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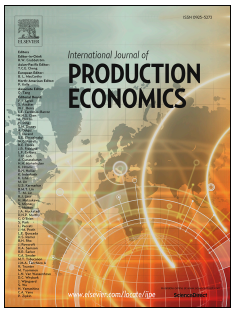

Assessing the influence of supply chain collaboration value innovation, supply chain capability and competitive advantage in Taiwan's networking communication industry

Shu-Hsien Liao, Fang-I. Kuo, Li-Wen Ding

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Assessing the influence of supply chain collaboration value innovation, supply chain capability and competitive advantage in Taiwan's networking communication industry

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Abstract

Taiwan's networking communication industry has had a clustering scale and a good position for collaboration in the global networking communication manufacturing network. This study considers whether Taiwan's networking communication industry can enhance its competitive advantage through supply chain management activities. In order to examine the relationships of supply chain collaboration value innovation, supply chain capability and competitive advantage, this research selects 74 firms and 465 questionnaires from the upstream, middle and downstream manufactures of Taiwan networking communication industry for research subjects, and uses structural equation modeling (SEM) to verify the theoretical model. Results show that the relationships among supply chain collaboration value innovation, supply chain capacity and competitive advantage can have a positive impact, and that supply chain capability is a full mediator. Moreover, supply chain echelons (upper, middle and downstream) have some moderating effects in these relationships.

Key words: Supply chain collaboration value innovation; Supply chain capability; Competitive Advantage; Mediating effect; Structural equation modeling.

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Graphical abstract

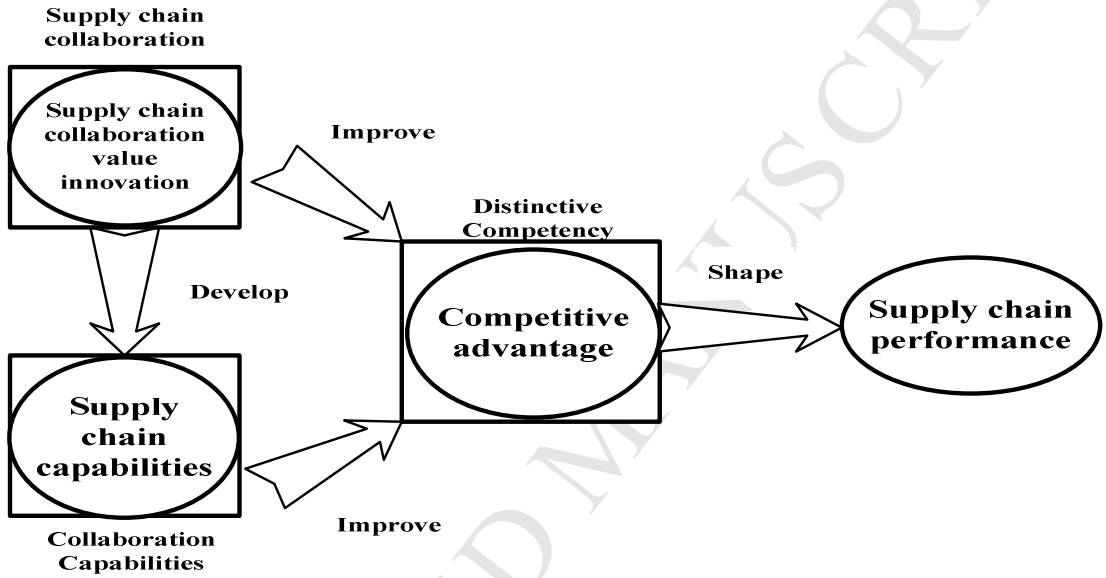

Figure 1 Conceptual framework

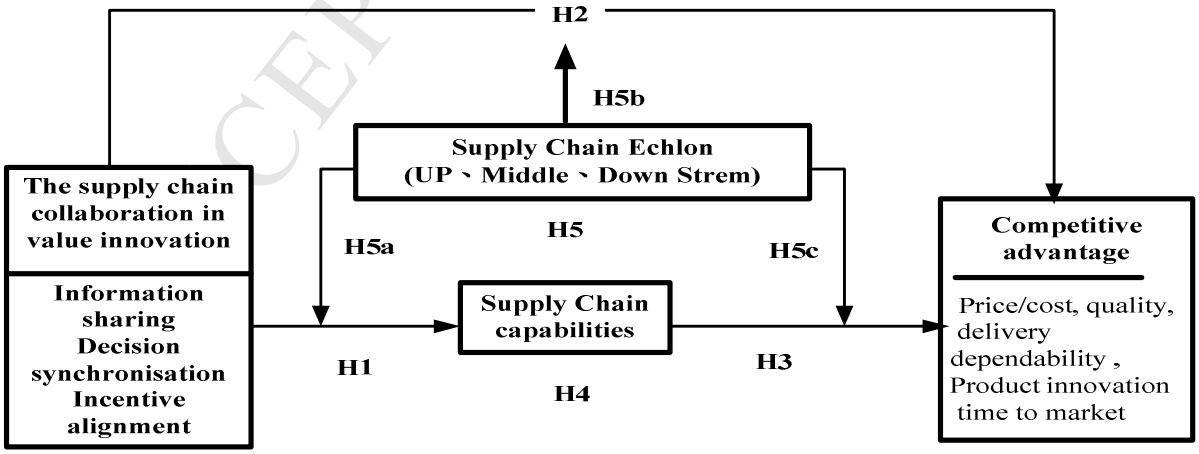

Figure 2 Research framework

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1. Introduction

Collaboration is working with others to complete tasks and to achieve shared goals. As such, it is a recursive process, in which two or more people or organizations work together: more than simply the intersection of common goals, as seen in co-operative ventures, but a deep, collective, determination to achieve a common objective. In particular, firms that work collaboratively can obtain greater resources, recognition and rewards when facing competition for finite resources. Collaboration is one of the most frequently mentioned words in the study of supply chain management. In the past several decades, there has been a need for firms to look outside their organizations for opportunities to collaborate with partners to ensure that the supply chain is efficient and responsive to dynamic market needs. Firms have strived to achieve greater supply chain collaboration to leverage the resources and knowledge of their suppliers and customers and achieve a stronger competitive position (Handfield and Bechtel, 2002; Fawcett and Magnan, 2004; Sheu et al., 2006; Masten and Kim, 2015). Collaborative partner relationships can help firms to increase competitive advantage (Mentzer et al., 2000), manage knowledge flow (Purwaningrum and Yaniasih, 2012), share information (Du et al., 2012), manage inventory levels (Tsou, 2013; Yang et al., 2013), aligning supply chain (Ramanathan, 2013), manage risk (Quoc Le et al., 2013), coordination (Masten and Kim, 2015) and enhance firm performance (Cao and Zhang, 2011). Supply chain collaboration clearly has great potential, but further investigation is needed to recognize its value (Thomé et al., 2012; Forster et al., 2013).

