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Supply Chain Integration and Performance: Revisiting the Philippine Experience

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This paper seeks to identify the supply chain integration strategies adopted by selected Philippine firms, the measures used to assess supply chain performance, and the association between these strategies and measures. Supply chain integration and supply chain performance constructs were developed through literature review and in consultation with industry experts. To determine the construct validity, factor analysis was employed. Reliability analysis was done to assess internal consistency. A total of 57 firms from the Philippine manufacturing and service sectors participated in the study.

Two supply chain integration strategy factors were derived from the factor analysis: (1) joint decision making with supply chain partners and (2) information sharing with supply chain partners. On the other hand, the validated supply chain performance factors can be classified into two: (1) supply chain effectiveness (responsiveness measures) and (2) supply chain efficiency (cost-based measures). Results showed a significant association between supply chain integration and supply chain performance.

Research findings provide the literature with pragmatic definitions of supply chain integration strategies and performance measures. Collaboration between the industry and the academe is needed to educate practitioners and educators on the strategies needed to achieve effective supply chains.

Keywords: Supply chain integration, internal integration, external integration, supply chain performance, supply chain efficiency, supply chain effectiveness

1 Introduction

Supply chain management (SCM) as a philosophy relies on the effective design and integration of the supply chains and is founded on strong organizational relationships, linked processes, information systems, and performance measurements (Fawcett, Magnan, & McCarter 2008). SCM is an important management function that integrates the demand and supply functions and links the different players of the supply chain (the customers, manufacturers, intermediaries, and suppliers) (CSCMP, 2016). Managing the supply chain is critical given the need of companies to deliver to their customers their products and services at the right time, place, quantity, and quality. SCM, therefore, should be from a holistic and integrated perspective (Metz, 1998; Blackwell & Blackwell, 1999; Mentzer et al., 2001; Cavinato, 2002; Lambert, Garcia-Dastugue, & Croxton, 2005).

To effectively implement SCM, supply chain integration is important (Mentzer et al., 2001; Gimenez & Ventura, 2005; Hadaya & Cassivi, 2007; Anbanandam, Banwet, & Shankar, 2011; Hua, Chatterjee, & Kang-kang, 2009; Jones, Fawcett, Fawcett, & Wallin, 2010; McDowell, Harris, & Gibson, 2013; Nguyen & Liem, 2013; Rascovic & Morec, 2013; Seo, Dinwoodie, & Kwak, 2014). Supply chain integration (SCI) refers to the management of the downstream and upstream levels of the supply chain (Naslund & Hutlen, 2012) and involves both internal and external integration (Stevens, 1989; Vargas, Cardenas, & Matarranz, 2000; Germain & Iyer, 2006; Koufteros, Vonderembse, & Jayaram, 2005; Quesada, Rachamadugu, Gonzales, & Martinez, 2008; Basnet, 2013). For firms to effectively integrate, there is a need for information sharing and coordination among different entities belonging to the supply chains such as the firm's suppliers and customers as well as their respective supply chain networks (Lee, Kwon, & Severance, 2007; Naslund & Hutlen, 2012). On one hand, functional departments need to synchronize their supply chain operations—materials planning, demand forecasting, procurement, inventory planning, and logistics, among others—to achieve internal integration (Langley & Holcomb, 1992). On the other hand, relationships between the supply chain

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players (suppliers, customers, manufacturers/service providers, and stakeholders) also need to be managed to achieve external integration (Cooper & Ellram, 1993; Waller, 1999; Kumar, 2001; Lambert et al., 2005). To implement SCI, firms need to make collaborative decisions in areas like demand planning, strategic sourcing, supply chain strategy, information sharing, risk and rewards sharing, and supply chain performance (Anderson, Britt, & Favre, 2007; Hadaya & Cassivi, 2007).

Through SCI, supply chain entities are able to deliver products and services to customers efficiently and effectively (Gimenez & Ventura, 2005; Seo et al., 2014). Joint decision-making strengthens a supply chain partnership (Hadaya & Cassivi, 2007) and helps achieve supply chain visibility (Seo et al., 2014) leading to better operational performance (Anbanandam et al., 2011; Hua et al., 2009) and global competitive advantage (Jones et al., 2010; McDowell et al., 2013; Nguyen & Liem, 2013; Rascovic & Morec, 2013).

