured on seven-point scales as proxies of the selection of partners; (1) The extent of formalization in the supplier-selection procedure; (2) similarity suppliers; (3) extent of resource complementarity between the your company and suppliers.

Monitoring partner's contributions and behaviors requires a review of supplier performance, inventory level and delivery performance (Kabadayi & Ryu, 2007). This step also verifies the capability of the suppliers. The evaluation process may be formal or informal (Heide & John, 1990). Supplier monitoring is a governance mechanism that is measured in terms of four items on a seven-point scale from 1 to 7. The four measurements are based on (1) formal and informal supplier performance evaluations; (2) detailed indicators of performance that suppliers are asked to achieve; (3) regular reviews of performance of major suppliers; (4) regular reports of performance of suppliers by themselves.

Managing rent appropriation ensures that each partner captures a fair share of the rents in an alliance (Gulati & Singh, 1998). Competitive bidding in which incumbents are not given any advantage in winning orders is typically referred to as an arms-length transaction (Dyer, 2000). Competitive bidding does not consider past performance and does not encourage partners to become involved in supply chain integration. Thus, order distribution is used here to measure rent appropriation under the following three conditions; (1) the volume of orders is associated with partner performance; (2) all partners perceive that the volume of orders is fairly distributed among all partners; (3) the volume of order distribution is uncontested.

Firms must create shared value and relational norms by using informal mechanisms to build shared value and norms, which are measured on a seven-point scale from 1 to 7. Three items were as follows; (1) frequency with which the management team visits

suppliers; (2) extent to which all partners are educated to be fully supportive of each other; (3) whether problems that arose in the course of this relationship are treated by parties as joint rather than individual responsibility.

### **3.5 Control variables**

Two control variables were analyzed in this study. While no formal hypotheses concerning these factors are proposed, their effects are controlled in the presented model. These control variables are industry and size. The effect of industry was evaluated using three dummy variables, which were related to the fourth industry which was labeled as the “other” industry. The numbers of employees and sales were used as measures of firm size.

### **3.6 Reliability and validity**

Table 3 reports the Cronbach’s  $\alpha$  values of the measurements in this investigation, which indicated that all constructs were reliable, since the Cronbach’s  $\alpha$  of each exceeded 0.7 (Churchill, 1979). Factor analysis was then performed to assess convergent validity. Only one of the indicators yields a factor loading of 0.63, which was slightly lower than 0.7; all factor loadings other indicators exceeded 0.7, indicating high construct validity (Liu et al., 2008).

## **4. Results and Discussion**

Table 4 presents the statistical results concerning the means, standard deviation and correlation coefficient of each construct. Linear regression analysis was adopted to examine the relationship between governance mechanism and supply chain integration (Table 5). For the sake of high inter-correlation between “selecting partners” and “creating shared value and social norms,” these two variables were separated to test their impact on supply chain integration into two regression models to prevent potential multi-collinearity. The results indicated that models 1 and 4 were statistically insignificant ( $F=1.011$ ,  $p>0.05$ ;  $F=1.877$ ,  $p>0.05$ ), suggesting that the control variables did not explain the variances in the integration of the supply chain. The VIF value ranged from 1.127 to 2.329 for all regression models, revealing that multi-collinearity was negligible.