For example, supply chain collaboration value innovation is a critical issue in supply chain management (Lin et al., 2010; Berghman et al., 2012). Supply chain collaboration provides access to new knowledge (Ballou et al., 2000) since firms can learn and innovate from and with other organizations (Liker and Choi, 2004; Bierly and Daly, 2007; Hsieh et al., 2010; Wong et al., 2013). For this, the benefits of supply chain collaboration value innovation, and in particular of inter-firm collaboration, are evident. Scholars have found that collaboration with external parties (e.g., through access to diverse sources of information) determines the degree of novelty of an innovation (Nieto and Santamaría, 2007). Vega-Jurado et al. (2008) hence claim that a firm's capability to develop radically innovative business concepts that influence and even create business value requires not only a differential internal learning mode but also a different external perspective on collaboration and partnerships. We here consider supply chain information sharing as a critical external factor that may influence the effectiveness of deliberate learning mechanisms for innovation ability. Similarly, the benefits of information sharing with other parties may differ throughout different stages of the innovation process (Song and Thieme, 2009). In this regard, we can assume that the information that members of a supply chain can exchange spontaneously through their normal, daily collaborative relationships could function as a platform to develop deeper insight into the type of supply chain that innovation requires. In other words, the amount of information provided by a supply chain through collaborative relationships can be inferred to improve the effectiveness of supply chain capability.

Supply chain capability refers to the ability of an organization to identify, use, and assimilate both internal and external resources and information to facilitate the overall supply chain activities (Bharadwaj, 2000; Wu et al., 2006). Prior research categorizes supply chain capabilities into efficiency- and efficacy-related capabilities (Chen et al., 2009). Efficiency-related capabilities enable organizations to achieve logistics performance at lower cost (Chen et al., 2009; Wu et al., 2003), while efficacy-related capabilities allow organizations to both maintain relationships with supply chain partners and better respond to consumer requirements (Chen et al., 2009; Kim et al., 2006). Supply chain capability can improve the competitive advantage of partners by integrating key business processes from end users through suppliers and vendors and thereby improve business performance (Sahay et al., 2003; Kristal et al., 2010). This is an integration of fall activities associated with the flow of goods from raw material stage through end users, as well as the associated information flows both up and down the supply chain. The success of supply chain management as a system depends on companies that can develop specific capabilities and competitiveness, seek total supply chain coordination, enhance communication to reduce uncertainty and inventory levels, ensure on-time delivery of high quality goods and services at a reasonable cost, and the involvement of appropriate business partners (Acharyulu and Shekbar, 2012).

Competitive advantage provides a valuable theoretical basis for investigating the ways in which supply chain collaboration value innovation can support supply chain capability to achieve a

competitive advantage. This view has its roots in the resource-based perspective (RBV) (Barney, 1991). A firm's resources provide it with unique capabilities that allow it to manage change and identify new opportunities (Barney, 1991). Specifically, the RBV posits that resources are heterogeneously distributed among firms and that advantage emerges as resources are used to cultivate rare, valuable, inimitable, and non-substitutable competencies (Wernerfelt, 1984). This theoretical perspective suggests that critical resources often span firm boundaries and may be embedded in inter-firm routines and processes. It has changed the focus of competitive advantage from the single organization to inter-organizational resources, thereby shifting from a single organization to the entire supply chain network (Barney, 1991). Moreover, the main argument of the capability-based theory of competitive advantages is that conscious and systematic actions of firms can create distinctive capabilities, which enable firms to gain competitive advantages (Penrose, 1959; Wernerfelt, 1984; Hülsmann et al., 2008; Yusuf et al., 2014). Resources are often valuable because they are bundled and used in combination with other resources (Ray et al., 2004). Supply chain collaboration also allows firms to focus on their unique core activities, which increase firm-specific skills and realize economies of scale and learning effects, thereby improving their competitive positions (Lee and Wilhelm, 2010; Cao and Zhangb, 2011).

Thus, SCC (supply chain collaboration) seeks to enhance competitive performance by closely integrating the internal functions within a firm and effectively linking them with the external operations of suppliers, customers, and other channel members (Kim, 2009). While the emerging

conventional practice suggests that the greater the extent to which manufacturers engage in Internet-enabled commerce with supply chain partners the better the performance. Such as Rosenzweig (2009) examines that the relational view of competitive advantage and contingency theory, he develops a model and a series of hypotheses that specify how various product and market characteristics may influence the nature of the expected positive relationship between supply chain e-collaboration and performance. Viewed from this perspective, we can recognize that the level of supply chain collaboration has significant associations with the utilization of SCC practices for the intensification of competitive capabilities and firm performance. Lin et al. (2010) proposed a model which addresses the drivers of innovation in the channel integration of supply chain management. In addition, Wu et al. (2013) proposes a research model to examine the relationships among SET-based variables, information sharing and collaboration, and supply chain performance. Their findings show that SET-based issues are important to determine information sharing and collaboration and both information sharing and collaboration indicate partial mediation effect on supply chain performance. Their findings confirm that value co-creation and value constellations, which serve as the drivers of innovation in channel integration, are positively associated with supply chain performance.

