The relationships among network ties, organizational agility, and organizational performance: A study of the flat glass industry in Taiwan

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Abstract

Firms face a rapidly changing market environment under the pressure of difficult challenges such as limited resources and increasing costs. Organizations may actively seek to cooperate with other members for benefits from knowledge sharing. Establishing quality network ties among suppliers and customers is a significant study subject. Here, we assessed the impact of the signing of the Economic Cooperation Framework Agreement on Taiwan flat glass industry and study measures adopted by the manufacturers. The effective sample size is 250. We found that through the intermediary of organizational agility and strong network ties, a firm can enhance its organizational performance.

Keywords: network ties, organizational agility, organizational performance, Economic Cooperation Framework Agreement (ECFA), flat glass industry

INTRODUCTION

The maxim that 'the fittest survive,' derived from mid-19th century Darwinian evolutionary theory, has now been regarded as indisputable for many years. An organization, just like a creature, has survival mechanisms for adapting to environmental change, thus evolving with the changes. When facing an ever-changing environment, managers know how to react and adjust their organizational structure effectively. The way for a firm to survive is to observe the environment constantly and to understand correctly the key to success.

Since the proposal of the virtual organization concept in 'The Virtual Corporation' by Davidow and Malone (1992), it is still widely discussed in the academic and practical fields. Their research showed a similarity between the service industry and the manufacturing industry. In order to meet customers' needs for customization and rapid responses, the related information and resources must be integrated to engage in collaboration, thereby achieving customer satisfaction that enterprises seek. New organization types are generated due to competition or environmental changes, while virtual organizations or network organizations emerge in response to the rapidly changing environment and new opportunities. Enterprises can be quickly divided into several parts and then regrouped in a new way (Kaplan & Norton, 2006).

Many different schools and viewpoints discuss the direction of virtual organizational performance, and most literatures explore and summarize the structure, procedure, or level of virtual organizations,

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involving a great deal of observation. However, the present study was conducted from a rather different angle and perspective from the general direction of industrial development. Additionally, three key factors with higher levels were extracted from past studies for research purposes, including the internal virtual organization, the transmission of information among organizations, and the interaction: network ties that represent the response speed of important concepts within the organization; organization agility; and the greatest concern of the practical and academic fields: whether virtual organizational operation leads to good performance.

When confronting changes in the competitive environment, the increasing uncertainty of market needs, and the acceleration of knowledge updates, a firm must obtain a differentiated competitive advantage to be successful. Therefore, a firm must possess the ability of perceiving the predictable and anticipating the unpredictable changes in the internal and external environments, and know how to respond to these changes (Overby, Bharadwaj, & Sambamurthy, 2006). Agility provides firms with new strategies mainly because of rapid response and time-based competitiveness (Youssef, 1992). Agility is a firm's ability to respond effectively to an incident that has occurred without warning, as well as the ability to maintain a competitive leading position in today's environment. Agility includes four factors: cost, time, robustness, and scope (Meade & Sarkis, 1999). It can be regarded as one kind of survivability when a firm can perceive the existence of demand, respond effectively to the market, provide customers with satisfactory products and services, and make profits in an ever-changing and unpredictable competitive environment (Gunasekaran, 1999). As for a firm's business operation, agility is the interface between the market and the company. It is also the foundation stone of improving an organization's competitiveness and business prospects (Katayama & Bennett, 1999). The more agile a firm is, the more capable it is in terms of enhancing its operational niche, responding rapidly to the uncertain environment, meeting customers' needs, and creating new opportunities. The quality of the information shared, including its timeliness, accuracy, adequacy, completeness, and reliability can be reflected by the willingness to share (Du, Lai, Cheung, & Cui, 2012). Thus, in an era where market changes cannot be predicted and planned, agility has become a major strategy for quickly grasping market changes and responding to customers' needs, as well as a required factor for improving business competitiveness (Yusuf, Sarhadi, & Gunasekaran, 1999).

Within the supply chain, strategic alliance and collaborative planning in the network of industry have a pivotal relationship (Guenter & Grote, 2012). To upgrade operating capabilities, dynamic capabilities within the domains of construction, extension, and modification are very important (Newey, Verreynne, & Griffiths, 2012). However, when the network size is bigger, the degree of strategic flexibility will increase (Fernández-Pérez, Fuentes-Fuentes, & Bojica, 2012). To deal with dynamic changes in the environment and the relationships among organizational networks, we intend to study whether the network ties, organizational agility, and organizational performance are correlated. When a firm faces a rapid, dynamic, and ever-changing market environment, the interaction with its suppliers and customers and its response speed have become one part of improving a firm's competitiveness. Nowadays, information transmission is much faster than it used to be, and an organization is highly sensitive to market changes. In order to enhance competitiveness and survivability, a firm must have frequent dealings with its suppliers and must respond rapidly to market changes and customers' needs. Moreover, we studied how to increase organizational agility effectively and to make various companies that belong to the same network carry out network business activities and resource sharing, etc., based on establishing good relationships. A firm can, accordingly, obtain the resources and technologies needed for its development, quickly resolve the problems generated from each procedure, and thus enhance the organization's competitiveness.

Our study was carried out in the context of the Economic Cooperation Framework Agreement (ECFA) and the flat glass industry in Taiwan, which are introduced below.

ECFA

Over the past 20 years, the economic and trade relations between Taiwan and China have grown closer, for Taiwan has become increasingly dependent on China; however, as an export-oriented economy, Taiwan is highly dependent on foreign trade. Therefore, in order to strengthen the growth momentum of foreign trade, provide help for Taiwanese firms, reduce tariffs, and enhance global competitiveness, the government spared no effort in promoting an agreement known as the ECFA with mainland China. The pact was signed on June 29, 2010, and it came into effect on September 12, 2010. It aims to provide assistance to Taiwanese firms globally, gain an advantage in the market entry to China against the world's competitors, and to attract more foreigners to invest in Taiwan. All of these measures are intended to help Taiwan become a priority cooperation partner and gateway for entering the mainland Chinese market while the portal and industry supply chain remain rooted in Taiwan. The competitiveness of Taiwanese firms in China will also be increased, along with local investments, and local industrial competitiveness will be enhanced. The pace at which Taiwan is becoming an operation center of industry will be accelerated through the instrumentation of follow-up economic cooperation agreements, and the ECFA will help Taiwan integrate into the global economy and will ensure an arrangement and guarantee in terms of internationalized economic and trade as well as in the mainland Chinese market. However, the impact could be significant on internal domestic demand, industries with low competitiveness, and employees who are vulnerable to the liberalization of trade.

