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# PROMOTING COMPETITIVE ADVANTAGE: THE ROLE OF IT INTEGRATION, TRUST AND INNOVATIVENESS

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## Abstract

*Due to the recent movements related to the focus of core competence and as a result of a tendency toward global profit squeezing, the innovativeness of the supply chain play a key role in influencing a firm's competitive advantage. Enterprises keep good relationships with their suppliers and customers in the hope that the supply chain system can operate effectively. This means that firms have been encouraged to connect key suppliers and customers in order to establish strong supply chains and thus to enhance the competitive advantages related to their supply chain systems. Electronic OEMs in Taiwan currently are facing fierce challenges related to high elasticity, fast speed, and small amounts and various modes of production. Therefore, enterprises need to enhance quick response through effective IT integration and mechanisms intended connect supply chain members in order to increase innovativeness and competitive advantage.*

*The model and hypothesized relationship are empirically tested using the structural equation modeling approach, supported by SmartPLS2.0 software. The results of this study showed that IT integration and trust of supply chain members all positively influence innovativeness, and further have positive effects on competitive advantage. Implications for researchers and practitioners, and suggestions for future research are also addressed in this study.*

*Keywords: IT Integration, Trust, Innovativeness, Competitive Advantage*

# 1 INTRODUCTION

Along with globalization and the emergence of the Internet and digital technology, customer needs are also increasing and more varied; the pressure of competition is increasing; the life cycle of products has also been shortened dramatically. Add to this the high uncertainty and unpredictability of the market, and all this results in the production and dispatching systems of enterprises meeting unprecedented challenges and changes. To maintain competitive advantage, businesses not only need to master the market information on time, maintain flexible operation and satisfy their market demands quickly, but they also need to maintain a consistent operational pattern characterized by low cost, high efficiency and high flexibility. Christopher and Towill (2001) pointed out that the fierce competitive environment today is no longer a confrontation between enterprises, but rather consists of a confrontation between supply chain systems as well as a competition between value chains (Lewis 1995). Thus, in order to cope with a rapidly changing external environment, enterprises gradually have realized that they should closely cooperate with their supply chain partners. Through effective interaction and the integration of advantages with their partners, they can develop competitive and innovative operating procedures and services intended to respond to diversified customer demands in the shortest amount of time. Bello et al. (2004) pointed out that innovation is the core of supply chain competitive advantage, which facilitates the development of information and relevant technology and puts forward new operating procedures that will improve efficiency and increase the effectiveness of services. The interaction and relationship between supply chain partners can help to come up with and develop innovation (Panayides & Venus Lun 2009). Thus, we can see that effective interaction and integration between supply chain partners have become important prerequisites for enterprises and supply chain systems in order for them to obtain sustainable competitive advantages (Byrd & Davidson 2003).

Gomes-Casseres (1994) pointed out that enterprises interconnect with each other for a common purpose, which results in a group vs. group competition pattern. Closs et al. (1998) suggested that partners in a supply chain have to and are willing to share important information so as to achieve external integration synergy. A lack of ability to gain success and sustain many supply chain systems is mostly due to difficulty with linking and integration of the production and marketing information between departments or organizations. James and Konsynski (1985) pointed out that the best method of integration is to use the network formed by information technology. When crossing the border of companies, the members within the network can improve their productivity, responsiveness and flexibility with regard to efficiency so as to improve overall competitiveness via the application and integration of information technology. Especially under the wave of globalization, enterprises always have to compete with each other in pursuit of higher profits. It is hard for the global economic and commercial trend to resist this tide. Commercial value and profit grow along with infinite multiple growth, and via internet technology, they can have a full impact on the industrial structure and trade pattern in the upstream, midstream and downstream sections of a supply chain. The development of internet and information technology in businesses has also improved the efficiency of information processing in a supply chain and accelerated the rate of response to customer demands. Thus, the improvement and integration of information technology as well as the sharing and delivery of information have become key factors affecting the performance management of a supply chain (McMullan 1996).