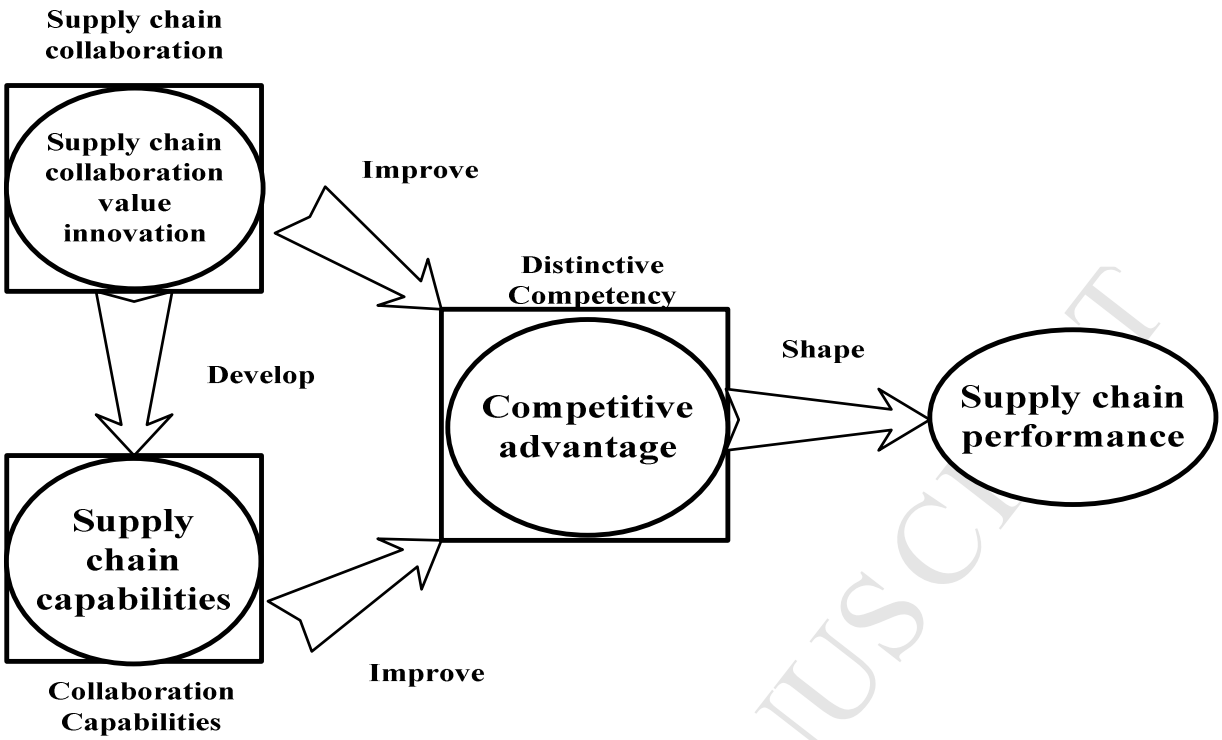

Figure 1 Conceptual framework

To investigate whether supply chain collaboration value innovation, and supply chain capabilities can improve competitive advantage, we do not overstress either the technical aspects or management aspects of supply chain management issues, since they are mutually complementary. Hence, this study proposes a conceptual structure, as shown in Figure 1, in terms of establishing a possible theoretical model, and implements measurement tools to investigate these relationships in the case of the networking communication industry in Taiwan.

Taiwan's networking communication industry has a clustering scale of supply chain and a position of collaboration in the global networking communications manufacturing network. Furthermore, in this industry the critical core components of technical limitations, short product life cycles, rapid market changes, and international economic development is currently experiencing a

continuing downturn. This study investigates how the Taiwan networking communication industry could enhance the competitive advantage of an enterprise itself, and also better manage its external competition further. The rest of this paper is organized as follows. In the next section, we briefly review the related literature to provide a theoretical foundation and underlying principles for our SC collaboration value innovation model, and based on this proposed model we develop our research hypotheses. Section 3 describes the research methodology, model development and results. Section 4 discusses managerial implications and section 5 concludes with our research findings, managerial implications and a discussion of possible directions for future research.

2. Literature review and hypothesis development

2.1 Supply chain collaboration value innovation (SCCVI)

Mentzer (2000) proposed that organizations should have the same collaboration goal and that relationships should involve long periods of joint activities. Ellinger et al. (2000) suggested that a higher level of supply chain collaboration leads to higher business-partner independence. Numerous organizations may have considered and pursued external collaboration, but often to the detriment of their efforts to promote internal collaboration. Collaborative SCM goes beyond merely exchanging and integrating information between suppliers and their customers since it involves tactical joint decision-making among the partners in the areas of collaborative planning, forecasting, distribution, and product design (Fawcett and Magnan, 2004). Simatupang and Sridharan (2005) found that supply chain members who had higher levels of collaboration practices were able to

achieve better operational performance and innovation activities.

Because of increased development of supply chains through collaboration, numerous scholars have extended the supply chain concept and expanded it to include upstream, midstream and downstream partners who share information and risk, synchronize business operations, improve customer services, and enhance customer satisfaction to create a more effective supply chain. Supply chain collaboration involves the participation of all supply chain partners in actively collaborating toward a common goal. Sahay (2003) also argued that collaboration enables value creation in supply chain activities. Michel et al. (2008) proposed that firms change their value creation by embedding operant resources into objects, by changing the resource integrators, and by reconfiguring value constellations. Therefore, firm value creation is altered through innovation. Only by promoting constant product innovation, service-process improvement, and overall supply chain value can enterprises maintain a sustainable competitive advantage and sustainable business, and thereby create business value (Matheson and Matheson, 1998). On the other hand, Kim et al. (2006) advocated that the innovations surrounding supply chain communication systems (SCCS) should affect channel relationships and market performance. By sharing plans for new products and market development, market performance reflects enhanced channel functions. Collaboration is a significant process that leads to value-creation opportunities in SCM (Fu and Piplani, 2004). Therefore, Simatupang and Sridharan (2002) proposed that collaborative supply chains are better able to deliver products with excellent quality on time. Based on Simatupang and

Sridharan (2005), Kim et al. (2006), and Michel et al. (2008) this study uses three dimensions to measure supply chain collaboration value innovation including information sharing, decision synchronization and incentive alignment.

2.2 Supply chain capability

Organizations seek competitive capabilities that enable them to exceed customers' expectations and enhance market and financial performance. According to Barney (1991), capability means that a firm needs to be so managed and organized that it can exploit the full potential of its resources. The emergence of global operations, scientific and technological progress has a rapidly changing industrial environment have shortened product life cycles. Thus, supply chain capabilities are becoming increasingly vital. Morash (2001) stated that, "supply chain capability is the building block for supply-chain strategy and a source of competitive advantage for firm success." Morash et al. (1996) indicated that different capabilities support different value disciplines. The first discipline is demand-oriented logistics capability, and the second value discipline is supply-oriented logistics capabilities.

Lynch et al. (2000) divided supply chain capabilities into supply-driven process capability, and demand-driven value-added capabilities. Supply-driven process capability uses a more streamlined and standardized supply-chain business process to analyze extensive or intensive distribution to create ways to deliver products and services that are more efficient, and to reduce total distribution costs. Demand-driven value-added capabilities meet customer demand for special

products or customized services, designed to create added customer value and to maximize customer satisfaction and continuous improvement. We here focus on coordinating upstream, midstream, and downstream supply-chain partners, and coordination effect on overall value innovation. Supply chain capabilities can be divided into five simple categories: supply chain process capabilities, product/service standardization and unification, improved product and service quality, maintaining customer and partner relationships, and customer and partner capacity to solve problems (Morash et al., 1996; Lynch et al., 2000).