The flat glass industry in Taiwan

Taiwan's glass industry offers a broad and diverse range of products. It can be divided into flat glass and glass products based on their use, among which flat glass is considered to be mass produced and to be the most closely related to our lives. Hence, this study employs flat glass for exploration and investigation, as it includes float glass, patterned glass, lined-in and netted glass, heat reflective glass, curved glass, tempered glass, heat-strengthened glass, laminated glass, insulating glass, and burned porcelain paint glass.

In order to meet the needs of the international architecture, processing, and automobile industries, the flat glass industry focuses on continuous construction and equipment expansion; however, the profit has shrunk severely because supply exceeds demand. Thus, competition in the market depends on the quality of the product and the service. In recent years, glass manufacturers in Taiwan have spared no effort in working on research and development as well as improvement, placing importance on 'green' building by producing low-emissivity glass containing such characteristics as high perspective and high temperature insulation. This approach is meant to produce a power-saving, cost-saving, and eco-friendly product, based on the concepts of high-quality life and environmental protection, which have gradually gained affirmation from both the government and consumers. The glass industry also intends to move toward diversification of business, introducing such products as glass fiberboard, which is used in high-tech products and which has greatly added value and spatial margins to industry profitability. Especially after the signing of the ECFA, glass manufacturers need to continue to focus on research and development as well as innovation in response to the productivity of mainland China.

The production of flat glass in Taiwan is based solely on local glass and on the supply and demand in the domestic market. In addition, the price rests mostly in the hands of Taiwanese glass companies. The upstream and downstream vendors in the glass industry have been working with each other for a long time, resulting in a unique relationship that is both competitive and cooperative, and the glass industry in Taiwan has spent a long time cultivating these cordial relationships. Therefore, in terms of

competing with China, it is very likely to maintain its advantages in the international market when faced with challenges after the signing of ECFA. The Taiwan Mirror Glass Enterprise Ltd., in particular, by means of promoting industry clustering and good management, has led the way in deepening the professional level and expanding the business scope to form a specialized economy and generate a high-quality, low-cost product with a high degree of flexibility. Even mainland Chinese vendors wish to imitate its success; however, it would take them a long time to catch up. In addition, since 2005 the quality of glass products manufactured in China has been suspected and questioned by many EU countries; thus, relatively speaking, Taiwanese products are highly regarded, and orders have increased significantly.

It is anticipated, however, that the signing of the ECFA will have several effects on the flat glass industry in Taiwan. There is one advantage in that glass products exported to mainland China from Taiwan may enjoy the advantage of zero tariffs, which will mean that the products can be competitive in the mainland Chinese market. However, more disadvantages are anticipated than advantages. First, the terms of the ECFA require that Taiwan will need to be open to many industrial products from mainland China that have been restricted from import into Taiwan (including glass products), and these products will enjoy zero tariffs as well; in this case, it is highly likely that the uneven and low-price glass products imported from China will erode the domestic market, which is not a propitious situation for domestic glass manufacturers. In order to maintain a competitive edge, domestic flat glass manufacturers must be able to meet the following requirements:

(1) They must enhance the quality of glass products, reduce production costs, create innovative research designs, produce glass products with high output values, and differentiate their goods from the cheap products made in the mainland China.
(2) They must establish their own brands and participate in international fairs to facilitate the promotion of the export market. The export market may be able to blunt the impact on the import market caused by the ECFA.
(3) They must enhance their local enterprise advantage and retain their existing domestic customers through better services, excellent quality, and rapid shipping.

With regard to the present study, most previous studies focused on network-ties-related issues, involving discussions on the transmission and sharing of knowledge and teamwork in knowledge management (Zhong, Huang, Davison, Yang, & Chen, 2012; Peng, Wan, & Woodlock, 2013) or the strength of ties (Petróczi, Nepusz, & Bazsó, 2007). Agility-related studies mostly focus on how agility in supply chain management affects efficiency, performance, or performance output, most of which directly involve the effect and correlation between 'network ties and performance' or 'agility and performance' (Sheng, Zhou, & Li, 2011; Gligor & Holcomb, 2012). However, in the dynamic environment, the network agility in the organizational structure has become increasingly important (Lin, Desouza, & Roy, 2010). There is scarce literature on discussions of the direct or indirect effects of organizational agility that may exist between the network ties and organizational performance. Therefore, the unique situation of the Taiwanese glass industry – with its already-established cooperative relationships, yet faced with a precarious situation that requires some organization changes – makes it a good candidate for the purpose of this study: to examine the impact of network ties on organizational performance. By means of a literature research and a questionnaire survey, this study explores network business application-related subjects, strategies, and procedures – from the establishment of network organizational structure and organizational agility, to organizational performance – in order to discuss strategies that can be adopted by the organization in the network system. The purpose is to develop the correlative subjects that can help enhance organizational agility from the network organizational environment, and further to analyze them accordingly. In the context of Taiwan's flat glass industry, this study will research the relationships between network ties

and organizational agility, and organizational performance. This study will also establish a set of indexes or factors to measure network ties and agility among members in a network organization by means of the literature review. We will also discuss the strategies businesses use to enhance each other's agility among organizations by an actual survey of the industry. Moreover, based on the above modeling framework, the relationship of these aspects to organizational performance is studied so that this research may contribute to network cooperation among organizations.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

Network ties

Sociology was the first to observe the network ties that cover the phenomena of linking, interaction, consultation, and information exchange among people. As sociologists began to study and analyze network ties, such fields as economics and organizational theory also began to notice and initiate research on the network phenomenon. The analysis of network ties is divided into three major types: the tie among individuals, the tie between individuals and organizations, and the tie among organizations.

In this study, the third level will be discussed, the network tie among organizations. As indicated by Johanson and Mattsson (1987), based on the hypothesis that external corporate resources must be obtained through the industrial network, the network is regarded as the behavior of interactive relationships among firms. Concerning an individual firm's position and its strategic implications, this study proposes five attributes of networks as follows: (1) A network is formed by the relationship of a group of firms that are interdependent on one another. (2) The relationship implies specialization, which is coordinated through the interactive behavior in the network. (3) The interaction consists of two types: resource exchange and the strategic action of adaptation. (4) The function of exchange is to obtain corporate external resources, sell corporate products and services, and facilitate the technological knowledge and information diffusion, while adaptation is to deal with the inconsistency of network ties and to make them endure. (5) In the network, the relationships of complementation and competition exist simultaneously. Formal and informal coordinated mechanisms are also considered.