Most of the partners in a supply chain are members of the same system. They establish a relationship and take it as the basis of mutual trust to carry out exchange, integration and deployment of resources, so as to respond to rapid changes in the environment and to try to create maximum value. The performance of the individual manufacturer is affected by the supply chain to which it belongs, so it has to manage various partnerships. In the competition between groups, the success of the individual manufacturer depends on the overall competitive advantage of the group (Dyer 2000; Gomes-Casseres 1994). If this supply chain is defeated by other supply chains, all the members will probably be left out (Victor et al. 2008). The advantage of a supply chain also depends on the continuous improvement of the individual manufacturer in terms of competitiveness. The key factor of the smooth operation of a supply chain is whether the upstream and downstream manufacturers and customers can support each other in each stage, creating a seamless coordination network (Anderson & Katz 1998), and forming a trusting and interdependent relationship.

With industrial globalization and competition in the international market becoming fiercer day by day, more changes will come into being in a short time, and the advantages of enterprises will disappear faster. Managers have to consider from different perspectives how to keep their core advantage in the midst of rapid industrial changes. Because the external environmental factors are changing rapidly, the research focusing on supply chains should not only be concerned about information technology integration and trust relationship among the manufacturing partners within a supply chain, but also should pay more attention to the relationship between the innovation of supply chains and their competitive advantage. Thus, under circumstances in which the business environment is changing dramatically, new technology is developing rapidly, and the life cycle of products is becoming shorter, it is of vital importance that empirical research explores how the integration of information technology and the trust relationship among supply partners affect the innovation, so as to further create long-term competitive advantages.

This research sets the Taiwanese manufacturing industry as the subject, expecting to explore how IT integration and the trust relationship between B2B partners influence the innovation of a supply chain and further influence the competitive advantage of manufacturers through the collection and analysis of the data from a manufacturing supply chain. It is hoped that this research will appropriately demonstrate the current manufacturing situation and the development of the supply chain in Taiwan through empirical analysis, so as to determine managerial implications internally, which can provide new ideas regarding supply chain management and put forward specific suggestions. In this way, it will provide substantial assistance to the enterprises in Taiwan.

## **2 LITERATURE REVIEW AND HYPOTHESES**

### **2.1 IT Integration**

Sproull and Kiesler (1991) pointed out that new information technology can encourage a person or group who seldom communicate with others to have more interaction and communication. Businesses can take advantage of the Internet to facilitate closer connections among enterprises, customers and suppliers, which can also improve communication efficiency and cut costs (Peypoch 1998). In the era of globalization, information technology has been proven to be an effective tool that assists in corporate resource planning and information communication between organizations and nations

(Barney 1999; Matusik & Hill 1998). It can also facilitate people, groups and organizations in different places to transmit information and perform well (McDonough & Kahn 1996; Bharadwaj et al. 1999). Byrd and Davidson (2003) showed that the integration and application of information technology has a positive influence on supply chains, and can help to improve the performance of organizations. In conditions with fierce competition nowadays, the strategic application of information technology is always an important topic in the field of information management. Owing to the prevalence of the Internet and the rapid spreading of e-commerce, determining methods by which to apply and integrate information technology effectively will be an important topic in order for enterprises to build chain systems (Lin & Lin 2003). Whoever grasps business opportunities first will have greater competitive advantages. Karimi et al. (2001) pointed out that information technology can be applied in operations management. Craighead and LaForge (2003) put forward patterns of information technology applications, including distributor applications, receiving applications, WIP applications, transportation applications and customer applications, that make products and information flow run smoothly and quickly through the IT integration phase of supply chains.

Information technology can provide organizations with a mechanism that can be used to connect, support, integrate, share, store and analyze data effectively. Davenport and Short (1990) stated that information technology contains the ability to process large amounts of data with cross-boundary, automation, analyzing, data accumulation, internal integration, knowledge integration, tracking and control and external integration abilities, among others. According to Grant's classification (1995), information technology can be classified as (1) Substantial IT Infrastructure construction; (2) Man-machine integrated resources; (3) Intangible resources formed by information technology. Rai et al. (2006) classified IT integration into three categories: the integration of information flow, the integration of substantial flow and the integration of financial flow. Information technology enables a supply chain to operate effectively and to achieve the goal of high speed, real time response and effectiveness, which are needed in order to collect and integrate the information in a supply chain. In this way, the managers, decision makers and personnel who use information technology can make sound judgments based on information. All these can be achieved with the aid of information technology; thus IT integration is the key to the supply chain management of enterprises. Knapp et al. (2006) suggested that IT integration can create a virtual supply chain effectively and defined IT integration as: the degree of information system connection and information sharing among different functional departments and partners in a supply chain. Swafford et al. (2008) defined IT integration as: the degree of communication, coordination and relevant information integration among various internal functional departments and external supply chain partners. It has been suggested that effective IT integration and application can improve the timeliness and accuracy of information flow (Handfield & Nichols 2002; Segars et al. 2001).