2.3 Competitive advantage

Competitive advantage is the extent to which an organization is able to create a defensible position over its competitors (Porter, 1985) To maximize competitive advantage all members within the supply chain should “seamlessly” work together to serve the end consumer (McGinnis and Vallopra, 1999). Porter (1985) suggests that the way a firm links to other firms in its value chain can affect its competitive advantage, particularly when assets external to the firm are created that can be differentiated from other value chains. Competitive advantage is broadly expressed in terms of cost, flexibility, quality and delivery. Therefore, Adner and Helfat, (2003) showed that strategic choices pursuing sustainability can be a decisive factor that may enable firms to create unique competitive advantages in terms of product image, sales, market share, and new market opportunities. Reducing product development cycle time and hence the time to introduce a new product can create relative advantages in market share, profit, and long term competitive advantage

(Karlsson and Ahlstrom 1999). Over the past decade, resource-based researchers have identified a number of value-creating dynamic capabilities, among which is product innovation. Innovation speed is particularly important in environments characterized by competitive intensity (Eisenhardt and Martin, 2000). Lin et al. (2006) describe a research framework for competitive capabilities and define the following five dimensions: competitive pricing, premium pricing, value-to-customer quality, dependable delivery, and production innovation. These dimensions are also described by Li et al. (2006). Based on the above, the dimensions of the competitive advantage constructs used in this study are price/cost, quality, delivery dependability, product innovation, and time to market.

2.4 Relationships between supply chain collaboration value innovation and supply chain capability

Manthou et al. (2004) presented a supply chain collaboration framework in a virtual environment. That model classifies partner roles, identifies key capabilities to structure each collaborative relationship, and evaluates partner readiness to collaborate. Lin et al. (2010) found market-orientation supply chain collaboration to be significantly related to embedding operant resources and resource integration, which is significantly related to value co-creation and innovation, embedding operant resources, and resource integration. Soosay et al. (2008) stressed that collaboration in supply chains is important for innovation as partners realize the various benefits of innovation such as high quality, lower costs, more timely delivery, and more efficient operations and effective coordination for of all activities. Lin et al. (2010) emphasized the importance of innovation in channel integration between supply chain partners collaborating to

co-create new customer value. Thus, drivers of supply chain performance and capabilities can be implemented from a strategically oriented perspective. This current study infers that supply chain collaboration value innovation affects supply chain capability, leading to enhanced supply chain capability. In addition, Fawcett et al. (2012) find that competitive success depends more on the strength of the supply chain collaboration than on the capabilities of any single company in terms of value innovation creation. Thus, we propose the first hypothesis as follows:

Hypothesis 1： Supply chain collaboration value innovation has a positive influence on supply chain capabilities.

2.5 Relationships between supply chain collaboration value innovation and competitive advantage

Mentzer et al. (2000) found that collaboration also resulted in faster product-to-market cycle times, improved service levels (based on stock outs, lead times, and quality), and a better understanding of end-customer needs throughout the entire chain (market intelligence). Li et al. (2009) investigated the relationship among three factors: IT implementation, supply chain integration (SCI), and supply chain performance (SCP). They presented a conceptual-structure model in which IT implementation affects SCP either directly or indirectly with collaborative innovations through SCI, and they also suggested that IT implementation has no direct effect on SCP, but that it enhances SCP through its positive SCI effect. Lin et al. (2010) proposed a model to address innovation drivers in supply chain channel integration and supply chain performance. Collaborating firms share responsibilities and benefits by establishing a degree of cooperation with

their upstream and downstream partners in order to create competitive advantage (Spekman et al., 1998). This study infers that collaborative supply chain value innovation affects competitive advantage. We thus propose the second hypothesis as follows:

Hypothesis 2: Supply chain collaboration value innovation has a positive influence on competitive advantage

2.6 Relationships between supply chain capability and competitive advantage

Based on the resource-based view (RBV), Wu et al. (2006) proposed that IT-enabled supply chain capabilities are firm-specific and difficult to copy across organizations. These capabilities serve as a catalyst in transforming IT-related resources into improved firm performance. Kim (2006) examined the causal linkages among SCM practice, competition capability, the level of supply chain (SC) integration, and firm performance. He developed a framework for linking a firm's SC integration strategy to its competitive strategy, and to identify how to connect such linkages to improved firm performance. Firms participated in collaboration to develop, maintain, and even enhance supply chain capabilities that contribute to enhancing firm performance and, ultimately, competitive advantage (Hardy et al., 2003). Kristal et al. (2010) investigated the influence of an ambidextrous supply chain strategy on manufacturers' combined-competitive capability—the ability to excel simultaneously in the competitive capabilities of quality, delivery, flexibility, and cost—and, in turn, on firm performance. They found that an ambidextrous supply chain strategy coincides with combined-competitive capabilities. Thus, we propose the third

hypothesis as follows:

Hypothesis 3: Supply chain capability has a positive influence on competitive advantage

2.7 Relationship among supply chain collaboration value innovation, supply chain capability and competitive advantage (mediating effect)

Supply chain collaboration is often defined as two or more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits that result from greater profitability of satisfying end customer needs than acting alone (Simatupang and Sridharan, 2002). Roth and Nigh (1992) and Gunasekaran et al. (2001) indicated that enterprise collaboration improves flexibility, delivery time, product quality, and other non-financial indicators. Sheu et al. (2006) defined the social factors of supply chain collaboration such as interaction, trust, and technological factors, such as information-technology capabilities and information-sharing, which affect collaborative supply chain value innovation. Lin et al. (2010) suggested that innovation value in supply chain collaboration is a resource that enhances business performance and capabilities. This study infers that supply chain collaboration value innovation affects competitive advantage through supply chain capability. Thus, we propose the following hypothesis:

Hypothesis 4: Supply chain collaboration value innovation affects competitive advantage through supply chain capability

2.8 Supply chain echelon (moderating effect)

Clark and Scarf (1960) first introduced the inventory-echelon concept, considering the problem of determining optimal-purchasing quantities in a multi-installation model of this type. Axsaeter and Rosling (1993) also compared installation and echelon-stock policies for multilevel inventory control, and found that inventory-echelon policies are better than installation-stock policies. On the other hand, from a supply network perspective, the relative position of individual firms with respect to one another influences both strategy and behavior. In this context, it becomes imperative to study each firm's role and importance as derived from its embedded position in the broader relationship structure on supply chain echelon (Kim et al., 2011). Based on their findings, we assume that the supply chain echelon has a regulatory effect on collaborative supply chain value innovation, supply chain capabilities, and business performance.

We use the concept of multiclass-level inventory to develop a supply chain-level collaborative mechanism for supply chain value innovation, supply chain capabilities, and business performance and to analyze the regulation effect. Supply chain collaboration and management has been used in many industries to gain competitive advantage (Akintoye et al., 2000). Thus, we measure upstream, midstream, and downstream supply chain levels in the inventory echelon. This study uses a questionnaire to analyze the distinction among upper, midstream, and downstream communications industries in Taiwan. Thus, we propose the following hypotheses:

H5: The supply chain echelon has a moderating effect on supply chain collaboration value innovation, supply chain capabilities and Competitive advantage.