Table 3 Factor analysis results and Cronbach's alpha

Construct	Dimensions	Variables	Factor loading	Eigen value (explained variance)	Cronbach's Alpha	
Governance mechanisms	Selecting partners	The extent of formalization in suppliers selection procedure	0.846	1.988 (66.259%)	0.736	
		The similarity in managerial philosophy between your company and suppliers	0.799			
		The extent of resource complementarity between your company and suppliers	0.796			
	Monitoring partner's contributions and behaviors	There are formal and informal suppliers performance evaluations	There are detail performance indicators to ask suppliers to achieve	0.823	1.697 (56.581%)	0.701
			There are regularly performance review of our major suppliers	0.788		
			Suppliers regularly report their performance	0.724		
			Suppliers regularly report their performance	0.633		
	Managing appropriation of rents	The volume of order is associated with partner's performance	All partners do perceive that the volume of orders distribution among partners are fair	0.877	1.925 (64.165%)	0.707
			All partners do perceive that the volume of orders distribution among partners are fair	0.825		
			There are no argument about the volume of order distribution	0.689		
	Creating shared value and relational norms	Top management team visits suppliers frequently	Extent to which all partners are educated to be fully supportive of each other	0.942	1.877 (62.900%)	0.790
			Problems arose in the course of this relationship are treated by parties as joint rather than individual responsibility	0.814		
Problems arose in the course of this relationship are treated by parties as joint rather than individual responsibility			0.760			
Supply chain integration	Information sharing	The frequency of information exchange between your company and suppliers	0.826	2.485 (62.120%)	0.789	
		the volume of information exchanged between the company and its suppliers	0.791			
		The frequency of information exchange among suppliers	0.773			
		The width of information exchange among suppliers	0.760			

續下表

續表 3

Interdependence	The level of interdependence in technology between your company and suppliers	0.929		
	The level of interdependence in business between your company and suppliers	0.921	2.997 (74.917%)	0.884
	The level of interdependence in technology among suppliers	0.872		
	The level of interdependence in business among suppliers	0.854		

Table 4 Means, standard deviation and correlation coefficient of latent constructs

Constructs	Mean	S.D.	a	b	c	d	e
a. Selecting partners	5.533	0.647					
b. Creating shared value and relational norms	5.662	0.701	0.638**				
c. Monitoring partner's contributions and behaviors	5.570	0.649	0.433**	0.410**			
d. managing appropriation of rents	5.358	0.688	0.416**	0.475**	0.588**		
e. Information sharing	5.082	0.792	0.462**	0.473**	0.535**	0.371**	
f. Interdependence	5.000	0.966	0.427**	0.451**	0.502**	0.338*	0.705**

Note: n=55; \*: p<0.05, \*\*: p<0.01

Table 5 The relationships between governance mechanisms and supply chain integration

Variables	Information sharing			Interdependence		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Intercept	4.642*** (7.000)	0.503 (0.473)	0.371 (0.350)	4.787*** (6.199)	-0.377 (-0.316)	-0.481 (-0.405)
Mechanical manufacturing	-0.050 (-0.136)	-0.200 (-0.624)	-0.084 (-0.264)	-0.119 (-0.337)	-0.264 (-0.897)	-0.149 (-0.509)
Electronic manufacturing	-0.052 (-0.150)	-0.074 (-0.241)	0.052 (0.172)	-0.035 (-0.104)	-0.045 (-0.160)	0.080 (0.285)
Food related	-0.006 (-0.024)	-0.215 (-0.950)	-0.026 (-0.115)	-0.098 (-0.394)	-0.310 (-1.496)	-0.124 (-0.601)
Employee (200-500)	0.487* (2.382)	0.159 (0.812)	0.171 (0.884)	0.486* (2.493)	0.145 (0.809)	0.155 (0.868)
Employee (500 upper)	0.434 (1.911)	0.125 (0.579)	0.065 (0.308)	0.659** (3.042)	0.340 (1.714)	0.278 (1.430)
Sales	-0.084 (-0.534)	-0.155 (-1.129)	-0.162 (-1.197)	-0.360* (-2.389)	-0.429** (-3.411)	-0.436** (-3.486)
Selecting partners		0.307* (2.286)			0.310* (2.520)	
Monitoring partner's contributions and behaviors		0.030 (0.186)	0.014 (0.085)		0.013 (0.087)	0.001 (0.009)
managing appropriation of rents		0.420* (2.391)	0.409* (2.359)		0.452** (2.808)	0.446** (2.791)
Creating shared value and relational norms			0.349* (2.552)			0.336* (2.665)
R <sup>2</sup>	0.112	0.404	0.419	0.190	0.499	0.507
Adj. R <sup>2</sup>	0.001	0.285	0.303	0.089	0.399	0.408
F value	1.011	3.391**	3.605**	1.877	4.988***	5.134***
VIF	1.127	1.362	1.448	1.158	2.239	2.331

Note: n=55, \* : p<0.05, \*\* : p<0.01, \*\*\* : p<0.001, t value in parentheses.

