

# The role of information sharing in supply chain performance (An empirical study on Chinese Tropical Fruits and vegetable industry)

Wang ChenXi\*, Sara Ravan Ramzani\*\*

\*PhD candidate \*\*senior lecturer Post Graduate Centre, Limkokwing University of creative Technology

**Abstract:** *The paper aims to investigate the role of information sharing in supply chain performance in China. Data were collected through a structured questionnaire and was analyzed b using SmartPLS software. The results of the analysis showed that the hypothesized relationship was supported, meaning that information sharing has a significant impact on supply chain performance.*

## Background

At present, the basic model of China's fresh agricultural products logistics is mainly: Producer's → purchaser's → wholesale markets of origin → wholesale markets of sales sites → supermarkets → consumers. This is a traditional, multi-link circulation model. At the same time, fresh agricultural products are still dominated by small-scale production of individual farmers, and the production and processing capacity is low. The multi-link circulation model combined with the backwardness of basic logistics facilities and equipment directly leads to the bad consequences of high transportation cost and high loss rate of fresh agricultural products. (Zhang Xiaoli, Li Gongxue. 2018) According to statistics, the circulation rate of fruits and vegetables, meat and aquatic products in China is as high as 20% to 30%, 12%, and 15% respectively. The annual loss of fruits and vegetables alone is as high as 100 billion yuan, and the economic losses are huge. It can be seen that the correct research and development of the logistics development model of fresh agricultural products has great practical significance.

In the past, the evolution in the logistics management was driven by the intention and need to continuously improve the system and to reduce the total cost. Logistics practitioners realized that the achievement of lowest total cost or cost tradeoffs is impossible if the cost improvement plan is carried out in each individual part of the logistics

process separately. This phenomenon has made the world appreciate the concept and application of logistics integration. Subsequently, companies began to realize that it is important to not only focus on the improvement of an organization itself, but also essential to include other relevant members of the respective organization, such as the trading partners, suppliers, distributors and customers in the effort of optimizing logistics costs. Such integration of business partners and business processes mainly emphasized in nurturing relationship within the terms of physical and information flows. This has created a challenging business atmosphere to all logistics practitioners to foster an integrated logistics performance within and across the members of organization. Henceforth, the concept and practices of supply chain management has become essential for business performance and operational success.

The phrase "Supply Chain Management" originated in the early 1980s. Oliver and Webber (1982) discussed the potential benefits of integrating the internal business functions of purchasing, manufacturing, sales and distribution. A thorough perusal of numerous descriptions of supply chain management reveals the common themes: effective flow of resources [information, finance, product, services] from the source of supplier to the destination of customer, through various distribution channels and manufacturers (Chopra & Meindl, 2007; Mohanty & Deshmukh,

2008). As such, the concept and practices of supply chain management remains as an interest of many stakeholders.

Intense globalization has led to a more competitive economics and geographical environment in which the world is seen as one marketplace and not segmented by country. “The growing interest in Supply Change Management (SCM) can be attributed to rapid changes in the global business scenario. Across the world, recent years have seen a marked shift towards customization and globalization. This has resulted in competition among firms reaching new frontiers. Therefore, in recent years, supply chain management has acquired immense attention from both academic and industry circles. Academics as well as practitioners are looking at SCM as a requisite for firms to compete on a variety of dimensions such as cost, quality, delivery and flexibility” (Chan & Qi, 2003b; Croom, Romano, & Giannakis, 2000; Li, Rao, Ragu-Nathan, & Ragu-Nathan, 2005; Tracey & Tan, 2001).

Moreover, “literatures on the current business trends reflecting the demands being placed on businesses by their customers are increasing. These demands include: reduced prices, superior product quality, excellent customer service, increased variety and exceptional value” (Chopra & Meindl, 2007). “This necessitates multiple companies to perform their business functions with the goal of satisfying a given customer’s demand. Firms across the world are meeting the increased competition by offering a high variety of products at the lowest costs whilst delivering them quickly. This has resulted in the development of supply chains with the aim of fulfilling their customers’ demands” (Mohanty & Deshmukh, 2008).