H5a: The supply chain echelon has a moderating effect on supply chain collaboration value innovation and supply chain capabilities.

H5b: The supply chain echelon has a moderating effect on supply chain collaboration value innovation and Competitive advantage.

H5c: The supply chain echelon has a moderating effect on supply chain capabilities and competitive advantage.

Accordingly, we investigate the relationships among supply chain collaboration value innovation, supply chain capability and competitive advantage by proposing our research framework, as described in Figure 2.

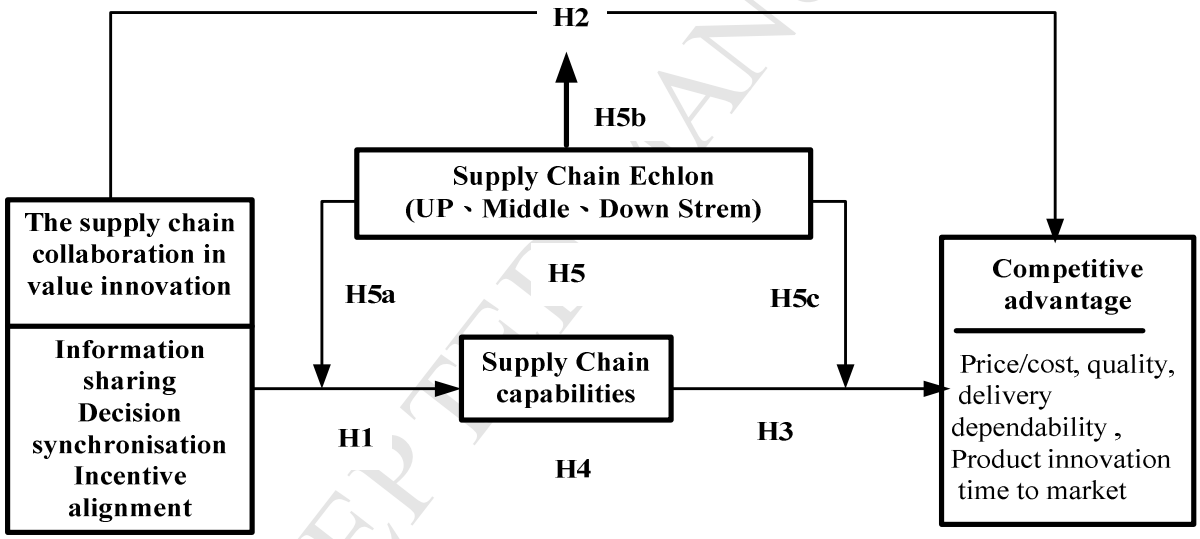

Fig. 2 Research framework

3. Measurement, data analysis, and results

3.1 Measurement

3.1.1 Supply chain collaboration value innovation (SCCVI)

We measured the features of upstream, midstream, and downstream partners involved in a

supply chain collaboration value innovation (SCCVI). The key features, which are the three dimensions of information sharing (IS), decision synchronization (DS) and incentive alignment (IA), are implemented in this study. We referred to information-sharing surveys developed byKim et al. (2006), Michel et al. (2008), and Simatupang and Sridharan (2005) in adopting a 7-point Likert scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*; Table 1)

Information-sharing (IS) is the degree of supply chain collaboration for one variable measure (i.e., IS between supply chain members that can be immediately accessed). We also transferred relevant market information to facilitate decision-maker planning and control (Kim et al., 2006; Michel et al., 2008; Simatupang and Sridharan, 2005). At the cooperative level in collaborative-value innovation, supply chain partners share information, including future market trends, new technologies, and process innovation and knowledge management capabilities to improve supply chain members and enhance value.

Decision synchronization (DS) is a dimension to measure the degree of supply chain collaboration. DS refers to supply chain collaboration and value innovation in market planning at the implementation level and through joint planning of target markets and product assortment. Incentive alignment (IA) is also a dimension to measure the degree of supply chain collaboration by investigating the alignment of supply chain partners.

For supply chain collaboration and value innovation, incentive alignment represents how supply chain members share costs, risks, and benefits (Kim et al., 2006; Michel et al., 2008,

Simatupang et al., 2002). The existing motivation affects how individual supply chain members behave and interact with other members. Interest conflicts often lead individual members who are concerned with self-maximized benefit to reduce overall supply chain profit and benefits. Conflict between partners prevents the supply chain from attaining expected benefits and creating value.

Table 1 Measurement of supply chain collaboration value innovation

Dimensions	Items	Source
Information sharing (IS)	1. Current trends and future opportunities for external prediction. 2 .New customers with their own preferences. 3. Products may be used more effectively. 4. New markets and forecasts of potential demand. 5. Preference for new customers, new product development and design (functional change) change. 6. Demand for innovation of new product design parts and components (service flow). 7. The cost structure of new product design. 8. Related projects with particular expertise knowledge databases. 9. The best features of new products / Utility Engineering Solutions (Integrated Services) program. 10. New product specifications and standards.	Kim et al. (2006)
Decision synchronization (DS)	1. Joint planning related to the impact of potential trends on current business models and business opportunities in the future. 2. Joint redefinition of the industrial customer base and common needs. 3. Re-planning of joint function products. 4. Joint development of new products and expansion of new demand benefits. 5. Joint planning and development and design of new product or service benefits. 6. Joint planning and development benefits of new product designs or parts and components required for innovation. 7. Joint planning benefits for the development of new products, using the target cost approach. 8. Joint planning and analysis required for the development of new product planning, technology and knowledge. 9. Conjoint analysis and planning to provide total solution products required	Michel et al. (2008) Simatupang and Sridharan (2005)

	by technology. 10. Joint planning and designed specifications for new products.	
Incentive alignment (IA)	1. By cross-functional core team meetings, partners will open up discussions about new ideas. 2. Coordination of new business ideas will reduce revenue and the market position of suppliers and lead to potential conflict. 3. A win-win partnership is a shared vision between partners. 4. Participation in the process of innovation and the development of intellectual properties a cooperative agreement between firms to share a common way. 5. Partners reach an agreement about the overall development costs of new services. 6. Partners have a common coordinating mechanism for the introduction of new product ideas in order to save time. 7. Partners share a common coordination mechanism for the concept of target cost. This leads to new benefits resulting from the effectiveness of coordination. 8. Partners have a joint coordination mechanism to increase or reduce the cost of the development of innovative new materials. 9. Partners have a common coordinating mechanism for continuous growth through sustained revenue and profitability. This can be ensured by a close relationship between partners. 10. Partners have common coordination mechanisms for autonomy and recognition of the value of cooperation between them.	