## **2.2 Trust**

Trust is widely researched in social exchange literature (Zaheer et al. 1998), and it is an important concept in social exchange theory (Blau 1964). Trust will help sustain the intention of both parties to continue cooperation (Ganesan 1994; Morgan & Hunt 1994; Aulakh et al. 1996; Doney & Cannon 1997). Moreover, it is an important foundation by which to improve the interactive performance among organizations (Smith & Barclay 1997), as well as a critical part of the process of achieving the goals of both parties (Eva & Neal 2001). Anderson et al. (1987) defined trust as: some people satisfy the future belief of another group by actions, which are the overall evaluation of honesty and trust

needed among partners, and the trust among organizations is regarded as an important mechanism of coordination and integration among organizations (Morgan & Hunt 1994). Doney and Cannon (1997) suggested that trust is the extent of credit and kindness of one party as perceived by the other party. Thus trust will produce confidence among partners to make cooperation more efficient and will create a long-term relationship between parties. Moorman et al. (1993) suggested that trust is an intention to make people become willing to rely on trading partners. Kumar et al. (1995) interpreted trust from the perspective of the customer. If enterprises consider the well-being of customers all the time, some possible negative outcomes for customers can be avoided (Anderson & Narus 1990). Bauer et al. (2002) and Abigail (2004) indicated that they believe that trust enables both exchange parties to keep a harmonious, coordinated and stable relationship with each other.

Anderson et al. (1987) found that the degree of trust is critical to keep the channel relationship in continuous operation. Anderson and Narus (1990) developed a model of cooperative relationship for a supply chain based on the cooperative relationship between the manufacturers and distributors under consideration in their study. They suggested that trust has a wide impact on the action of enterprises in the supply chain relationship. It further leads the enterprise to respond and be willing to bear losses or risks to maintain the relationship between both parties. Mutual trust in a supply chain relationship will bring high levels of cooperation and further improve the satisfaction of both parties.

Information technology is a media capable of communication (McKenna 1995) which has the characteristic of interaction (Prakash 1996). It could enable enterprises to communicate with each other in a faster and lower-cost manner (Hagel & Singer 1999). By eliminating place and time restrictions, it attracts mutual cooperation among different enterprises by which to achieve learning operation and interaction efficiency among organizations (Cockburn & Wilson 1996). Organizations use information communication technology to make connections among the internal functional departments and external supply chain partners in order to transform important data into useful knowledge. In addition, it achieves the goal of communication, coordination and reuse of shared knowledge through computer processing and transmission and helps establish a good relationship with partners, so as to strengthen the competitive advantage of the organization. Therefore, we can see if an organization has mature information and communication technology, it can store useful information and knowledge in its database, remove place and time restrictions, keep a smooth communication channel in real time, which will be conducive to good interaction, communication frequency and trust between supply chain partners and organizations. Due to the smooth communication flow achieved by IT integration, partners become more familiar with each other and with the operation of the business, making it beneficial to the development and establishment of trust among partners (Chiou et al. 2004). As a conclusion, it is posited herein that the degree of IT integration has a significantly positive influence on the trust relationship between the partners in a supply chain, which forms the hypothesis of this research:

H1: The higher the degree of IT integration of firms, the greater the influence it will have on a supply chain partner's trust.

### **2.3 Innovativeness**

Discussion and relevant research on the influence of innovativeness on business performance and economic growth made by economists has lasted for decades (Mansfield et al. 1971). Kolter (1994) classified new products into original products developed by a company, improved products, modified