There are series of product recalls in recent years that have shaken the public confidence in the ability of manufacturers to assure the safety of product exported to developed markets. This involves suppliers originated from developing countries, since they possess lower quality standards and safety regulations than their developed countries counterparts (Maruchek, Greis, Mena & Lai, 2011;

Speier, Whipple, Closs & Voss, 2011). In the pharmaceutical industry for instance, the global sourcing of both inactive and active medical substance from emerging economies has increased the risks of product contamination, as in the case of heparin incident in 2008 (Blum, 2008). With the long supply network involving many entities in different countries, operating in a global environment, thus may pose challenges to the local firms. Within the context of China, the globalization and economic transformation have provided both opportunities and challenges for the local industry. The increased trade liberalization offers opportunities for local manufacturers to tap into new markets and easy access to advanced technology, human resource and capital.

In the past, “firms targeted improved competitive positions by aggressively pursuing different methods. This includes such as marketing and financial improvements to survive and to compete. Since competition is no longer between organizations, but among supply chains” (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006) “the chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance” (Chan & Qi, 2003b; Moberg, Whipple, Cutler, & Speh, 2004).

The revolution of this state-of-the-art tool has also increased the rate of innovation. Yet, the success of a firm’s supply chain technology implementation depends greatly on the accuracy and speed of the information provided by each partner in the network (Chong, Ooi & Sohal, 2009). Wal-Mart is an example of company that rely on information sharing practice to manage its supply chain. The retailer shares online summaries of point-of-sales data with its close suppliers such as Johnson & Johnson and Lever Brothers (Lee, So & Tang, 2000), reaping reduced inventory and manufacturing costs and better understanding of customers’ needs. Information sharing between business units in a supply chain is essential as it provides supplier linkage, internal linkage and customer linkage leading to better performance

(Du, 2007; Sezen, 2008).

Within the information sharing literature, little empirical evidence exists on this issue. Despite the espoused benefits of information sharing in managing global supply chains, recent literature indicates that such practice has been low and in some cases firms have even abandoned such practice (Mohezar & Nazri, 2014; Ramayah & Omar, 2010; Ye & Wang, 2013). These findings have sparked in how industrial managers can successfully and effectively get their firms engage in information sharing to enhance their supply chain competitiveness. While many of the local production companies in developing nations have started to emerge and globalize their operations in diverse industries such as electronics, automotive and consumer durables, they are commonly at disadvantage as compared with multinational corporations from developed countries (Jean, Sinkovics & Kim, 2010; Cuervo-Cazurra & Genc, 2012). They tend to rely on low-cost strategy. Yet, a low cost strategy is not sustainable and instead they should place more emphasis on being more innovative, in which the role of information sharing may come into play

“The understanding and practicing of supply chain management (SCM) has become an essential prerequisite for staying competitive in the global race and for enhancing profitability” (Child house & Towill, 2003; Moberg, Cutler, Gross, & Speh, 2002; Power, Sohal, & Rahman, 2001; Tan, Lyman, & Wisner, 2002). “The practices of SCM are proposed to be a multi-dimensional concept, including the downstream and upstream sides of the supply chain” (Li, Lin, Wang, & Yan, 2006). As such, this has been the primary motive of study to identify the right set of supply chain management practices in tropical fruits and vegetable industry of China.

Increased competition and consumer expectations for product value, variety as well as convergence of taste in disparate geographical regions have forced organisations to adopt a new competitive strategy for sustainability (Tencati, Russo & Quaglia, 2010; Gereffi & Lee, 2012). SCM therefore must be

carefully selected and monitored to ensure competitive edge that is required to achieve success in the marketplace is attained. Matching the procurement, production, transportation, marketing and services activities with the right country conditions would lead to reduced cost, improved quality and innovations. This issue also highlights the need of fundamental change in the way the companies from developing economy, including China should manage their manufacturing operations, so that they could continue competing at the highest levels. They need to become more responsive to support more flexible and leaner manufacturing environment.