3.1.2 Supply chain capability

Measurement source: We mainly refer to the measurement table of supply chain capability (SCC) proposed by Morash et al. (1996) and Lynch et al. (2000) to establish five quizzes using a 7-point Likert scale measurement, from *strongly disagree* to *strongly agree*. A higher score indicates more effective executing ability in the supply chain (Table 2).

Supply-oriented: The firm or its supply chain, including upstream, midstream, and downstream, simplifies the standardized supply chain processes.

Demand-oriented: This refers to customer demand-driven value-added ability or the upstream, midstream, or downstream supply chain. Customer-tailored or customized products and services or special products designed for the downstream supply chain allow partners to create the greatest added value and to continuously improve customer satisfaction.

Table 2 Measurement of supply chain capability

Variables	Items	Source
Supply chain capability (SCC)	1. We are ready to simplify supply chain processes and have the strength to remove unnecessary or duplicated processes. 2. We provide high quality products and prompt delivery capacity. 3. We have good relations with customers and partners. 4. We have the ability to solve problems for customers. 5. We are capable of standardizing and unifying products and services.	Morash et al. (1996) and Lynch et al. (2000)

3.1.3 Competitive advantage

We referred to the study by Hill and Jones (2001) that the competitive advantage mainly from better efficiency, quality, innovation, and the ability to respond to customers. It therefore encouraged enterprises to achieve these four basic aspects and relies on the unique capabilities, efficiency, quality, innovation and customer response. Thus they are related to each other, interaction, good efficiency which can improve the quality of good quality and can be brought to charge higher prices, and lower costs. By doing so, innovation and customer responses can improve customer satisfaction enable enterprises to get better profits, build sustainable competitive

advantage. In addition, Kristal et al. (2010) investigated the influence of an ambidextrous supply chain strategy on manufacturers' combined-competitive capabilities and, in turn, on firm performance.

Roth and Nigh (1992), Gunasekaran et al. (2001) and Li et al. (2006) indicated that enterprise collaboration involves flexibility, delivery time, product quality, and other non-financial indicators. Accordingly, the dimensions of the competitive advantage constructs used in this study are price/cost, quality, delivery dependability, product innovation, and time to market.

Table 3 Measurement of competitive advantage

Dimensions	Items	source
Price/Cost	1. Your company can provide the lowest price. 2. Your company can provide prices as low or lower than our competitors	Tracey et al. (1999) Hill and Jones (2001) Li et al. (2006). Kristal et al. (2010)
Quality	3.Your company can use the product or service quality to compete with rivals 4.Your company provides reliable products and services 5. Your company provides products and services that are very durable. 6. Your company provides high-quality products that fulfill customer needs.	
Delivery Dependability	7. Your company guarantees to provide the market demand for the product or service. 8. Your company can provide timely delivery of customer products or services. 9. The transport process that provides your company's products or services is quite reliable.	
Product Innovation	10. Your company can adapt according to different needs of customers to provide customized products. 11. Your company alter our product offerings to meet client needs. 12. Your company can fully respond to customers on new product / service needs	

Time to Market	13. Your company has rapid product or services delivery. 14. Your company is often the first to introduce a new product or service on the market place. 15. Your company's products or services delivery time is lower than the industry average 16. Your company can quickly launch new products	

3.2 Sample

A total of 600 questionnaires were sent out and 233 were returned from the upstream, with a total of 113 valid responses. 85 were returned from middle stream. A total of 147 valid responses were returned from the downstream. Manufacturers and suppliers in the upstream, middle, and downstream with 4-6 years of cooperation on average accounted for 47.6%. Companies with turnovers of 50-100 million accounted for 19.8%. Those companies with turnovers of 10 billion or more accounted for 33.4%. Men accounted for 69.0%, while females accounted for 31.0%. 31-40 year olds accounted for more than 63.1% of respondents. Respondents with university education accounted for 50.5%, while those with masters accounted for 40.4%. 34% of respondents work in the R&D sector accounted, while 25.9% work in the purchasing department.

3.3 Measurement model

3.3.1 Confirmatory Factor Analysis

We implemented confirmatory factor analysis (CFA) to test the fitness-to-factor and variable items, as listed in Table 4. CFI performed well for both the small and large samples, with the GFI value equal to or exceeding 0.9 The SRMR value should be below 0.05, and the RMSEA value

should be below 0.08. The CFI value was equal to or exceeded 0.9. All indices matched the benchmarks (Hu and Bentler, 1999; McDonald and Ho, 2002).

Table 4 Confirmatory factor analysis

Index	The collaboration for supply chain value innovation	Supply chain capabilities	Competitive advantage
(GFI)	0.90	0.94	0.92
(SRMR)	0.075	0.064	0.043
(RMSEA)	0.13	0.25	0.076
(NNFI)	0.89	0.70	0.97
(CFI)	0.92	0.90	0.98
(Normed Chi-Square)	267.11	60.87	293.51

3.3.2 Reliability analysis

Cronbach's α for all variables in this study exceeds 0.8, and this method therefore achieves valid reliability (Nunnally, 1978) (Table 5).

Table 5 Reliability analysis

Variable name	Dimension	Cronbach's α
Collaborative supply chain value innovation	Information sharing	.800
	Decision synchronisation	.883
	Incentive alignment	.885
Supply chain capabilities	Supply chain capabilities	.846
Competitive advantage	Price/cost	.829
	Quality	.888
	Delivery Dependability	.867
	Product Innovation	.830
	Time to Market	.889

3.3.3 Convergent Validity

The T values of all the research items were between 3.77 and 23.58, indicating that all

observation items significantly represent latent variables.

3.3.4 Discriminant Validity

We based discriminant validity testing on the method by Anderson and Gerbing (1988). If the chi-square ($\chi 2$) value of the difference between the restricted model and the non-restricted model is greater than 3.84 then the discriminant validity of these two dimensions is good. Because the chi-square ($\Delta\chi 2$) value ranges from 17.40 to 129.1, the discriminant validity of this study is good (Table 6).