products and new brands based on the features of the products. Innovativeness is defined as the adoption of an idea or action. Whether it is a facility, system, procedure, policy, plan, product or service, it is called innovativeness as long as it is new to an organization (Zaltman et al. 1973). Robbins (2001) suggested that innovation is a revolution or a new idea that can improve a product, procedure and/or service. Weerawardena (2003) suggested that innovativeness can gradually improve a product, procedure, organizational system or marketing system to create value for customers. Ali, Krapfel and LaBahn (1995) stated that innovativeness can provide unique features or properties of products to distinguish them from other products in the current market. Brentani (2001) pointed out that innovativeness is a product, process or service launched by the manufacturers which belongs to a new creative endeavor if compared to the enterprise in the past or in the current market. Innovativeness pertains to breaking old rules and trying out untested ideas. Subin and Workman (2004) explained innovativeness from the aspect of creativity, and regarded innovativeness as a revolution, or the provision of the feature extremely different from industrial norms. Hurley and Hult (1998) defined innovativeness from a holistic view, namely, an open attitude towards a new idea which can be considered as a special culture of an enterprise. Marquis (1969) suggested that innovativeness can be classified as breakthrough, incremental and system innovations that contribute to the improvement of products and processes and make a value change towards service and management activities (Sher & Yang 2005). Deshpande and Farley (2004) pointed out that innovativeness can bring better performance to enterprises. It helps companies to develop products, procedures and management mechanisms that are diversified, valuable, rare, differentiated and difficult to imitate.

Functional departments within an enterprise communicate and coordinate using information technology. This is most evident in improved horizontal communication and connection among departments (Moenaert & Souder 1990). Khurana and Rosenthal (1997) believed that an internal horizontal connection helps provide an in-depth discussion of the technical feasibility, selection and evaluation of product features and possible market reaction. This integration and close discussion help inspire creativity from the product development team and the formation of new knowledge (Ford & Randolph 1992). External partners communicate and coordinate with each other through information technology, and this integrates customers and suppliers into the supply chain management process. Regular communication with customers can provide a better understanding of their needs so as to reduce the incidence of redesigning a product, thus enhancing the time and performance of a product design (Bajaj et al. 2004). Manufacturers communicate and connect with suppliers through information technology to allow partners to take advantage of key abilities, skills and supplier information. This helps create innovation as well as overcoming and correcting problems prior to their occurrence (Dröge et al. 2000; Eisenhardt & Tabrizi 1995). Based on the above discussion, the positive impact of IT integration has been observed on innovativeness and thus, the following hypothesis is derived from this principle:

H2 : The higher the degree of IT integration of firms, the greater influence it will have on the firm's innovativeness regarding its supply chain.

Landry et al. (2002) pointed out that a higher degree of trust among business partners can likely inspire innovation. However, a lower degree of trust has been shown to stifle innovation (Knack & Keefer 1997). Since the formation of social capital through trust helps reduce improper behavior, it increases the exchange of reliable information, respects signed agreements and promotes sharing of complete knowledge. Armbrrecht et al. (2001) indicated that new perspectives and information can

result from knowledge sharing, thus leading to the creation of new products or services. Helper and Sako (1995), and Carr and Person (1999) pointed out that suppliers and customers share beneficial market information and design or process information for manufacturers that help them design and improve products or technologies. Hong et al. (2004) revealed that there exists a significantly positive correlation between knowledge sharing and new product development. Trust can help enhance business innovation (Panayides & Venus Lun 2009). In a supply chain, relationships can promote innovation because the manufacturers involved in the relationship are influenced by other partners in the supply chain, which further affects their innovativeness and decision-making (Hausman & Stock 2003). Jean and Sinkovics (2010) mentioned that in the B2B supply chain network, the interdependence and long-term relationships between organizations are important to the manufacturing innovativeness. Based on the above discussion, the positive influence of trust among supply chain partners on innovativeness has been observed, and thus, the following hypothesis is derived from this principle:

H3: The higher the degree of trust among supply chain partners, the greater the influence it will have on firm's innovativeness as it relates to a supply chain.