Besides identifying the right supply chain management practices, the set of supply chain management practices is expected to perform uniformly as a single entity, and simultaneously its impact on supply chain performance has to be monitored to ensure the desired productivity and operational cost efficiency are achieved (Brewer & Speh, 2000). This implies that, business organizations should measure its performance at various aspect to achieve sustainable competitiveness (Elmuti, 2002). Chan and Qi (2003b) asserted that, the relationship between supply chain management practices and performance could better facilitate the inter organization understanding and integration among partners in the supply chain. Above all, implementation of supply chain management practices, enhancing supply chain information sharing and improving supply chain performance will be a pre-requisite for the survival of any supply chain.

Moreover, with various new information technologies impacting manufacturing sector are rapidly being introduced in the market, further research on information sharing exploring wider range of technologies may facilitate in building deeper understanding of this issue. Rajaguru and Matanda (2013) for instance, have conducted a study involving Australian retail operators. Their studies have measured the information technology capabilities in terms of technology compatibility

and integration between firms and supply chain partners. In another study conducted by Wu et al. (2006), information technology capabilities are conceptualized as the degree of IT advancement and alignment between firms and partners as compared to the competitors. These constructs were developed based on the resource based view theory. Similarly, based on the resource based view theory, Morgan et al. (2016) has explored the influence of information technology competency on logistics capabilities. The study has measured the information technology competency using items that assess the capabilities of the IT systems in collecting and storing information.

While these studies do provide some valuable insights, they are limited in scope. Measuring the impact of information sharing through technological resources on supply chain management by quantifying the technological aspects only may not provide a deeper understanding of this issue. Despite the importance of technological aspects, it is the frequency, quantity and quality of information that is shared that really pertinent. Over reliance on technology without willingness to share the critical information regarding the supply chain operations may not contribute to the maximum benefits. In exception to Projogo and Olhager (2012) and Ramayah and Omar (2010), little research has examined this issue.

Neely, (1997) reiterated that limited agreement achieved on how to monitor and how to assess the performance of a supply chain, despite the fact that most organizations are able to track costs and measure revenues. It is of critical importance to identify suitable measures in cases of continual evolution of supply chains, so as to cope with competition and the changing environment (Jutter & Maklan, 2011). This is another reason that prompted the researcher to study the relationship between supply chain management practices and performance of supply chains in the tropical fruits and vegetable sector in China. Measures that are currently available and being used by supply chains found in developed economies need to be ascertained on their compatibility to supply chains

in Chinese tropical fruits and vegetable industry.

A void persists in theories explaining this issue. For instance, while theory such as DOI has been applied widely in the information sharing through technology adoption field, many researchers have questioned the usefulness and applicability of this theory to elucidate the acceptance of complex and networked technologies utilized in the supply chain environment (Lyytinen & Damsgaard 2011; Prescott & Conger 1995). Researchers argue that the adoption not only requires firms to interface their internal infrastructure with their supply chain partners', but also require them to change their organizational processes and structures, and engage in intensive learning. Other researchers have also argue that resource-based view may not be able to fully explain why some firms that have substantial resources fail to refresh and change then in turbulent environment (Ambrosini & Bowman, 2009; Rajaguru & Matanda, 2013). Given these arguments, it is appropriate to consider grounding this issue on other theories or combining several theoretical perspectives to fill this void. Within the supply chain literature, there are lacks of studies that combine several theoretical perspectives into an integrated view of supply chain management (Izam Ibrahim, Costello & Wilkinson, 2013). Focusing only on one theory may lead to an overestimation of the impact of some factors (Chwelos, Benbasat & Dexter, 2001; Hair et al., 1998). Similarly, having a unified research framework may contribute to improved theory development with greater explanatory power (Kuhn, 1970).