Hypothesis 1 predicts that selection of partners positively affects the degree of integration of a supply chain network. Models 2 and 5 showed that the proper selection of partners positively affected information sharing ( $\beta=0.307$ ,  $p<0.001$  in Model 2) and interdependence ( $\beta=0.310$ ,  $p<0.05$  in Model 5) among supply chain partners, and so affected the success of supply chain



integration. Hence, the extent to which central firms can select appropriate partners is positively related to the degree of supply chain network integration. Accordingly, the first hypothesis is supported. Supply chain integration begins with the selection of partners with complementary abilities and compatible cultures (Brouthers et al., 1995). Selecting appropriate partners can reduce the need for coordination. Thus, having appropriate partners can maximize value creation and minimize the transaction costs in the integration of a supply chain.

Hypothesis 2 expects that perceived ability of a central firm to monitor the contributions and behaviors of partners positively affects the extent of integration in the supply chain. Models 2, 3, 5, and 6 revealed that the direct link between monitoring a partner's contributions and behaviors and supply chain integration, determined in terms of information sharing and interdependence, was not significant ( $\beta=0.030$ ,  $p>0.05$  in Model 2;  $\beta=0.014$ ,  $p>0.05$  in Model 3;  $\beta=0.013$ ,  $p>0.05$  in Model 5;  $\beta=0.001$ ,  $p>0.05$  in Model 6), so H2 was not supported. Monitoring supplier compliance with established standards of cost, quality, and delivery may increase the ability of the central firm to detect and restrict opportunism by a supplier. Transaction cost theory focuses on the loss of transaction-specific-quasi-rent that is caused by opportunism by partners (Madhok & Tallman, 1998). Although this investigation hypothesized a positive relationship between the monitoring of a partner's behavior and supply chain integration, the empirical data did not support this hypothesis. This issue may be worthy of further research to examine the relationship between monitoring and cooperative behaviors. Although monitoring protects central firms from potential opportunism by suppliers, it may also negatively influence relationships with them. Kabadayi and Ryu (2007) noted that monitoring may be ineffective or even negatively affect non-measurable behavior (such as spontaneous cooperation). Safeguard as well as joint value creation are the most important tasks in supply chain integration. Overemphasizing protective mechanisms may inhibit the pursuit of value (Madhok & Tallman, 1998). The likely non-linear relationship between monitoring and cooperative behavior is plotted as an inverted U-curve (Huang, Kang, & Hong, 2012), so a balance must be struck between monitoring and cooperating to optimize the integration of a supply chain network.

Hypothesis 3 proposes that perceived fairness of rent distribution positively affects the integration of a supply chain network. Empirical results reported that managing rent appropriability did affect information sharing ( $\beta=0.420$ ,  $p<0.05$  in Model 2;  $\beta=0.409$ ,  $p<0.05$  in Model 3) and interdependence ( $\beta=0.452$ ,  $p<0.01$  in Model 5;  $\beta=0.446$ ,  $p<0.01$  in Model 6). Perceived fairness of benefit distribution positively influences supply chain network integration. Accordingly, greater perceived fairness of the distribution of benefits corresponds to greater

supply chain network integration. Therefore, the H3 was supported. The distribution of rents may not correspond to the contribution made by individual firms (Kogut, 2000). A respondent in a study by Numan and Sanules (1995) claimed, “We want the efficiency of volume, versus giving manufactures the efficiencies. If they have efficiencies of volume through their distribution operations, then they can give everyone, including our competitors, a cheaper price”. No one member of the chain should benefit at the expense of another (Ballou et al., 2000). To promote supply chain integration, the central firm should enlarge the overall network pie and distribute it to the partners in the supply chain fairly. The perceived fairness of the distribution of benefits depends on balancing rent appropriation with contribution, to avoid conflicts and risks to relationships, and to promote supply chain integration.