## **2.4 Competitive Advantage**

Competitive advantage pertains to an enterprise's ability to show a higher degree of competitiveness as compared to its competitors within a given industry and indicates that there are unique features and performance of an enterprise when facing competition from others by making good use of advantage strategies like cutting down on costs, creating differences or satisfying customers (Porter 1990). The reason why enterprises have advantages over others probably stems from better production systems, lower salaries and costs, and better products or service provided to customers, among other positive attributes, while the importance of resources depends on evaluations made by customers (Coyne 1986). However, usually, what the enterprises want to establish is not a temporary competitive advantage, but a long lasting one. Besides being significantly different from competitors, businesses have to cover the key success factors, being able to cope with environmental changes and resist the actions of competitors (Aaker 1984). Both the resource advantage theory (R-A Theory) and resource-based theory (RBT) assume that incomplete competition is the normal state in the market, and these theories suggest that enterprises pursue financial performance under conditions characterized by insufficient market information (potential market segmentation, competitors, suppliers, shareholders and technology). Thus, the financial performance of some enterprises is superior to others (Kay 1993; Hunt 2002). Hayes and Wheelwright (1984) put forward five competitive advantages in regard to manufacturing, including low cost, high quality, on-time delivery, flexibility and innovation. Hill and Jones (1998) suggested that the foundation of constructing competitive advantage includes high efficiency, good quality, innovation and quick response to customers, among other such service attributes. Competitive advantages help businesses cope with competitive demand, and the competitive advantage of an enterprise is a relative concept (Hu 1995; Kay 1993).

Innovativeness is an essential condition to the survival of enterprises in a changing environment. Innovativeness means exploring new opportunities actively rather than only using the advantages one has on hand (Menguc & Auh 2006). Innovativeness is an indispensable ability that can surpass the expectation of customers. Deshpande and Farley (2004) pointed out that innovativeness can bring



enterprises better performance and help them to develop products, procedures and management mechanisms that are diversified, valuable, rare, differentiated and difficult to imitate. Hult et al. (2004) discovered that managers can find feasible solutions to problems and challenges through innovativeness, which helps enterprises to maintain a competitive advantage and also helps avoid decline. To sum up, this research concludes that the degree of supply chain innovativeness has a significant positive influence on competitive advantage, which forms the following hypothesis of this research:

H4: The higher the degree of firm innovativeness in a supply chain, the greater the influence it will have on the competitive advantage of firms.

### 3 RESEARCH METHODOLOGY

#### 3.1 Research model

This research mainly explores how the competitive advantage of manufacturers in a supply chain is affected by IT integration, partner trust relationships, and innovativeness. Based on the above literature review and analysis, the hypothesis and architecture of this research are proposed, as shown in Figure 1.

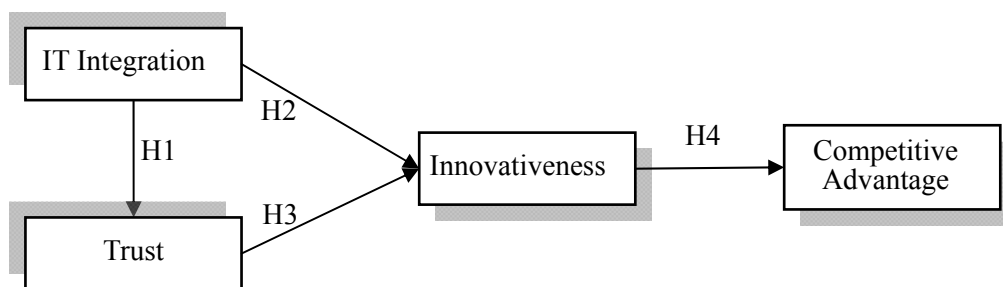


Figure 1. Research Model

#### 3.2 Respondents and procedure

This study consists of two stages. Thirty-eight (38) pre-test questionnaires were collected. The expert validity and Cronbach's alpha were used as reliability verification standards, in which the resulting alpha was between 0.82 and 0.89, indicating rather good scale reliability. This research took 853 manufacturing companies as questionnaire objects. 853 questionnaires were sent by e-mail, mail and personal delivery, after three reminder letters and intensive phone calls and personnel contact. Altogether, 197 questionnaires were collected, with 24 invalid questionnaires excluded after screening, and 173 samples were considered valid, with an overall response rate of 20.3%.

In order to evaluate possible non-response bias and sample representativeness, we compared samples collected earlier (56) with those collected afterward (64), in which we verified the mean difference of the two subsamples for all latent variables. The results did not reveal a statistically significant difference (Armstrong & Overton 1977). In addition, the results did not show a statistically significant difference when the characteristics of the collected samples were compared with those of the parent. This means that a non-response bias did not have a significant impact. Based on a data analysis of sample characteristics, more than 80% of respondents hold important posts in their businesses, among

them are middle-level managers who accounted for most of the respondents (58.6%), followed by senior managers (23.6%), and others, who accounted for 17.8%. Mitchell (1994) pointed out that the characteristics of respondents helps further reduce single source bias.