This study expands prior works by investigating the role of information sharing in supply chains. Unlike previous studies which are mainly focusing on linking technology to supply chain performance (Lee et al., 2000; Croson & Donohue, 2003; Zhou & Benton, 2007; Rajaguru & Matanda, 2013), this study examine information sharing capability (information sharing). Furthering this thought, this study posits information sharing to be the mediator between different dimensions found to affect supply chain management. Within the international business literature, factors such as strategic



alliances (Kumar & Malegeant, 2006), technological advancement (Wu et al., 2006), trust (Handfield & Bechtel, 2002), integration (Song & Panayides, 2008; Projogo & Olhager, 2012), and strategic sourcing (Khan & Pillania, 2008) have been cited as important in achieving supply chain competitiveness.

Moreover, SCM also has been distinguished for its strategic role in coordinating business processes across trading partners and simultaneously to improve both (1) the performance of an individual organization (Stevens, 1990) and (2) the performance of the entire supply chain (Li, et al., 2005; Wong, Tjosvold, Wong, & Liu, 1999). In order to compete, “supply chain management seeks close integration with internal functions within firm and external linking with suppliers, customers and other channel members. This could be achieved through effective construction of various supply chain practices” (Kim, 2006b). Despite knowing the essentials of supply chain, there are still some business organisations who are clueless and do not know precisely what are the sets of supply chain management practices to be implemented to improve the performance (Li, Ragu-Nathan, et al., 2006). All these point to the need for studies that are predicated on supply chain management practices and their models.

In examining the supply chain performance and information sharing issues among the Chinese production firms, this study develops a conceptual model based on several theoretical perspectives which include resource-based view, dynamic capability theory, and social exchange theory. Therefore, this research study has discovered a set of new combination of supply chain management practices component (variables) which combines component of supply chain management practices proposed by Li et al., (2006) (comprehensive model) and Min and Mentzer, (2004) (system approach model).

Thus, this study aims towards fulfilling the need to study and understand supply chain management practices and its impact towards information sharing towards about supply chain and supply chain

performance among tropical fruits and vegetable industry of China.

### **Literature: Information sharing and its relationship with other study variables**

While empirical studies exist to further our understanding of the global supply chain competitiveness, relatively little is known about the mediating role of information sharing in the global supply chain. Moreover, despite the facts that elements such as unique resources and good relationships may hold great potential for effective global supply chain operations, there are however inconsistencies observed in some studies. One suspected reason for this research finding could be because of the effect of a mediator - information sharing. Information is one of the most important resources powering global supply chain competitiveness, as this element is tied up with two critical factors - visibility and flexibility (Sajadieh, 2008). Visibility allows other members in the network to view accurate and timely data as well as information at different stages in the chain, enabling firms to strategically avoid any risks of delays and the need to keeping safety stock.

Since global supply chains are associated with uncertainty, where markets and customers are dynamic, flexibility has become increasingly important. As firms source and market their products around the globe, lead time in both inbound and outbound logistics has dramatically increased, and would result in a more uncertainty environment. Information sharing among different business processes and supply chain partners could effectively create a virtual supply chain (Knapp et al., 2006). This practice facilitates firms in coordinating various supply chain functions across the networks, in which forecasting data, production schedules, inventory status and production quality could be shared, reducing the risks of supply chain breakdown (Li et al., 2009).