Having summarized the aforementioned concepts, this study attempts to measure the following: the 'betweenness centrality' proposed by Freeman (1979): this is a measure of the shortest paths between node pairs that connect through a node representing the most power or importance. The 'density,' as introduced by Tichy, Tushman, and Fombrun (1979), is the ratio of the number of actual relational ties compared with the number of possible relational ties. 'Intensity' is the intensity of network ties or contact numbers within unit intervals of network members. Finally, 'reciprocity' relates to whether the intensities of the relationships are equal to one another among network members.

Organizational agility

Compared with the past, the strategy and procedure of a world-class firm must be fast, fluent, and flexible. Achieving these targets requires initiating the potentiality of all new technologies and new concepts by implementing innovative management philosophy and administration. The organization with agility is not only highly decentralized, but also more agile, dynamic, diversified, and thoughtful in structure (Barker, 1995). Youssef (1992) argued that the ability of an agile organization to respond quickly to competitive threats and market opportunities is related to time-based competitiveness. Gunasekaran (1999), however, proposed a composite argument from the aforesaid two scholars and defined agility as a firm's capability to respond rapidly and effectively to the market and to make a profit in a competitive environment that is ever-changing and unpredictable. It can also be considered as a firm's survivability. Chengalur-Smith, Duchessi, and Gil-Garcia (2012) proposed that when a

large company initiates information sharing, other companies can follow the policy. As a result, rapid response is the key to becoming an agile organization in an environment that requires flexibility and speed, as well as being able to provide new customer services promptly. Hence, it becomes an index whereby to judge an organization's agility in terms of its capability to grasp the sudden opportunity. Therefore, agility will influence the organization's operating strategy and the way its business is operated (Corstjens & Lal, 2000). Agility refers to quick responses to customers, minimization of manufacturing lead time, and speed of delivery (Jacobs, Droge, Vickery, & Calantone, 2011). In order to achieve true agility, supplies partners must make good use of existing equipment and promote efficiency in order to act faster (Pearson, Masson, & Swain, 2010; Costantino, Dotoli, Falagario, Fanti, & Mangini, 2012; Mirzapour Al-e-Hashem, Malekly, & Aryanezhad, 2012). Numerous existing literatures advocate that the achievement and maintenance of agility are the key elements to sustain corporate competitiveness in the dynamic and uncertain environment (Yusuf, Musa, Dauda, El-Berishy, Kovvuri, & Abubakar, 2013).

This study reviews and summarizes the literature related to agility and further classifies agility into three types of correlative capabilities as follows: customer agility, partnership agility, and competitor agility (Treacy & Wiersema, 1993; Cronin, 2000; Tapscott, Lowy, & Ticoll, 2000). Customer agility means including customers in the activities of exploration, innovation, and competitive opportunity. It represents a firm's capability of making choices between obtaining market intelligence from customer feedback and detecting opportunity in the competitive activity. Partnership agility, through alliance, partnership, and joint venture, means balancing the assets, knowledge, and capabilities of suppliers, distributors, contracted manufacturers, and logistics. Competitor agility is a firm's capability of understanding and reacting to information from competitors. It enables the firm to use opportunities in competitive activity more rapidly and precisely, and to achieve cost-efficiency. The above three dimensions together interpret agility.

Organizational performance

Day (1984) argued that organizational capability must include the ability to learn and understand customers' requirements and needs, to create new products and services for meeting their requirements, and to further enhance the organizational performance. Provan and Sebastian (1998) summarized the past research on performance and suggested that performance is the most commonly used standard for evaluating an organization. In the field of organizational theory, performance broadly implies the result of three aspects: efficiency, effectiveness, and efficacy. Performance evaluation not only enables a firm to review its resources and see if they are utilized effectively, but also becomes a valuable reference for a firm's decision making. Venkatraman and Ramanujam (1986), however, argued that performance consists of three dimensions: (1) 'financial performance,' which uses the sales growth rate and profitability as a measurement index; (2) 'business performance,' including market share and product quality in addition to financial performance, and (3) 'organizational effectiveness,' which includes employee morale and customer satisfaction.

Yusuf, Gunasekaran, Adeleye, and Sivayoganathan (2004) argued that agile manufacturing has an impact on manufacturing performance, including great flexibility; low cost; and fast, reliable, and consistent quality. In particular, the authors indicated that the approach of agile manufacturing has an apparent impact on flexibility. In order to measure performance effectively, there must be a standard of measuring it. Although performance indexes differ according to organizational purpose and needs, they must meet requirements that are reliable, comprehensible, and usable.

Farrell and Buckley (1999) stated in research on the overall performance model of network organization that there are five criteria for measuring the overall performance of network organization: (1) the capability of accomplishing tasks with limited time and resources, (2) greater efficiency than

that in traditional organizations, (3) finished products of higher quality than the ones manufactured by traditional organizations, (4) adaptation of sensitivity and flexibility to environmental changes, and (5) achievement of the target of overall development and the demand on resources in the network. The five measured items, as stated above, imply respectively that such organizations have the capability of rapid response, task accomplishment, quality assurance, active reaction and adaptation, and profit growth and market share.

This study summarizes the views of the aforesaid scholars and further proposes the indexes to measure, through agility activities, whether a firm can attain the capabilities of enhancing its response to market changes, manufacturing high-quality products, providing excellent customer services, responding to market changes, shortening the time of satisfying customer needs, and increasing corporate profits.

Network ties and organizational performance

The establishment of network ties will enable a firm to reduce trading costs, decrease environmental uncertainty, and obtain the operation resources needed, including manpower, capital, operation knowledge, and information technology. It will enhance a firm's relative competitiveness, as well as the organization's operational performance. Short and Venkatraman (1992) presented the concept of replacing business process reengineering by network tie redesign through which a firm can rebuild relationships among businesses and enhance overall organizational performance. Hagedoorn and Schakenraad (1994) analyzed the impact of strategic alliance numbers and network interactive relationships on economic performance in IT, machinery, and petrochemical companies in Europe, the United States, and Japan. They found that building strategic networks can enhance economic performance in those organizations. Powell (1990) developed organizational learning through the concept of business networks and pointed out that alliance numbers, degree of network centralization, and network experience will enhance organizational learning speed. Blankenburg Holm, Eriksson, and Johanson (1999) considered that establishing a firm's network will help to create value because of the mutual trust and commitments among members.

We may infer from the research summarized above that network ties should affect organizational performance; thus, Hypothesis 1 may be established, as follows:

Hypothesis 1: Network ties generate an apparent positive effect on organizational performance.