### **3.3 Measures**

All the measurement items in the study were based on relevant literature. Moreover, the opinions of experts and scholars with advanced industry knowledge were consulted for the adjustment and modification of the content and terms in order to conform to actual situations and provide a theoretical basis. All latent variables were measured using many observation variables. Respondents answered each observation variable according to the degree of agreement on the content described in the items. We used a 7-point Likert scale to represent the degree of agreement. 1 point represents “strongly disagree”, 4 points represents “average”, and 7 points represents “strongly agree”.

IT integration is defined as the degree of communication, coordination and relevant integration of information among various internal functional departments and external supply chain partners. It is measured by five question items (Turban et al. 2001; Swafford et al. 2008). Trust is defined as faith. An enterprise believes that the performance and action of another enterprise has a positive impact and does not create an unexpected action or negative action that can affect the business (Anderson & Narus 1990). Trust is measured by six question items (Larzelere & Huston 1980; Doney & Cannon 1997). Innovativeness is defined as a manufacturers’ ability to create a new idea or action using logistics, facilities, systems, procedures, policies, plans, products or services (Weerawardena 2003; Zaltman et al. 1973). It is measured by five question items (Hurt & Teigen 1977; Hurt et al. 1977; Calantone et al. 2002). Competitive advantage is defined as the process by which an organization has better resources and implementation ability so as to cut cost, create more value for customers and gain higher business performance over a long time amid growing competitors. It is measured by seven question items (Aaker 1989; Hunt & Morgan 1995).

## **4 DATA ANALYSIS AND RESULTS**

The research uses partial least squares (PLS), and SmartPLS2.0, a software developed by Ringle et al. (2005) to conduct PLS analysis. Since this research only has a few samples, it can be free from the restriction of the sample number and the effects of the variable distribution pattern by analyzing using PLS, which can have quite good predictability and interpretability. For stability of estimation of every variable, bootstrap resampling is used in the testing procedure 500 times (Chin 1998). There are two stages in the analysis and estimation procedures of PLS. The first is reliability and validity analysis of the measurement model, and the second is the test of path coefficient and the estimation of predictability of the model.

### **4.1 Analysis of the measurement model**

In regard to reliability and convergent validity, the evaluation standards proposed by Hair et al. (1998) were adopted, considering individual item reliability, composite reliability (CR) and Cronbach’s  $\alpha$  of latent variables, and average variance extracted (AVE). In sum, these results provide strong empirical support for the reliability and convergent validity of the scales used in this study (see Table 1).

Construct	Item	Factor loading	t value	CR	Cronbach's alpha	AVE
IT Integration (ITI)	ITI1~ITI5	0.79~0.83	15.36*~19.68*	0.91	0.87	0.66
Trust (Tr)	Tr1~Tr6	0.73~0.83	13.23*~20.63*	0.88	0.83	0.62
Innovativeness (In)	In1~In5	0.78~0.91	12.80*~42.10*	0.91	0.88	0.68
Competitive Advantage (CA)	CA1~CA7	0.71~0.88	9.54*~21.59*	0.88	0.83	0.64

Table 1. Confirmatory factor analysis results of the measurement model

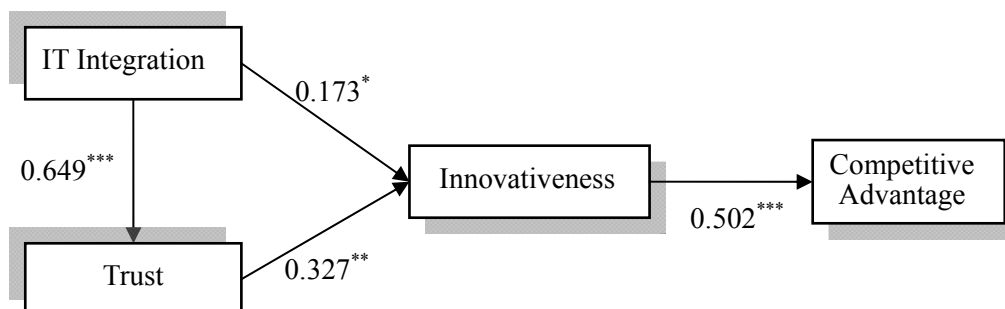
As for the discriminant validity, the degree of relationship among latent variables must be lower than that between the latent variables if a measurement model has discriminant validity, which is therefore tested by the correlation between the variables. The standard suggested by Hair et al. (1998) is that the square root of the latent variables' should be higher than correlation coefficients between all other variables. The AVE of the square roots of the variables in this study were all larger than correlation coefficients between the variables, ranging from 0.79 to 0.82, which shows the latent variables of the research to be obviously distinctive and to have good discriminant validity (see Table 2).