### **What to share and with whom?**

The information sharing can be realizing at different organizational levels between members in the supply chain (Taylor & Fearn, 2006). For example,

“supply chain partners could share forecasts, trends and plans to sustain and enhance company and supply chain competitiveness” (Yigitbasioglu, 2010). As indicated, information sharing also helps supply chain managers in making efficient, effective and timely business decisions by reducing response time to unforeseen events and market changes (Guffrida & Nagi, 2006). Nowadays, the supply chain partners cannot avoid information sharing. As in new technology era, advances in information technology (IT) have enabled the coordination and collaboration that underlie today’s SCM strategies (Frohlich & Westbrook, 2001; Fawcett et al., 2007). The technology aspects of information sharing granted that firms are willing to share information (Cachon & Fisher, 2000; Lee et al., 2000). By having access to information, firms could become aware of inexpensive and quality suppliers in other regions that other companies may not inform (Ndubisi et al., 2005). Spathis and Ananiadis (2005) also argue that “an enterprise information system significantly contributes towards increased flexibility in information provision through effective monitoring and exploitation of the company’s assets and revenue-expenditure flow”.

Moreover, information sharing is a foundation for economic growth, in which it allows business entities to communicate with customers who are unfamiliar with their products or services but likely to be interested in using their products or services in a more cost-effective manner (Cate & Staten, 2000). “One of the main barriers of interpersonal information sharing may be concerned about information privacy. A trusted network should be created for individuals to share information” (Razavi and Iverson, 2006). Organisation members may lack trust in each other which may impede information sharing (Ardichvili & Gasparishvili, 2003; Cetindamar, Catay & Serdar Basmaci, 2005).

There has been various research activities carried out, for instance, Clark and Lee (2000) have investigated the impact of continuous replenishment, which enables manufacturers to access the inventory status of retailers and plan

shipments accordingly, instead of waiting for order placement. Similarly, Cachon and Fisher (2000) have analysed the impact of sharing demand and inventory data between a supplier and multiple retailers. They found that information sharing led to substantial savings of lead time and batch size reduction. Few empirical studies have also provided evidence that information sharing could influence the levels of integration and coordination across supply chain (Power, 2005).

Notwithstanding these, there are also studies examined the impact of internal and external factors on information sharing in supply chain management. For instance, Li and Lin (2006) determine the effect of environmental uncertainty, intra organizational factors and partnerships on information sharing. The study which collected data from 196 companies found that top management support, trust and shared vision between supply chain partners as important ingredient in information sharing, while supplier and customer uncertainty reduce the level of information shared. In another study, Durocher and Kilpatrick (2000) found that firms with highly integrated departments have higher levels of information sharing practice, leading to stronger performance. Some studies have also highlighted the importance of trust in information sharing as this element facilitates more collaborative relationships among supply chain members and helps to reduce uncertainty (Martins, 2010).

### **How to share the information**

The information sharing can be done through “face-to-face contact, telephone and fax as well as email, EDI, Web-enabled portals, enterprise resource planning and data warehouse management” (Hill & Scudder, 2002; Stefansson, 2002; Adewole, 2005). In the upstream and downstream information sharing, the supply chain can be facilitated by the used of internet

It is clear that information sharing enables strong supplier and customer coordination in various supply chain processed from acquiring raw materials through to delivering of finished

products. Timely and accurate information exchanged between network members ensures smooth flow of materials along the chain as it reduces uncertainty, resulting in improved flexibility and visibility. While the potential benefits of information sharing are well comprehended in the literature, this area of research is still limited. Table 3.8 highlights the previous research in the area of information sharing in Global Supply Chain Competitiveness

An organization has attained competitive advantage, when through its offering; it has able to create more value for its customers in comparison with rival firm (Goshal, 1987). In the production sector, competitiveness is defined as the ability of production system to compete on basic dimensions such as quality, cost, flexibility, speed or time and delivery (Safizadeh et al. 2000). One would expect that operational excellence to be supported by supply chain capabilities. Prior research have categorizes supply chain competitiveness into delivery and flexibility. In turn, these will lead to better competitive position and better sales and profits (Jin Su & Vidyananya, 2012).

It is very important for a firm to choose an appropriate set of sources for inter- organizational competitive advantages so that it may successfully accomplish its supply base evolution. While majority of early global firms have focused on exporting products, they have little concern on their delivery capability. Delivery capability refers to supply chain capacity to meet quoted and anticipated dates and quantities in both make-to-order and make-to-stock environment.