Network organization and organizational agility

The reason network organization emerges is that it possesses the attributes of flexibility and agility in response to rapid, dynamic, and diverse market needs. Networks are formed for numerous reasons, and diverse arguments have been proposed by many scholars. Miles and Snow (1995) suggested that networks evolve from organizations and present a cooperative relationship according to environmental change. Through cooperation with one another, organizational members can reduce trading costs, attain dependence and reciprocity on resources, decrease environmental uncertainty, and further enhance their own competitive advantages. Information technology usually accompanies network organization in which interactive and complementary relationships exist. To deal with changeable and dynamic operations and competitive patterns, more and more firms have begun to utilize the information technology for integrating the resources of material purchase, production, logistics, delivery, and sales. Thus, it can generate the effects of responding rapidly to market needs, reducing operational cost, and enhancing operational efficiency.

Organizations that collaborate through network ties can achieve common interests through agility, cooperation, and knowledge sharing, which is a must, considering today's uncertain environment

(Lin, Desouza, & Roy, 2010). With regard to communication between enterprises, ties provide advents such as learning, sharing, and transmission of internal information and engaging in resource allocation in an unfamiliar market (Li & Zhou, 2010). Chung (2012) found that as the level of network ties between enterprises increases, the effectiveness of aspects such as market intelligence and responsiveness is enhanced. Earlier studies also pointed out that enterprises' networks are important indicators that determine their success (Boso, Story, & Cadogan, 2013), as these networks provide the following benefits: increased sharing of resources and market intelligence, improved cooperation in logistical efforts, reduced transaction costs, and opportunistic behaviors of partners (Park & Luo, 2001; Luo, Hsu, & Liu, 2008; Boso, Story, & Cadogan, 2013). Yusuf et al. (2013) reported that clustering-oriented organizations can enhance the overall organizational agility and promote the implementation of agility in their respective clusters.

Having summarized the above scholars' research, we may infer that network ties should have an impact on organizational performance. Thus, by inference, Hypothesis 2 can be established as follows:

Hypothesis 2: Network organization generates an apparent positive effect on organizational agility.

Organizational agility and organizational performance

What agility emphasizes is responding to uncertain environmental changes rapidly, agilely, and precisely so that an organization is able actively to adapt itself to the environment. The agility concept nowadays is broadly utilized in business. A firm should realize that agility is the basis of maintaining survival and competitiveness (Danuta & Swierczek, 2009). Therefore, a firm must acquire a deeper understanding of the elements, attributes, capabilities, and implementation stages that comprise agility. Goldman, Nagel, and Preiss (1995) indicated that the elements of an agile organization must include customer support and dialogue, continuous improvements and changes, employee support, and the flexibility for a rapid-response process. Sharifi and Zhang (1999) stated that the implementation pattern of agility consists of three diverse elements, as follows: (1) Agility drivers – that is, a firm must seek new approaches to maintain corporate competitive advantage in response to environmental changes or survival pressure. (2) Agility capabilities – the required abilities possessed by a firm for maintaining profitability. (3) Agility providers – the places in which agile capabilities exist or the providers offering agile capabilities. For a firm, agility is a required ability for earning profits in business operation under the competitive environment with sustainability, uncertainty, and continuous change in terms of customer opportunity (Goldman, Nagel, & Preiss, 1995). According to Sambamurthy, Bharadwaj, and Grover (2003), agility can contribute to organizational performance in regard to three aspects. First, a firm with agility can enhance customer satisfaction and loyalty through rapid response to changes in customer needs. In addition, agility can be utilized through the company's embedded influence on customers and the turning points generated by frequently grasping market opportunities (Kidd, 1994; Goldman, Nagel, & Preiss, 1995). Second, through establishing an extended partnership of networks based on impact, it can make use of the assets, knowledge, and capabilities of suppliers, agents, contract manufacturers, and logistics in enhancing organizational performance (Venkatraman & Henderson, 1998). Lastly, the impact of agility on organizational performance is also implemented quickly in redesigning and simplifying the organizational process using speed, preciseness, and economic cost (Teece, Pisano, & Shuen, 1997).

Having summarized the above scholars' research, we may infer that network ties and organizational agility should have an impact on organizational performance. From this inference, then, we may establish Hypotheses 3, as follows:

Hypotheses 3: Organizational agility generates an apparently positive effect on the organizational performance.

Intermediary effects in organizational agility

Based on the results of Yusuf et al. (2013), it was found that the stronger and more obvious the industrial cluster, the better is the agility of external environment changes reflected and customer satisfaction achieved, which in turn will affect the overall competitiveness and organizational performance. In the competitive industry, senior generals establish effective ties to obtain benefits from internal information exchanges in larger industries with market intelligence and effectively lock on market demands and objectives, all of which will contribute to the success of the enterprise (Boso, Story, & Cadogan, 2013). Due to the geographical locations and industrial characteristics of Taiwan's floating glass industry, industrial clusters of floating glass manufacturers are available in Zhangbing Industrial One, and this feature has contributed to the special network ties and collaborative relationships.

The research theories proposed by the abovementioned scholars were summarized and inferences were derived from them. A certain kind of relationship was inferred to exist between organizational agility and network ties and organizational performance. This inference led to the establishment of Hypothesis 4, as follows:

Hypotheses 4: With the intermediary of organizational agility, network ties generate an apparent positive effect on organizational performance.

RESEARCH METHOD

Research framework

This study will examine organizational agility and network ties among organizations in relation to the organizational performance in the network system. In an attempt to develop correlative question items, we analyze how to further enhance a firm's operational performance through maintaining proper network climate and reinforcing relationships among suppliers. Hence, based on the research purpose and motivation along with the theoretical literature, the study is approached from the view of network ties: one is the direct influence of the three aspects of network ties on organizational agility, of network ties on organizational performance, and of organizational agility on organizational performance. Moreover, we construct a linear structural equation model using network ties as the antecedent variable, organizational agility as the intervening variable, and organizational performance as the outcome variable to examine the cause and effect of these important variables. The research framework is shown in Figure 1.