To achieve the objectives of SCI, it is necessary that firms measure supply chain performance (SCP) —(1) to assess the effectiveness of the supply chain (Beamon, 1999; Gopal & Thakkar, 2012; Khare, Saxsena, & Teewari, 2012; Elrod, Murray, & Bande, 2013); and (2) to facilitate inter-firm coordination and information flow (Cirtita & Glaser-Segura, 2012; Saaed, Malhotra, & Grover, 2011; Espinoza, Bond, & Kline, 2010). There is a need, however, for a comprehensive SCP measurement system (Cirtita & Glaser-Segura, 2012; Elrod et al., 2013). Having a comprehensive set of SCP metrics provides the supply chain partners with greater visibility of the performance of the chain, promotes inter-firm coordination (Cirtita & Glaser-Segura, 2012), and guides managers as to their courses of action (Sambasivan, Nandan, & Mohamed, 2009).

Several studies have been conducted on supply chain integration and its association with supply chain performance measures in different countries (Fynes, Voss, & de Burca, 2005; Koufteros et al., 2005; Tracey, Lim, & Vonderembse, 2005; Zailani & Rajagopal, 2005; Germain & Iyer, 2006; Aryee, Naim, & Lalwani, 2008; Quesada et al., 2008; Sezen, 2008; Johnson & Filippini, 2009; Lee et al., 2007; Kannan & Tan, 2010; Gimenez & Dok, 2012; Huo, 2012; Basnet, 2013; Thatte, Rao, & Ragu-Nathan, 2013; Peng, Verghese, Shah, & Schroeder, 2013; Seo et al., 2014; Tomas, Rosales, Batalha, & Alcantara, 2014). Important insights from the above literature include the following – (a) Firms have different stages and modes of supply chain integration depending on the similarity of supply chain activities and level of supply chain complexity (Zailani & Rajagopal, 2005; Aryee et al., 2008; Gimenez & Dok, 2012; Otchere, Annan, & Quansah, 2013); (b) Communication, trust and relationship are critical in SCI (Fynes et al., 2005; Koufteros et al., 2005; Basnet, 2013); and (c) Internal and external integration were found to be associated with innovation, operational and customer performance improvements (Fynes et al., 2005; Tracey et al., 2005; Zailani & Rajagopal, 2005; Germain & Iyer, 2006; Lee et al., 2007; Quesada et al., 2008; Sezen, 2008; Johnson & Filippini, 2009; Kannan & Tan, 2010; Huo, 2012; Thatte et al., 2013; Peng et al., 2013; Seo et al., 2014; Tomas et al., 2014).

Very limited studies involving Philippine companies have been done on the relationship of supply chain integration with performance (Talavera, 2008a; Talavera, 2008b, Talavera, 2010; Salindo, 2015). This study revisits the state of supply chain integration strategies in the country and presents alternative ways of measuring supply chain performance as originally reported by Talavera (2008a, 2008b, 2010).

Section 1 presents the research objectives while section 2 of the paper provides a literature review on supply chain strategies and performance. The methodology is described in section 3 while section 4 presents the results and analysis. The remaining sections show the conclusion, study limitations, and areas for further study.

2 Literature Review

The succeeding discussions present the relevant literature on supply chain integration, the measures to assess supply chain performance and the various factors affecting such performance. The research gaps from the literature review are then identified.

2.1 Supply chain integration

Supply chain integration (SCI) refers to linking the actions and programs related to the movement of products and services from procurement up to distribution (i.e., external) and within the company's departments like production, storage, and other related functions (i.e., internal) (Vargas, Cardenas, & Matarranz, 2000). According to Stevens (1989), SCI involves three stages: (1) functional integration (integration within the function), (2) internal integration (integration among functions), and (3) external integration (inter-firm integration). More than just identifying the different ways to illustrate integration, Germain and Iyer (2006) emphasized the term "unifying functions and processes" inside the firm (internal) and across trade partners (external).