Delivery performance is argued to be gaining recognition as viable competitive weapons (Fawcett & Clinton, 1997). Flexibility refers to a supply chain capacity to change production volume and production mix. Christopher (1992) argued that when it comes to the whole supply chain which comprises supply network, production firms and delivering enterprises, flexibility is taken into account as an important and relevant factor.

In line with the Dynamic Capability Theory, which

highlights the need for supply chain partners to be able to reconfigure resources within organisations and business network, the expected benefits of technological advances could be “retarded without the willingness of firms to exchange strategic information as well as transactional data such as materials or product order” (Fawcett et al., 2007). Similarly, few researchers have relate trust, organizational culture-fit and logistics integration to information sharing, which in turn, creates value in the exchange relationships (Yisitbioglu, 2010; Olhager & Projogo, 2012; Wu et al., 2006). Development of strategic sourcing practice could enhance supply chain capabilities, information sharing plays a role in which it allows suppliers to work with more complete information, and improve their responsiveness. This study, therefore, view information sharing as mediator between different factors identified to contribute towards firms' global supply chain performance.

While technology capability is pertinent in ensuring greater information exchange, various literature have highlighted that this element does not necessarily guarantee willingness of partners in sharing strategic information (Sarkar, Echambadi, Cavusgill & Aulakh, 2001; Tippins & Sohi, 2003; Sambas Ivan & Nguet Yen, 2010). While the technical capabilities are pertinent in achieving supply chain performance, “the frequency, quantity and quality of information that is shared really matters” (Fawcett et al., 2007). Large investment in technology could fail to produce expected benefits if it is not supported by willingness to share information. By sharing real-time data such as inventory levels, delivery status and production planning and scheduling, firms are able to manage and control their supply chain activities. As such, the problems in coordinating global supply chain activities which are often hindered by time and distance could be reduced. For instance, in a food industry, information gathered from supermarkets' Tropical fruits and vegetable point-of-sales system permit food retailers, manufacturers and packaging companies to collaboratively develop new knowledge on consumer purchasing behaviours, facilitating the new product development process

(Cox & Mowatt, 2004). Similarly, information sharing has also driven the successful implementation of vendor-managed inventory programs, in which it facilitates the replenishment activities, and has been shown to reduce the bullwhip effect. Based on these arguments, this study postulates that: Based on the literature above about the depth of the variable and its relationship in literature with other variables, following five more hypotheses were generated;

H1: Information sharing has a positive significant impact on firms' supply chain performance in Chinese tropical fruits and vegetable industry.

### **Method of Survey**

Recently, web based surveys are becoming popular because they are easier and faster. However, the response rate is lower relative to mail surveys. In this study, only mail and personnel administrated surveys were used. The mail survey was used to reach a relatively large sample of firms scattered throughout China. Most researchers in relation to firm base survey adopt a mail survey approach despite difficulties associated with low response rates (Newby, Watson, & Woodcliff, 2003).

It is important to minimize the errors that are associated with the mail survey method of data collection (Mangione, 1998). One of the common errors in mail survey is non-response error. In order to address this non-response error, the study targets to achieve a high response rate by employing various techniques: reminders, as suggested by Cooper and Schindler (2003), telephone pre-notification (Schlegelmilch & Diamantopoulos, 1991), coloured paper (LaGarce & Kuhn, 1995), using double-sided rather than single-sided or short rather than long questionnaires (Jobber, 1998). In addition, the university logo has been found to increase response rate (Greer & Lohtia, 1994). Assurance of anonymity has generally proven successful in acquiring higher response rate (Kanso, 2000; Tyagi, 1989). By providing clear instructions, the failure of respondents to answer individual questions or item non-response error can be reduced. The questionnaire was made to look

attractive, not crowded and the questions were not too long. Many of the total design method (TDM) recommendations suggested by Dillman, (2000) were adopted. The questionnaire was designed in an easy to read format with a total of nine pages.