Hypothesis 4 predicts the perception of shared value and relational norm creation positively influences the integration of a supply chain network. As expected, models 5 and 6 showed that creating shared value and social norms positively influenced supply chain integration ( $\beta=0.349$ ,  $p<0.05$  in Model 5;  $\beta=0.336$ ,  $p<0.05$  in Model 6). Greater perception of shared value and relational norm creation corresponded to increased supply chain network integration, supporting H4. Firms cannot work together efficiently if they have very different organizational cultures, managerial practices or strategic orientations (Das & Teng, 2000). In a strategic alliance, learning must be balanced with the protection of proprietary assets (Kale et al., 2000). Ballou et al. (2000) suggested that when formal mechanisms are not established or functioned, a supply chain must use other, informal mechanisms that are direct and obvious. Central firms must socialize partners and create shared value and social norms to ensure effective collaboration.

## 5. Conclusion

A cooperative supplier-supplier relationship influences supplier performance and is one of the factors that are critical to a buyer's success. In an effort to establish the theory of supply chain integration, this study makes two theoretical contributions. The first contribution of this study is that it presents a model of a spider-web supply network that can be used to evaluate the extent of supply chain integration. Second, governance is needed to coordinate and safeguard the exchange, and it can improve collaboration within a supply chain. This study synthesizes transaction cost theory and a network perspective to elucidate four governance mechanisms that facilitate efficient integration among all supply chain members. Although monitoring a partner's

contributions and behaviors did not significantly affect the extent of supply chain integration, other mechanisms effectively did.

This study offers practical guidance for supply chain management. Companies tend to focus on core competences and outsource other activities to suppliers. In the Toyota JIT supply network, emergent supply chain integration is an important innovation in both supply chain management and alliance management. To facilitate collaboration throughout the supply chain, central firm manages the relationships between itself and its suppliers and those among suppliers by applying governance mechanisms.

### **5.1 Limitations and suggestions for future research**

While this study helps to refine our understanding of the relationship between governance mechanisms and supply chain integration, it has some limitations. First, the effects of information sharing and interdependence may interact with each other. For example, high task interdependence may increase the need for informational exchange (Jaspers & van den Ende, 2006). Efforts to verify about a supplier's performance and behavior in close inter-firm relationships have parallels in close interpersonal relationships (Heide & John, 1990). Further research may examine the relationship between interdependence and information sharing or among governance mechanisms.

Second, central firms integrate satellite firms in a supply chain network primarily to increase the value of the overall network. Informational asymmetry and position of the firm in the network (centrality) determine the benefits that can be gained by the firm through its alliances (Powell, Koput, & Smith-Doerr, 1996; Burt, 2000; Dhanaraj & Parkhe, 2006; Léger et al., 2006; Koka & Prescott, 2008). A firm in a central network position can control network resources and information (Tsai & Ghoshal, 1998). Prior studies have assumed that central firms can operate independently of each satellite firm (Griffith & Myers, 2005). However, a highly integrated supply chain, such as a spider-web network, has no lead company (Lin & Zhang, 2005). Satellite firms depend on central firms to obtain market information to solve problems. Central firms may lose their centrality in a supply chain network. Stronger supplier-supplier alliances may be associated with weaker buyer-supplier alliances (Lazzarini et al., 2008). Future studies may investigate how central firms and satellite firms create and share overall value.

Third, according to transaction cost theory, the environmental context is critical to a firm's choice of form of governance. This study did not examine the effect of environmental variables

upon supply chain integration. Environmental uncertainty may drive firms to integrate supply chains as a network. Fourthly, most empirical data support a positive relationship between supply chain integration and performance (Bagchi et al., 2005; Gimenez & Ventura, 2005; Zailani & Rajagopal, 2005), but some data indicate the opposite (Fabb-Costes & Jahre, 2008). Exactly how supply chain integration and performance are related to each other remains ambiguous, and further research (must be carried out) to improve the theory by defining and measuring supply chain integration and the trade-offs between flexibility and integration (Fabbe-Costes & Jahre, 2008).

Finally, based on the study of central firms in Taiwanese central-satellite production system, this research demonstrates how a supply chain can be integrated as a spider-web supply network by governance mechanisms. However, for cultural and value differences, the function and results of governance mechanisms could be different. This investigation just surveys the central firm. Therefore, buyer-supplier dyad or buyer-supplier-supplier triad is needed for future study.

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