Internal integration, on one hand, involves coordination of functions inside the organization and communication leading to mutual trust and affective relationship and is an important precursor to external integration (Koufteros et al., 2005; Basnet, 2013). Internal integration involves the following dimensions: (1) coordination (cooperation and synchronization), (2) communication (information exchange, consultation, and interaction), and (3) affective relationship (accessibility to each other and unity in vision) (Basnet, 2013). Internal integration, therefore, links the various activities related to the following operations inside the firm: production, quality, inventory, warehousing, storage, and production planning, among others.

External integration, on the other hand, deals with upstream (integration with suppliers) and downstream external integration (integration with customers) (Quesada et al., 2008). Specifically, it pertains to activities related to collaborative planning with suppliers on materials and production planning and with customers for demand planning. Another way of looking at supply chain integration is from the perspective of the stakeholder involved (customers and/or suppliers) and the focus of integration (operational versus strategic) (Peng et al., 2013). Zhang, Gunasekaran, & Wang (2015) suggested a more comprehensive model for supply chain integration by looking at several dimensions – (a) level of integration (strategic, managerial, operational, fundamental); and (b) elements of integration to include strategic, planning and control, organization, process, finance, knowledge, information and materials integration.

SCI also involves collaborative decision making in the various activities in the supply chain (Lee et al., 2007; Talavera, 2008a, Talavera, 2008b, Talavera, 2010, Basnet, 2013; Otchere et al., 2013). Quesada et al. (2008) reported that firms that seek customer feedback and involvement as early as the product development stage have better knowledge of their customers and products leading to better product quality. Germain and Iyer (2006) likewise reported that internal integration leads to stronger downstream integration, which in turn affects logistical performance. Johnson and Filippini (2009) reported that internal and external integration (also referred as internal and external collaboration) lead to innovation capabilities. With better coordination with the supply chain partners (customers or suppliers), the value chain is streamlined, the rework costs are lower, and the time to market for new product development is reduced. Peng et al. (2013) likewise presented that supply chain integration provides firms with relational and collaboration competence which is inimitable resulting to operational and innovation capabilities as well as strategic performance.

Talavera (2008a) reported the validated supply chain management constructs consisting of three relevant factors: (1) supply chain collaboration, (2) supply chain operations, and (3) coordination mechanisms. Factor 1 (supply chain collaboration), refers to the strategies involving internal and external collaboration. In this study, the SCI constructs will be re-evaluated. The term supply chain collaboration will be interchangeably used with supply chain integration given the commonality in their definitions.

2.2 Supply chain performance

Several authors emphasized the importance of having a holistic and comprehensive set of performance measures to assess supply chain efficiency and effectiveness (Beamon, 1999; Gunasekaran, Patel, & Tirtiroglu, 2001; Kleijnen & Smits, 2003; Sambasivan et al., 2009; Talavera, 2010; Banomyong & Supatn, 2011; Cirtita & Glaser-Segura, 2012; Khare et al., 2012).

The succeeding discussion presents the literature on the need to evaluate supply chain performance from a holistic perspective, as follows – (a) consider customer, operational and financial metrics (Beamon, 1999; Gunasekaran et al., 2001; Kleijnen & Smits, 2003; Talavera, 2010; Banomyong

& Supatn, 2011; Cirtita & Glaser-Segura, 2012; Greer & Theuri (2012); Huo, 2012; Elrod et al., 2013), and (b) evaluate the effectiveness and efficiency at various levels of the supply chain (Cirtita & Glaser-Segura, 2012; Gopal & Thakkar, 2012).

On the need to measure the supply chain using a more comprehensive set of metrics, Banomyong and Supatn (2011) and Elrod et al. (2013) recommended that supply chain performance measurement consider the following operations management dimensions: cost, quality, timeliness, delivery, and reliability. Cirtita and Glaser-Segura (2012) also suggested the use of the metrics based on the Supply Chain Operations Reference (SCOR), a framework used by the Supply Chain Council. The five measures included in the SCOR model are (1) supply chain delivery reliability, (2) supply chain responsiveness, (3) supply chain flexibility, (4) supply chain costs, and (5) supply chain asset management efficiency. Gunasekaran et al. (2001) emphasized the use of financial and non-financial performance measures taken at strategic, tactical, and operational levels.