A detailed structured questionnaire was administrated at the firm level. A significant challenge for this study is to find the appropriate managers who can answer variety of questions spanning upstream till downstream supply chain process. Managers with appropriate titles (i.e., managers or directors of logistics, distribution, or supply chain management) are targeted. We used two sources of motivation for managers in order to increase their participation. First, we informed them that ministry of food endorsed this study. Second, we also informed them that a copy of the study findings would be provided to them (Rokkan, Heide, & Wathne, 2003).

This study used the individual such as managers related to the supply chain operations as the unit of analysis in this study. We used companies from a variety of fruits and vegetable industries. The size of companies provided us with substantial variation in the levels of practices, integration and performance measurement mechanisms used by firms.

### **Data Analysis**

Data analysis in this study was conducted with the help of the software package, SmartPLS, Version 3.0 M3 as suggested by Ringle, Wende and Will (2005). "Smart PLS is extensively utilized in the field of marketing and management science" (Henseler et al., 2009). According to researchers (Hair et al., 2011; Valerie, 2012), a

PLS model is generally analyzed and interpreted in two phases; first measuring the outer model for validity and reliability and second, analyzing the structure model by R square, effect size, predictive model relevance, and goodness of fit (GoF). In the first phase, properties of multi-item constructs are measured with the inclusion of convergent validity and discriminant validity. Following the second phase, the study hypotheses testing is conducted



through the bootstrapping method.

**The Convergent Validity Analysis**

According to Hair et al. (2010) “convergent validity refers to the degree to which a group of variables converge in measuring a particular concept. They suggested that convergent validity can be established through the simultaneous testing of three criteria; factor loadings, composite reliability (CR) and average variance extracted (AVE)”. As such, the entire items loadings were examined and confirmed to be above 0.70 (the acceptable level recommended by Hair et al., 2010) (See Table 4.5).

“Convergent validity is also confirmed through composite reliability – a test that refers to the level to which the items set indicate the latent construct in a consistent manner” (Hair et al., 2010). For this study, the Cronbach Alpha and Composite Reliability values are listed in Table 4.7. From the table, “the values of Cronbach Alpha fall between

the range of 0.771- 0.945 while composite reliability values fall between 0.881-0.956 indicating that the latter values exceeded value of 0.70” (Fornell & Larcker, 1981; Hair et al., 2010). Hence, the results confirm the outer model’s convergent validity.

In addition to the above, the average variance extracted (AVE) values were tested to further confirm the outer model’s convergent validity. AVE shows the group of items average variance extracted in relation to the variance shared with measurement errors. Specifically, AVE gauges the variance encapsulated by indicators that relate to the assignable variance to the measurement errors. If the AVE value is 0.5, the set of items is deemed to have sufficient convergence in measuring the construct (Barclay, Higgins, & Thompson, 1995). In the present study, the values of AVE fall in the range of 0.622-0.686 indicating good construct validity of measures as recommended by Barclay et al. (1995).

**Table - the t Validity and Reliability Analysis**

Construct	Items	Loading	Cronbach's Alpha	CR	AVE
Information sharing	IS1	0.804	<b>0.909</b>	<b>0.928</b>	<b>0.648</b>
	IS2	0.754			
	IS3	0.863			
	IS4	0.848			
	IS5	0.759			
	IS6	0.797			
	IS7	0.804			
Supply chain performance	SCP1	0.807	<b>0.82</b>	<b>0.881</b>	<b>0.649</b>
	SCP2	0.83			
	SCP3	0.794			
	SCP4	0.792			
	SCP5	0.837			
	SCP6	0.811			
	SCP7	0.801			
	SCP8	0.769			
	SCP9	0.812			
	SCP10	0.907			
	SCP11	0.891			
	SCP12	0.813			
	SCP13	0.73			
	SCP14	0.888			
	SCP15	0.621			
	SCP16	0.859			
	SCP17	0.901			