Questionnaire design and sampling method

The design of the items in the questionnaire is divided into four parts: (1) basic information concerning the subjects' companies, including such continuous and discontinuous variables as
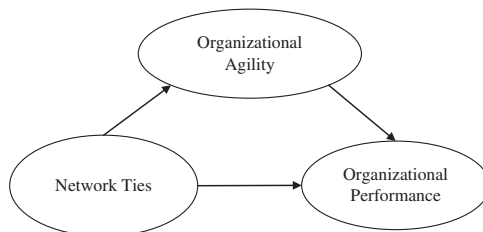

FIGURE 1. RESEARCH FRAMEWORK

company types, capital of the establishment, years of establishment, numbers of employees, average yearly sales turnover, etc.; (2) scale of network ties; (3) scale of organizational agility; and (4) scale of organizational performance. The last three parts consist of 55 questions with a 5-point Likert scale as the measurement. The subjects all are the owners or general managers of companies in the flat glass industry as registered at the Industrial Development Bureau, Ministry of Economic Affairs, chosen in order to ensure that the subjects have sufficient experience and vision to answer the organizational level questions in this study.

Methods of sampling and questionnaire collection are as follows: (1) Paper questionnaire: the researcher personally visited the subjects' companies and had them fill out the questionnaires, of which 136 were retrieved; (2) Internet online questionnaire: had the subjects recommend other subjects in the same industry, or the researcher contacted the companies registered at the Industrial Development Bureau of Ministry of Economic Affairs and sent out the questionnaires to subjects after phone confirmation; of these, 180 were retrieved. The total questionnaires retrieved were 316, and from these, 250 valid questionnaires emerged after invalid samples with such problems as incomplete answers and omitted information were discarded. The valid sample rate is 80%.

Method of information analysis

For this study, a scale questionnaire survey was adopted, and SPSS18 used for the reliability analysis, correlation analysis, and descriptive statistics. Further, a structural equation analysis measurement model and theoretical framework were constructed using AMOS18.0. In the information analysis procedure, the suggestion of Anderson and Gerbing (1988) was followed in the adoption of a two-phase analysis. In the first phase, the measurement model of variables was evaluated for reliability analysis, validity analysis, and confirmatory factor analysis to understand the various dimensions of reliability and validity (convergent and discriminant). In the second phase, a theoretical framework was evaluated, and each hypothesis was validated.

DATA ANALYSIS AND RESULTS

Descriptive statistics analysis

The valid questionnaires of this study number 250. The company types, establishment capital, years of establishment, number of employees, and sales turnover are shown in Table 1.

Structural equation modeling

Reliability analysis

The internal consistency of the questionnaires was examined using Cronbach's α coefficient, as suggested by Bagozzi and Yi (1988). For each scale, the item-total correlation of questionnaire items was examined to see if it is >0.5. The item-total correlations are all >0.5, which reveals good reliability in each scale and meets internal consistency.

Validity analysis

For validity assessment, the suitability of each construct measurement model was assessed using the maximum likelihood estimation of confirmatory factor analysis in order to evaluate if each construct has sufficient convergent and discriminant validity.

Convergent validity analysis: According to the convergent validity analysis criteria suggested by Anderson and Gerbing (1988), the evaluation criteria of confirmatory factor analysis proposed by

TABLE 1. DEMOGRAPHICS OF SAMPLE COMPANY

Firm characteristics	Frequency	Percent
Company types		
Limited companies	148	59.3
Joint ventures	52	20.8
Sole proprietors	50	19.9
Establishment capital (NTD) (M)		
<10	82	32.7
10–50	129	51.4
≧50	39	15.9
Years of establishment		
<5	22	8.6
5–10	92	36.6
10–15	67	26.7
15–20	53	21.1
≧20	16	7
No. of employees		
<10	131	52.6
10–100	87	34.8
100–1,000	30	12.52
≧1,000	2	0.08
Sales turnover (NTD) (M)		
<5	88	35
5–50	119	47.5
50–100	36	14.5
≧100	7	3

TABLE 2. ASSESSMENT OF CONVERGENT VALIDITY

Constructs	No. of items	Item loading	Cronbach's α	Composite reliability	AVE
Density of network ties	4	0.919–0.941	0.963	0.962	0.867
Intensity of network ties	4	0.876–0.919	0.941	0.943	0.805
Reciprocity of network ties	8	0.741–0.908	0.958	0.958	0.749
Betweenness centrality of network ties	5	0.810–0.969	0.964	0.963	0.839
Agility-customer	7	0.743–0.898	0.949	0.951	0.707
Agility-supplier	7	0.670–0.929	0.952	0.953	0.746
Agility-competitor	8	0.765–0.942	0.960	0.961	0.756
Organizational performance	7	0.780–0.899	0.946	0.946	0.716

Note. AVE = average variance extracted.

Bagozzi and Yi (1988) and the goodness of fit index presented by Gefen, Straub, and Boudreau (2000), an assessment was conducted with the suggested data with seven resulting evaluation criteria, as follows: (1) goodness of fit index (GFI), normed fit index (NFI), and comparative fit index (CFI) are >0.9, while the root mean square residual is <0.05; (2) the factor loadings of each index are significant; (3) the composite reliability of each construct is >0.7; and (4) the average variance extracted is >0.5. Table 2 shows the results of the convergent validity analysis for (a) the scale of network ties, (b) the scale of organizational agility, and (c) the scale of organizational performance. The analyzed data reveal that the convergent validity for all of these scales is within the acceptable range.

TABLE 3. ASSESSMENT OF DISCRIMINANT VALIDITY

	DNT	INT	RNT	BCNT	ACU	AS	ACO	OP
DNT	0.931							
INT	0.732	0.897						
RNT	0.781	0.848	0.865					
BCNT	0.688	0.794	0.738	0.916				
ACU	0.399	0.171	0.229	0.075	0.841			
AS	0.419	0.305	0.276	0.214	0.730	0.864		
ACO	0.303	0.199	0.190	0.044	0.811	0.708	0.869	
OP	0.436	0.386	0.414	0.296	0.311	0.401	0.318	0.846

Note. The diagonal values are the square roots of the AVE for each construct.
ACO = agility-competitor; ACU = agility-customer; AS = agility-supplier; AVE = average variance extracted;
BCNT = betweenness centrality of network ties; DNT = density of network ties; INT = intensity of network ties;
OP = organizational performance; RNT = reciprocity of network ties.

Discriminant validity analysis: This study was based on the two criteria of examining discriminant validity proposed by Gaski and Nevin (1985): (1) the correlation coefficient of two constructs is <1; and (2) the correlation coefficient of two constructs is less than the individual Cronbach's α reliability coefficient, implying that the two constructs have discriminant validity. Besides, based on the approach of Fornell and Larcker (1981), this study presents the third criterion of examining discriminant validity. (3) The correlation coefficient of two constructs is less than average variance extracted's square root, implying that the two constructs have discriminant validity. The analysis data summarized in Table 3 all meet the above three criteria for examining discriminant validity, revealing good discriminant validity in each construct.