Table 6 Discriminant Validity

	Model	X^2	DF	Δx^2
Collaborative supply chain value innovation	Non-restricted model	267.11	32	---
	Information sharing – Decision Synchronisation	498.12	33	231.01
	Information sharing – Incentive alignment	348.55	33	81.11
	Decision Synchronisation- Incentive alignment	350.00	33	82.89
Competitive Advantage	Non-restricted model	293.51	80	---
	Price- Quality	378.28	81	84.77
	Price- Delivery Dependability	373.84	81	80.33
	Price- Product Innovation	382.02	81	88.51
	Price- Time to Market	333.81	81	40.3
	Quality- Delivery Dependability	395.11	81	101.60
	Quality- Product Innovation	379.43	81	85.92
	Quality- Time to Market	297.61	81	4.1
	Delivery Dependability - Product Innovation	309.43	81	15.92
	Delivery Dependability	293.51	81	---

	- Time to Market			
	Product Innovation - Time to Market	295.28	81	1.77
1：Δx^2=之 X^2 2：>3.84，*				

3.5 Research Hypothesis

We used maximum likelihood estimation to estimate the theoretical model of γ and β, and to test whether the hypotheses were significantly supported. The sample size should be between 100 and 150 when using the maximum likelihood estimation method to estimate a structural model (Ding et al., 1995). The sample size in this study was 465, meeting the sample-size requirements. Test results are shown in Table 7.Research results from the structural model are as follows:

(1) Relationship between collaborative supply chain value innovation and supply chain capabilities

Table 7 shows that CSCVI and supply chain capabilities are significantly correlated ($\gamma 11 = 0.62$, $p < .05$), indicating that CSCVI has a direct influence on supply chain capabilities. Therefore, H1 is supported.

(2) Relationship between CSCVI and Competitive advantage

Table 7 shows that CSCVI and competitive advantage are not significantly correlated ($\gamma 11 = -0.23$, $p < .05$), indicating that CSCVI has a negative influence on supply chain capabilities. Therefore, H2 is not supported.

(3) Relationship between supply chain capabilities and competitive advantage

Table 7 also shows that supply chain capabilities and competitive advantage are significantly correlated ($\beta 21 = 0.74, P < 0.05$), indicating that supply chain capabilities have a direct influence on competitive advantage. Therefore, H3 is supported.

(4) The relationship among collaborative supply chain value innovation, supply chain capabilities, and competitive advantage

According to LISREL 8.80, total and indirect effects are shown as Table 7. The total effect of collaborative supply chain value innovation on competitive advantage was 0.24, and the indirect effect was 0.46 ($p < .05$), as shown in Tables 4-10. From the results, the relationship between CSCVI and competitive advantage is partially mediated by supply chain capabilities. Thus, H4 is supported.

Table 7 Path variables

Path	Parameter estimate	Standard error	T Value	Hypotheses	Result
CSCVI ⟶ Supply chain capabilities	0.62	0.62	4.02	***	Supported
CSCVI ⟶ Competitive advantage	-0.23	0.74	-2.67	___	
Supply chain capabilities⟶ Competitive advantage	0.74	-0.23	3.63	***	Supported
Note 1: ｜T｜≧1.96，*p 0.05 level。					

3.6 Total and indirect effect

In this case, supply chain capabilities mediate the relationship between CSCVI and competitive advantage. Thus, H4 is supported (Figure 3 and Table 8).

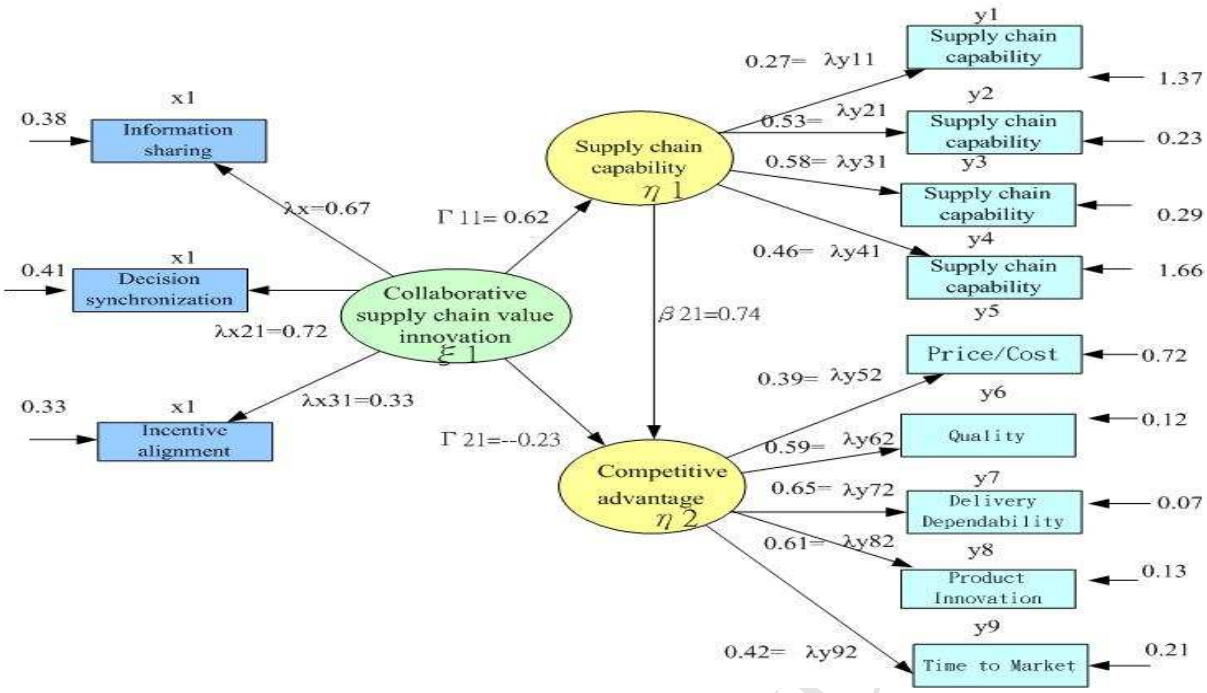

Fig 3. Path analysis diagram

Table8 Total and indirect effect

	Variable name	Effect	Supply chain capabilities		Competitive advantage	
			Effect	T Value	Effect	T Value
Exogenous Variable	CSCVI	Direct effect	0.62	4.02	-0.23	-2.67
		Indirect effect	----	----	0.46**	
		Total effect	0.62	4.02	0.24	
Endogenous Variable	Supply chain capabilities	Direct effect	----	----	0.74	3.63
		Indirect effect	----	----	----	---
		Total effect	----	----	0.74	3.63

3.7 Supply chain echelon analysis (moderating effect)

Following Brockman and Morgan (2006), we used multi-group analysis to test whether the supply chain echelon has a regulatory effect on the theoretical models. In the supply chain echelon, supply chain capabilities is significantly correlated with competitive advantage (△ $\chi 2$ = 15.85). In the supply chain echelon, CSCVI and supply chain capabilities exhibit a non-convergence effect.

Therefore, the data were not statistically useful. Supply chain collaboration in value innovation and competitive advantage was also found to be correlated at a less than significant level, △ χ2 (Table 9).