Construct	Mean	St. dev.	AVE	1	2	3	4
IT Integration (1)	5.55	0.73	0.66	<b>0.81</b>			
Trust (2)	4.95	0.88	0.62	0.55**	<b>0.79</b>		
Innovativeness (3)	5.04	1.09	0.68	0.29**	0.34**	<b>0.82</b>	
Competitive Advantage (4)	5.41	0.87	0.64	0.38**	0.41**	0.47**	<b>0.80</b>

Table 2. Discriminant validity: correlations and AVE

#### 4.2 Test of the structural model

SmartPLS2.0 software is used in this study to analyze and test the causation between the latent variables in the structural model, and to test the interpretability of the study model by  $R^2$  (Pavlou & Fygenon 2006) during the following analysis of the structural model. The empirical results show that four path relationships can be found in the overall structural model, all of which were found to be significant, as shown in Figure 2 (the significance is shown by solid lines).



Note: \* $P < 0.05$ 、\*\* $P < 0.01$ 、\*\*\* $P < 0.001$

Figure 2. Results of PLS analysis

## 5 DISCUSSION AND IMPLICATIONS

### 5.1 Discussion

The research deeply explores whether IT integration and the trust relationship between partners in a supply chain will promote an increase in innovativeness that results in a substantially positive effect on the advancement of a manufacturer's competitive advantages in the current highly-dynamic and globally-competitive business environment. The results indicate the manufacturers' degree of IT integration to have significantly positive impacts on the trust relationship between partners in the supply chain. This is based on the fact that companies widely use IT systems and techniques to process both internal and external data, to deliver and exchange information and to share information and knowledge between partners rapidly and smoothly, which will help the suppliers establish a friendly and trusting relationship with customers. Li et al. (2009) considered the concept that IT integration can facilitate information sharing, communication and coordination in the areas of demand estimation, production scheduling, and inventory and production quality. Meanwhile integration will enhance knowledge sharing within a supply chain, exchange between manufacturers and their suppliers, and will contribute to cooperation with regard to making collaborative replenishment plans (Nagi et al. 2011). Therefore, delivering information and knowledge to partners of the supply chain through IT integration is an effective way to cement trust between suppliers and their customers. For example, in important regions around the world, Lifeng Group employees will know the latest market trends and fashion concepts very well, will be able to visit major customers, and will be able to provide their suppliers with the latest information they've collected via IT. Accordingly, Lifeng's suppliers will provide procurement information in relation to the different types of fabrics and ingredients, share the newest information with each other, which can naturally strengthen trust and foster a mutually beneficial relationship. Frohlich and Westbrook (2002) pointed out that the most respectable competitor is the one who's able to utilize the integrated management systems of supply chains to make full use of IT integration, so as to integrate customers and suppliers tightly and cement their trust. From that, we can see that IT integration degree plays a decisive role in developing trust between partners in a supply chain.

The degree of companies' IT integration has been shown to have a weak positive impact on the innovation of a supply chain, which is significant according to the statistical test, while the degree of trust among the partners in the chain has been shown to have a strong significant impact. Davenport and Short (1990) stated that information technology includes automation and the ability to process large amounts of data, to cut across regions, to conduct analysis processing, to accumulate materials, to integrate knowledge both internally and externally, and to implement tracking controls, among other relevant abilities. Technology is weak in regard to the management of ambiguous information, but face to face communication can reduce ambiguous and uncertain situations effectively. Information communication technology contributes to delivering obvious information and knowledge, but face to face communication covers passing and sharing both ambiguous and obvious information (Nonaka & Takeuchi 1995). It was pointed out by Dittrich and Duysters (2007) that trust and a close relationship between partners is indispensable for applying knowledge into present systems, techniques, products and services. Jean and Sinkovics (2010) indicated that manufacturers can update their understanding of customer demands, preferences and actions continuously through trust and joint

effort with the partners of a supply chain, which can help with regard to the development of innovative products and services. Thus, although the degree of IT integration has a weak impact on the supply chain's innovation significantly and directly, manufacturers still need to increase integration and investment in information technology, which will promote the degree of trust among those involved in the supply chain to make a significantly positive impact on innovation.