Overall structural equation modeling analysis

Analysis results

The analysis results are presented in two parts, including the evaluation of the theoretical model and the verification of hypotheses relationships, which are discussed successively.

Evaluation of theoretical model: The evaluation of model fit, based on Bagozzi and Yi's (1988) suggestion, is assessed from three perspectives: (1) preliminary fit criteria, (2) overall model fit, and (3) fit of internal structure of mode, as follows:

(a) Preliminary fit criteria: The error variances of the theoretical model do not show negative values, and the standardized factor loading is not <0.5 or >1; in addition, all reach a significant level. Nor is a higher standard error found. Thus, the preliminary fit criteria of this study model overall reach an acceptable level.

(b) Overall model fit: The overall model fit is used to evaluate the entire model and to observe the fit level of information. The suggestion of Hair, Black, Babin, Anderson, and Tatham (2006) was adopted, and three indexes were chosen for evaluating the entire model and observing the fit level of information: (1) absolute fit measures, (2) incremental fit measures, and (3) parsimonious fit measures. The absolute fit measures of the overall theoretical model in this study are $\chi^2 = 330.603$, $df = 74$, $\chi^2/df = 4.468$, GFI = 0.838, RMR = 0.062, RMSEA = 0.118, and AGFI = 0.770. Except for RMSEA, the other indexes are all within the standard. The incremental fit measures of the overall theoretical model in this study are NFI = 0.897 and CFI = 0.917, and both are within acceptable range. The parsimonious fit measures of the overall theoretical model in this study are PNFI = 0.729
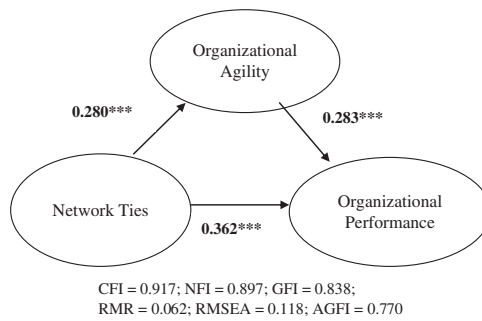
FIGURE 2. DIAGRAM OF THE PATH ANALYSIS RESULTS OF STRUCTURAL MODELING

and PGFI = 0.590, and both are within acceptable range (>0.500). As a whole, except χ^2, judging from each index, the overall model fit of the theoretical model in this study is passable.

(c) Fit of internal structure of mode: The fit of the internal structure of mode is to estimate the significant level of parameters and the reliability of each index and latent variable in the evaluation model. The composite reliability coefficients of each construct, ranging from 0.943 to 0.963, all exceed the acceptable level of 0.7. The average variance extracted the coefficients of each construct, which, ranging from 0.707 to 0.867, all exceed the acceptable level of 0.5. As a whole, the fit of the internal structure of mode in this study is good.

Verification of hypotheses relationship: After confirming that each construct has a certain degree of validity and reliability, the next step is to examine the research hypotheses established by the research model and to analyze how the variables of 'network ties,' 'organizational agility,' and others collectively affect 'organizational performance.' Based on Figure 2, the regression coefficient of overall path analysis is used to examine the hypotheses. The analysis results support the four hypotheses in this study, as *p*-values all reach the significant level of .05. The findings are as follows:

(1) Concerning hypotheses 1 and 2, the reason network ties affect organizational agility has to do with the attributes of flexibility and agility, as network ties help an organization adapt to rapid, dynamic, and diverse market needs. From the view of the aforementioned transaction cost, transaction behavior occurs along with, among other things, the costs of information search, condition negotiation, and transaction proceedings. The more difficult the transaction procedure, the higher the transaction cost. However, establishing efficient network ties (density, intensity, reciprocity, and betweenness centrality) can increase the return rate of assets, lower unit cost, reduce waste or lower unit fixed cost, enlarge the investment/production rate, improve the organization's internal efficiency, and further enhance organizational performance through organizational agility.

(2) The findings from hypothesis 3 show that agility emphasizes responding rapidly, agilely, and precisely to an uncertain environment. Further, an agile organization can proactively adapt itself to the environment. Under the competitive environment of sustainability, uncertainty, and continuous change in obtaining customer opportunity, agility is the required capability for sustaining business profits and enhancing operational performance.

(3) In Hypothesis 4, it was found that establishing network ties will enable a firm to reduce transaction costs, decrease environmental uncertainty, and obtain required operational resources – including manpower, capital, business knowledge, and information technology. Thus, not only is the firm's relative competitiveness reinforced, but also its operational performance.

CONCLUSIONS AND SUGGESTIONS

Conclusion of research hypotheses verification

This study has found that through the intermediary of organizational agility, a firm can enhance organizational performance. This finding also indicates that customer-orientation has been a trend in the market for years. Because organizational changes are not accomplished in a short time, traditional industries, as they transform gradually, also need to face the challenge of quick response to a dynamic environment for survival. The aforementioned results imply that although network ties and organizational agility are both able to enhance organizational performance and though a firm may have the ability to fulfill all specifications of customer orders, the repeat order rate from customers may also be relatively low because of price competitiveness. The supply chain partnership is highly influenced by price competitiveness. However, the firms' agility toward suppliers reflects that firms find it relatively difficult to collect information from suppliers. Thus, Taiwan's flat glass manufacturers need not only tighter and more active shares in network ties, but also supply chain integration, which is inevitable if a firm is to achieve synergy.

Research contribution and management implications

In the face of global competition, turbulence, and uncertainty, today's managers need to deal with in increasingly intense, complex, and paradoxical competitive environment through dynamic thinking and decision making in order to maintain a competitive edge. Taiwan's industrial background started with a foundry base. At the time, whenever production capacity was inadequate, orders were first accepted and then distributed to other companies in the same industry to ensure sufficient financial resources for survival and to avoid the loss of orders, and thus a unique competitive and cooperative relationship was formed. However, as times changed, the various manufacturers developed a variety of competitive advantages, and firms underwent phase-out and integration.

Because of the rise of Mainland China in recent years, the disappearing subtly competitive relationship has become an issue in the maintenance of overall competitive advantage once again, thus affecting not only the industry but also the national competitiveness. This issue is most urgently faced in Taiwan, in which the industrial structure is based on small to medium enterprises. Through network ties, an industry's overall competitive advantage can be maintained, thereby enhancing organizational agility and performance within the industry.