Table 9 Supply chain echelon (Moderating effect)

Path	Chi-square	Df	△χ2
No limit	592.10	153	
Collaboration for supply chain value innovation - Supply chain capabilities	593.10	155	1
Collaboration for supply chain value innovation - Competitive advantage	590.36	155	-2
Supply chain capabilities - Competitive advantage	607.95	155	15.85
Note 1: The collaboration for supply chain value innovation - Supply chain capabilities: No convergence. Note 2: The supply chain collaboration in value innovation - Competitive advantage: No need to adjust. Note 3: Supply chain capabilities - Competitive advantage: Need to adjust.			

According to this path, supply chain capabilities have a significant moderating effect on competitive advantage. Upstream, midstream, and downstream parameter estimates are then 0.34, 0.34, and -0.19, respectively, meaning that the upstream and downstream firms of supply chain capabilities- competitive advantage is higher than downstream (Table 10).

Table 10 Path limit

	Up Stream		Middle Stream		Down Stream	
	Estimates	T value	Estimates	T value	Estimates	T value
CSCVI -Supply chain capabilities	-0.05	-0.5	1.65	4.37	1.53	3.63
CSCVI - Competitive advantage	-0.14	-1.76	1.03	4.37	0.34	4.37
Supply chain capabilities - Competitive advantage	0.34	4.37	0.34	3.44	-0.19	-0.90

4. Managerial implications

(1) This study shows that the supply chain collaboration value innovation has a positive impact on supply chain capability. The analysis results are same as those in the study by Simatupang and Sridharan (2005). For the networking communication industry supply chains of upper, middle and downstream manufacturers, this study recommends that higher supply chain collaboration value innovation is better than supply chain capacity. Because the supply chain collaboration value innovation creates an information-transparent platform, making the supply chain partner a cooperation place when facing the competition market. These efforts can make changes to create the product difference, and simplify operational procedures, helping the new product to meet the market demand more rapidly, and thereby promote enterprises' competitiveness. This result is also consistent with the study by Moarsh (2001).

(2) This research finds that a firm’s supply chain ability has a positive influence on its competitive advantage which may promote operational achievements of the enterprise. Results of the analysis are consistent with Morash et al. (1996), and Lynch et al. (2000) their research results. The networking communication industry can enhance the ability to use the supply chain to provide high quality products and fast delivery capabilities, as well as to adjust and improve workflow efficiency.

(3) The supply chain capability is a mediator between supply chain collaboration value innovation and competitive advantage and supply chain collaboration direct effect competition advantage is

not obvious. Kristal et al. (2010) find that an ambidextrous supply chain strategy coincides with combinative competitive capabilities and business performance. Therefore, this study suggests that in Taiwan's networking communication industry, middle and downstream manufacturers that intend to improve their competitive advantage can proceed from an innovative supply chain capability.

(4) In recent years, the scholars began to pay increasing attention on multi-level analysis on the supply chain echelon using moderating effect analysis. Based on the supply chain echelon moderating effect, in networking industry's upper, middle and downstream, collaboration for supply chain value innovation, supply chain capabilities and competitive advantage has a partial moderating effect. Thus assumption H5 is supported.

(5) From the supply chain echelon moderating effect, this industry echelon, moderating effect between collaboration for supply chain value innovation and supply chain capabilities is not obvious. Thus Hypothesis H5a is not supported. Because most of the major key components are still controlled by a few upstream manufacturers, a stable supply must be established with upstream sources to ensure the stability of shipments.

(6) From supply chain echelon, a moderating effect result showed that the networking communication industry (upper, middle and down stream) moderating effect in the supply chain collaboration value innovation, supply chain capability is not significant and does not require adjustment. Thus Hypothesis H5b is not supported. In the Taiwan networking communication

industry, supply chain collaboration value innovation and competitive advantage stands at the lowest level of the upstream cooperation. The key core manufacturing components controlled by some other international firms, thus product costs can not be declined in own technologies. However, supply chain cooperation is difficult in the short term, although it also affects an enterprise's competitive advantage.

(7) Moderating effects on supply chain capabilities and competitive advantage are significant. The Hypothesis H5c is supported. Supply chain capabilities can enable the right product, at the right time to be delivered to the right place, and to the right people (Morash and Cliton, 1995). This is consistent with this study. To enhance the Taiwan networking communication industry's competitive advantage and this result can be controlled through enhanced supply chain capability that allows companies to enhance competitive advantage.

(8) Taiwan's networking communication industry is a vertically integrated industry. Its supply chain mode through upstream core component manufacturers is responsible for defined Netcom products of features specifications. This collaborative relationship mode, a close partnership among upper, middle and downstream, is belonging to a supply chain vertical type of collaborative mode (supply chain vertical cooperation model), at all levels, through information-sharing, technology transfer and resource sharing to achieve this collaboration. Thus, this study proposes a value research issue by investigating a real case of a vertical supply chain in Taiwan networking communication industry on how to enhance supply chain capability and competitive advantage through collaboration value innovation.

5. Conclusion

Due to changes in the external environment, enterprises must make some adjustments in order to survive. In the traditional supply chain, the relationship between manufacturers is a "zero sum game," and there is no mutual cooperation. However, in today's value chain patterns the interests of manufacturers are tied together. With supply chain integration, this partnership allows companies to control backward supply raw materials or components, and enhance the inventory management system, optimize product manufacturing and reduce production costs.

On the other hand, integration with distributors has more accurately customer needs, providing more market product and can help to build service brand, towards the development of high value-added services. In addition, strategic alliance integration is through complementary group war strategy, growing momentum to improve the chances in the marketplace. From this study, the research results indicate that supply chain collaboration value innovation could help enhance the firm competitive advantage through supply chain capabilities. Therefore, this study suggests that the Taiwan networking communication supply chain industry must pay attention to the supply chain collaboration value innovation and use supply chain capabilities in order to promote the improvement of competitive advantage.

They are selected firms of Taiwan networking communication industry participated as subjects on this study. This limitation should be overcome by investigating a complete survey on the whole Taiwan networking communication industry supply chain. Finally, this study might be an example to consider extending research results to other industries on future supply chain research.

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Assessing the influence of supply chain collaboration value innovation, supply chain capability and competitive advantage in Taiwan's networking communication industry

Highlight

1. Taiwan's networking communication industry has a good position for collaboration in the global manufacturing network.
2. This research selects 74 firms and 465 questionnaires from supply chain echelons of the industry.
3. This study uses structural equation modeling (SEM) to verify the theoretical model.
4. Results show that the relationships among SCCVI, SCC and CA can have a positive impact.
5. Supply chain capability is a full mediator.
6. Moreover, supply chain echelons have some moderating effects in these relationships.