The results show that the degree of innovation of a supply chain has significant positive impacts on manufacturers' competitive advantages. In a rapidly changing environment, companies should foster detect changes in market demands, strengthen market response ability, acquire needed resources and skills, lower production costs, strive to achieve customer satisfaction, and remove non-value adding activities to maintain an advantageous position in a competitive environment. Moreover, Martin (2002) emphasized that manufacturers should create diversity by making use of present technology and innovation to get competitive superiority, which can develop the market, diversify risk and help companies operate sustainably. Apple's computers are innovative, and its related products (ipod, iphone and ipad etc.) meet varied customer demands. Innovation in Apple's supply chain plays a critical role in its maintaining a dominant position with strong competitive advantages on a global level.

## **5.2 Implications**

This study discusses in depth the innovation of a supply chain by means of a literature review, interviews with experts and scholars, questionnaire surveys and field interviews with companies to verify the impacts from important factors on competitive advantage. The study contributes to an exploration of the subject of supply chain innovation, as well as complementing gaps in the literature on this topic, for this study not only analyzes IT integration in the Taiwanese manufacturing environment and B2B partners trust relationships from a theoretical viewpoint, but it also tests effects of supply chain innovation on enterprises and the relationships among manufacturers' competitive advantages from an empirical perspective. From the empirical analysis, the research shows the manufacturing environment in Taiwan and the developmental status of a supply chain and puts forward several important management implications, including new ideas and specific suggestions on the management of a supply chain. It is hoped that this study will provide Taiwanese businesses with a practical reference.

Innovation of the supply chain become a company's competitive advantage, so enterprises should think of how to enhance their degree of innovation as it relates to their supply chain in order to achieve a competitive advantage. Manufacturers should make effort to make investments in information technology, information systems among organizations, the development of relationships among partners, to involve themselves in information communication and the sharing of knowledge. As to innovation, companies should make gradual progress in products, production processes, and services, as well as in organizational systems and marketing systems in order to create value. To implement an innovative concept and apply it into a supply chain's activities, businesses need to take advantage of mutual cooperation among customers, suppliers, cooperative partners and the enterprises themselves.

The IT integration of manufacturers and the degree of trust between partners in supply chains are the factors that influence the innovation. Taiwan's manufacturers are famous for their mobility and flexibility and the role of OEM/ODM to interact and cooperate with the supply chain although they

are not in the network center. Therefore, if manufacturers want to get good performance in regard to innovation, they should integrate information immediately and should invest in information systems and in systems involving customer relations management and relationships with external partners. They should also establish an electronic communication channel, a Bulletin Board System, online technical forums, online product testing, questionnaires and virtual community of practice and other interactive systems. Establishing mutual trust between manufacturers and supply chain partners is beneficial and responding to customer demands rapidly and providing high-quality products is important for the deployment of resources and the encouragement of innovation. The integration of scientific and technological information and the degree of trust among a supply chain's partners play an important role in regard to innovation.

### **5.3 Limitations and future research directions**

This study was an attempt to be rigorous in all aspects of the areas under consideration and anticipates offering reliable results to readers. However, there still exist imperfections in the course of this study owing to time constraints, insufficient human resources and cost restrictions. In this study, the supply chain in the enterprises often links the customers and the suppliers and creates a multipartite complex relationship, thus the question of how to measure partner relationships in a supply chain more accurately was the direction of this study. The framework in the study is reasonable enough to be a reference for a supply chain. It would be more perfect if the theoretical framework of the study could be studied in cases. Therefore, we suggest beginning the study with materialization. What is more, the study method makes use of interviews, and the questionnaire survey cannot be measured from the company and the appointed supply chain partners' point of view at the same time, so we could not determine whether or not the two parties had cognitive differences. Therefore, it is suggested that a method including more diversified interviewees could be adopted to avoid the limitations of the study by verifying the views of both parties concerned.

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