**The Discriminant Validity Analysis**

“Discriminant validity refers to the level to which items can differentiate among different constructs in that it shows that the items of different constructs are not overlapping. Additionally, discriminant

*Table: The Discriminant Validity Matrix*

	<b>SP</b>	<b>IS</b>
<b>IS</b>	<b>0.599</b>	
<b>SCP</b>	0.31	<b>0.638</b>

**Hypothesis Testing**

*The Results of the Inner Structural Model*

<b>Hypothesis No.</b>	<b>Hypothesis</b>	<b>Path Coefficient</b>	<b>Standard Error</b>	<b>T-Value</b>	<b>P-Value</b>	<b>Decision</b>
H11	<b>IS -&gt; SCP</b>	0.198*	0.142	1.398	0.081	Supported
*: p>0.10; **: p>0.05; ***: p>0.01						

The path coefficients statistical significance can be determined via bootstrapping methods in SmartPLS 3.0. In this regard, the T-values of each path coefficient were produced through such method and P-values were eventually obtained. Based on the results, the hypothesis were supported.

**Discussion**

The positive significant relationship between information sharing and supply chain integration found in this study provides empirical evidence on the importance of information communication effectiveness among the supply chain partners. As such, this point provides confirmation of the conclusion of both Li et al., (2009) and Kim, (2006b). In addition, this study also found that information quality has positive significant relationship with supply chain integration. In relation to electronics manufacturing firms, the finding shows that a quality communication of information could enhance the level of supply chain integration in the tropical fruits and vegetable industry. This finding supports the view that supply chain integration could be influenced profoundly by information quality in terms of supply chain

validity of measures share variance between each individual construct and hence it should be higher than the variance shared among specific constructs” (Compeau, Higgins & Huff, 1999). In this study, the discriminant validity of measures was established through Fornell and Larcker’s (1981) method.

management practices (Levy, et al., 1995). Also, agreed vision & goal has positive significant relationship with supply chain integration.

What dimensions of supply chain performance are related to supply chain integration in the in China, can be answered by the survey findings. The supply chain integration has a direct positive impact on the supply chain performance. The supply chain performance is further investigated specifically in terms of resource performance, flexibility performance and output performance. The finding implies that supply chain integration enhances the performance of supply chain in terms of resource performance, flexibility performance and output performance in the tropical fruits and vegetable industry.

Specifically, this study found that supply chain performance (includes resources performance, output performance, flexibility performance) could be enhanced through extensive level of supply chain integration. The specific findings of the relationship between supply chain integration and supply chain performance is discussed in the following section.

## Implications

Managers in the Chinese production firms have to consider the strategic role information exchange, in managing their global supply chains. Local manufacturing firms that compete in global arena cannot ignore the influence information sharing. Specifically, they need to understand their supply chain partners. This could help them formulate appropriate strategies to enhance the degree of integration and thus lead to improved capabilities. Often, good business relationships are formed not on the ground of explicit rules and regulations, yet a set of ethical habits, moral obligations that have become values and norms that are internalized by each of the supply chain partner; and this will translate into trusts, commitment and successful collaboration,

Information exchange through sharing of customers and suppliers knowledge could also facilitate in speeding up the product development process and enhance process performance, leading to reduced time to market and enhanced customer value. These benefits would permit the local manufacturing firms to respond quickly to changing consumer demands. For instance, within the local food processing industry, the changes of lifestyle has resulted in increased demands for convenience food, highlighting the need for intense continuous innovations in the sector (Mohezar & Nazri, 2014). Willingness of firms to share information with supply chain partners presents immense opportunities for them to manage and support the product development process and increase their ability to be responsive to market requirements through collaborative network. This could also help local firms in addressing the problem of inability to position them as part of the value chain.

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