This study makes both academic and practical contributions, the latter being related to managerial implications. In terms of the academic aspect, this study explored the network ties, organizational agility, organizational performance, and other theories and dimensions through the literature. In addition, from a network organization perspective, a framework was constructed for exploring the relationship between network ties and organizational performance, with organizational agility as the intervening variable. The abovementioned verification results can be understood through this research framework, and the results may serve as a reference for related follow-up research. The research results may also serve as a research direction and reference target for the government as they assess and analyze the impact of ECFA on Taiwan's industries.

Regarding the practical aspect, in order for the government or traditional industry's managers to improve organizational agility and enhance the referential value and adoption of organizational performance through Taiwan's network ties among the industries after signing ECFA, three important managerial implications may be derived from this study:

First, the cooperative relationship in a supply chain is similar to that of gangs. In the process of close integration, market price and the organization's ability to respond to the dynamic market are put to the severest test. According to the competitiveness analysis results of this study,

Taiwan's flat glass industry has relatively high entry barriers, and competition among industries is fierce. Because of consumers' diverse needs, buyers' bargaining power is high. However, subject to the sources of glass, suppliers' bargaining power is relatively lower, but glass has better quality and attributes than other alternatives. Hence, threats from alternatives were relatively low. As mentioned above, under the environmental characteristics of complexity, versatility, and uncertainty, every kind of resource had other uses in the huge business opportunities. Additionally, a network system among organizations can provide the resources to members in need through mutual reciprocity or resource interaction. This will not only resolve the problems of partners among organizations, but also will more effectively convert idle resources into what enterprises need, thus preventing resource idling or freewheeling. In this way, enterprise costs can be reduced for deriving a direct competitive advantage or indirectly enhancing the overall competitiveness of the system. The reactivity toward market changes will also be greatly improved through the network organization's provision of information, which will be more conducive to helping the members gain the advantage of quick response to the market.

Second, the signing of the ECFA between the two sides across the strait will exclude a variety of adverse obstacles to exports, coupled with China's non-nominal tax items (of which there are 27 kinds), the yearly rise in labor wages, the increasingly serious lack of manpower in coastal areas, and the difficulty involved in cost control. Taiwan's labor is high in quality and active. Under the cross-strait industrial division of labor, such high-priced products as fiber glass and glass fabric will be produced in Taiwan. Because in this study, agility has been shown to enhance organizational performance, Taiwan's flat glass industry should take Taiwan Glass Ind. Corp's ability to integrate and their R&D capabilities as a guide. In the face of the new situation after the signing of ECFA, the development focus of the flat glass industry should lie in aggressive investment and expansion plans, including the production of solar photovoltaic glass, Double Low-E coated glass, and the development of transparent conductive oxide of optical glass, so as to enhance organizational agility and meet customer demand, thereby improving the organizational performance.

Third, in terms of strategic alliance, the most successful example is Taiwan Mirror Glass Enterprise Ltd., which spent 10 years in gathering 15 glass companies by 2005 to set up plants in the Chang-Ping Industry Area, thus creating Taiwan's glass industry team – the Team Taiwan Glass brand. The companies jointly accepted orders and engaged in industrial division of labor. For 10 consecutive years, orders placed in Taiwan have made up 80% of IKEA's glass furniture inventory. Currently, more than 200 glass small to medium enterprises have joined the team, and for this reason, Taiwan Glass Ind. Corp., the main supplier of glass raw materials, returned to Taiwan to set up its factory after 15 years of industry in China. At the time of the ECFA signing, the Taiwan Mirror Glass Enterprise Ltd. persuaded IKEA in Sweden to set up an R&D center in Taiwan to seize the cutting-edge R&D technology. Concurrently, several world-renowned furniture brands – such as Wal-Mart, HOMEDECO, and Japan TOTO – have also indicated strong recognition of the Taiwan glass team's Team Taiwan Glass brand, so orders from these companies can be expected soon. Based on the abovementioned successful glass industry integration and cooperation cases, Taiwan's flat glass manufacturers ought to consider joining Team Taiwan Glass in order to establish a more powerful cooperative network and engage in industrial level and vertical integration. If Taiwan's flat glass industry can cooperate with the upstream raw material market (Taiwan Glass Ind. Corp.), there will be room for price negotiation with the upstream companies, while the team alliance can also jointly enhance the quality control and R&D capabilities. At the same time, in response to the rapid rise of China's automobile market, industry officials should consider letting Taiwan Glass Ind. Corp. and Taiwan Mirror Glass Enterprise Ltd. take the lead in gaining entry into the automobile glass industrial market through the cooperative relationship between Taiwan Glass Ind. Corp. and

China, thereby expanding Taiwan's flat glass industry overseas. The main reasons that contribute to success are summarized into four phases.

(1) Establishment of a trusting relationship and selfless offer of funding assistance: Assistance such as funds, equipment, factory premises, and raw materials were offered to solid companies that give recognition to industrial clustering, but face operating and capital problems. This approach not only saved many floating glass processors on the verge of bankruptcy, but also reduced the start-up costs for a number of new entrants. The new and existing companies could accept purchase orders and produce high-quality products. After making profits, they gradually returned the funds and materials borrowed through amortization. The companies that benefited from this approach not only expressed heartfelt gratitude, but also undoubtedly developed a sense of trust and recognition for the 'coexistence.'

(2) Maintaining and strengthening the relationship trust and sharing of orders: As the small processing plants lacked resources and manpower, Taiwan Mirror Glass Enterprise Ltd. integrated the related glass industries and accepted unified external orders to engage in professional labor of division. Through original equipment manufacturer, the purchase orders were distributed to other organizations in the same industry in order to integrate resources and distribute profits, thereby preventing larger companies from losing orders due to inadequate production capacity, or smaller companies from losing orders due to a scarcity of resources.

(3) Resource integration: Taiwan Mirror Glass Enterprise Ltd. continued to engage in self-upgrade and strengthening scale of the collaborating team within the industrial cluster. It also continued to join external bids on behalf of the industrial team. If a third party under the group won a bid, Taiwan Mirror Glass Enterprise Ltd. would provide raw materials needed for production. If Taiwan Mirror Glass Enterprise Ltd. won a bid, the third parties under the group would be commissioned for original equipment manufacturer. This practice prevented bargaining from competitors and maintained the market prices. Then, through strategic alliances, with the glass operators from the Chunghwa area as the core, Taiwan was divided into three scopes to share and integrate resources.

(4) Formation of the main cluster network: With the tacit cooperation experience within the cluster network, the third parties were divided into two main groups based on their credibility, machines and equipment, quality, and delivery dates. Based on their professional capacity and processing processes, orders accepted by Taiwan Mirror Glass Enterprise Ltd. were distributed to cope with the customers' rapidly changing needs, stabilize product quality, and enhance the competitiveness of orders.

Currently, Team Taiwan Glass has extended this spirit to other industries, and the 'Taiwan Glass Team and Related Industries Association' was established, with hopes of engaging in marketing, product development, and development through a greater cluster effect and involving more relevant industries.

As the competitive environment of the market continues to change, the organizational structure is also subject to adjustment. In response to business environmental needs, companies are no longer confined to their own borders. Focused on the perspectives of resource dependence and specialization, more and more organizations emphasize the importance of establishing relationships with upstream and downstream manufacturers. In addition, buyers and sellers continue to strengthen their cooperative behaviors and maintain long-term partnerships (Kalwani & Narayandas, 1995). From the angle of competitive advantage, in addition to the need for the flat glass industry to bid farewell to the era of fighting alone, other industries in Taiwan should also follow suit. The government and industries should engage in resource, talent, and market integration in order to prevent the signing of the ECFA from destroying Taiwan's flat glass industry and even other industries.

Research limitations and future direction for research

This study has three main limitations, outlined below.

Limitation of measurement

The structural equation modeling of this study focuses on the fit indices in order to meet an excellent standard. However, one should keep in mind that goodness-of-fit indices are merely to evaluate if the path analysis model diagram of the hypotheses has mutually fit to the actual data collected. This is to measure the consistency level between the hypothesis theoretical model and the actual data, not to indicate whether the path analysis diagram is good or not. The model cannot be guaranteed to be useful even if its model diagram of fit completely meets the evaluation standard. It indicates only that the model diagram of research hypotheses better meets the actual data, but it still might not be suitable for all industries.

Limitation of empirical data

Three limitations are manifest. (1) An empirical study cannot use a longitudinal research method to collect data for discussion. On the contrary, cross sectional data is used as the basis for cause and effect among variables in an empirical study. Thus, inferences must be discreet. (2) The data for this study were collected from an industrial interview and questionnaire survey. However, because the firms in the same industry have a great deal of concern about other participants' obtaining of business information, it is possible that the subjects might minimize problems or stretch the truth. This could mislead the research results and possibly cause inaccuracy in the results. (3) The interviewees of the industry tend to conceal important information with regard to the questions involved in business confidentiality based on the position of protecting their own interests. This reluctance to share information has restricted the collected data, which in turn has influenced the completeness of the study.

Limitation of sample size

Only 250 firms remained as samples because of the limitations of the population sample and after unqualified questionnaires were eliminated. Compared with the thousands in sample sizes in the past, only structural equation model could be used for this study. Based on the acceptance principle of basic sample size, this study simultaneously used paper and Internet questionnaires. Although it meets research method requirements, it cannot assure that the sample size is sufficient to provide a complete picture of Taiwan's flat glass industry.

Limitation of assumed condition

Under the dynamics, it is indeed possible for the product structure tree to undergo reconfiguration. However, due to the time constraints and limited funds, all the respondents were company in-charges or general managers, which increased the difficulty in collecting the samples. In addition, as the longitudinal research method was not used to collect data, the assumptions in this study included the following: The network is dynamic and the measurement time points are as follows: (1) the resource allocation remains unchanged and (2) the organizations within the industry remain unchanged (without new setups, mergers and acquisitions, out of business, within the supply chain, etc.). Assuming the above conditions remain unchanged, the research was controlled at a certain time point for the purpose of gaining an insight into whether the research participants under the effect of interaction with external information were able to timely respond, which in turn would indirectly or directly affect performance.

Several options remain for future research direction: (1) Only Taiwan's flat glass industry has been researched for this study. In the future, other industries could be sampled to verify if the model and framework presented in this study can be used for other industries also. (2) The information about network ties in this study has been cited from the empirical research of numerous domestic and foreign scholars, which has adopted for measurement the four variables of density, intensity, reciprocity, and betweenness centrality. Follow-up studies could try to discover the common measures of network ties suitable to specific industries, such as the factors of openness, stability, and gradability in order to provide firms with more references for evaluating their network ties. (3) Future research could explore whether the diverse construct measures that can be extended from the research of network tie constructs get the same research results, such as using social networks to measure the correlation of organizational agility and organizational performance, and to discuss the proportion of these variables' impact on organizational performance. (4) Su and Yang (2010) argued that the design of the supply chain has become a firm's core competitiveness and that a firm expects to integrate supply chain management by means of an enterprise resource planning system which can integrate internal and external management information across an entire organization. (5) The main theme of this paper is discussion of the network ties dimension to understand whether information transmission and interaction among organizations have a direct effect on customers, suppliers, and competitors' sense and ability to respond, thereby indirectly or directly affecting organizational performance. Concerning strategic alliances, the export markets and the internal supply and demand, Taiwan's float glass industry in this study is mainly dominated by Taiwan Glass Ind. Corp., while Taiwan Mirror Glass Enterprise Ltd. deepens the professional standards and has expanded labor of division through industrial clustering and coordination, combined with the collective involvement of a number of third parties, leading to the establishment of Team Taiwan Glass. These two companies lead some of the organizations within the industry to engage in cooperation through virtual organizations and strategic alliances. However, in dynamic competition, not every company engages in mutual collaboration through strategic alliances and formation of virtual organizations. They may only mutually share information and some orders beyond their capacity. To avoid blurring the research focus and ensure representativeness of the research samples, we focused on information sharing among the different organizations within the industry and their interactive relationships. It is suggested that more in-depth studies targeting virtual organizations within the industry and the direction of strategic alliances be conducted in the future. (6) The research framework can be extended to study many issues. For example, Cunha and Putnik (2006) found that in the dynamic business environment, business alignment in agile or virtual enterprises is of great importance. In response to the rapidly changing environment, flexible and reconfigurable partnerships are considered highly helpful. In their research, with the 'reconfiguration dynamics' as the major feature, follow-up researches may attempt to include dimensions such as reconfigurability, reconfigurability dynamics, enterprise reconfiguration, enterprise dynamics, etc. into the research to obtain more discoveries and contributions from agile or virtual organizations/enterprises-related researches.

The research indicates that for firms, implementing supply chain management is helpful for both the supply chain and organizational agility, aside from the operational, managerial, or organizational aspects. Further, it reinforces a firm's core competitiveness and organizational performance. Therefore, future research could include a supply chain field in broad studies of subjects relevant to network ties, agility, and performance.

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