Huo (2012) in his study of 617 Chinese companies used a comprehensive set of measures to assess supply chain performance. These measures include (1) customer-oriented performance (i.e., manufacturer's performance in serving its customers, (2) supplier-oriented performance (i.e., suppliers' performance in serving the manufacturers), and (3) firm performance (to include measures of firm profitability and market growth).

Beamon (1999) proposed three types of performance measures to include the following: resource measures (R), output measures (O), and flexibility measures (F). Another approach to having a holistic supply chain performance measurement system is through the adoption of the balanced scorecard (BSC) framework (Gunasekaran et al., 2001; Kleijnen & Smits, 2003) wherein supply chain performance is measured through these perspectives: customers, internal processes, innovation, and finance. Talavera (2010) measured supply chain performance in terms of order delivery time and order fulfillment performance but similarly emphasized the need for a comprehensive set of supply chain performance measures.

There are challenges, however, in measuring supply chain performance. Gopal and Thakkar (2012) emphasized the need to measure supply chain performance not just from an individual company perspective but from the supply chain's perspective. Identification of measures should also take into account their link to supply chain strategy and firm product characteristics as well as to supply chain integration issues in an industry and across industries. With regard to firm performance, Greer and Theuri (2012) noted that while there are researches that show the relationship between supply chain performance and firm performance, companies have different ways of defining firm performance, either as reduction in costs, increase in revenues, market share, or return on assets, among others. In their study of the electronics industry in Malaysia, Sambasivan et al. (2009) emphasized the importance of measuring the company's tangible and intangible assets.

2.3 Relationship of supply chain integration and supply chain performance

The extant literature on the association of the supply chain integration and performance provided support on the significant relationship of supply chain integration, particularly collaborative and joint decision making among the supply chain partners, with operational performance (Tan, 2002; Lockamy & McComark, 2004; Corsten & Felde, 2005; Gimenez & Ventura, 2005; Eng, 2005; Koh, Demirbag, Bayraktar, Tatoglu, & Zaim, 2007; Narasimhan, Swink, & Viswanathan, 2010; Talavera, 2010; and Thatte et al., 2013).

Tan (2002) observed the significant relationship of SCM strategies and the following operational performance measures in terms of product quality and customer service, as well as reduction in response time and supplier delivery time. Lockamy and McCormack (2004), who looked into the effect of SCM practices on performance using the SCOR model, found out that collaborative demand and supplier planning, supplier transactional collaboration, and delivery process integration and delivery planning process activities are significantly associated with supply chain performance.

Corsten and Felde (2005) also reported, based on their study of 135 Swiss buyer-supplier relationships, the positive relationship of supplier collaboration with buyer performance in terms of innovative capability and financial results. Gimenez and Ventura (2005), on the other hand, highlighted the effects of external integration (information sharing, joint planning, teamwork, joint decisions on cost reduction activities) on operational performance, measured in terms of reduction in costs, stock

outs, and lead times. Eng (2005) noted that having a cross-functional-oriented structure coupled with a strong information system has positive effects on the following supply chain performance metrics: (1) customer satisfaction and (2) supply chain responsiveness (measured in terms of improved efficiency among different functions in the supply chain).

The same was noted by Koh et al. (2007) based on their study of the SCM practices of 203 SMEs: Outsourcing, multi-tiered strategy, and strategic collaboration, have positive impact on operational performance measures (flexibility, lead time, cost measures, among others). Narasimhan et al. (2010) observed a positive relationship between supply integration and SCP measures such as quality, delivery, and process flexibility. Likewise, they also reported the positive relationship between customer integration and the SCM measures such as quality and new product flexibility.

Talavera (2010) reported the significant effect of collaborative materials and production planning using multifunctional team on order delivery time and of coordination with customers through regular communication systems (telephone calls, letters) on order fulfillment performance. Thatte et al. (2013) examined the impact of SCM practices on supply chain responsiveness, which is defined as the ability and flexibility of the supply chain to respond to changes in customer demand and supplier situation. Their study reported that supply chain collaboration and information sharing enabled firms to respond better to supply chain changes. Such supply chain responsiveness was observed to be positively related to competitive advantage (measured in terms of price, cost, quality, flexibility, and product innovation).

The following studies, however, indicate that to achieve better firm performance, there is a need for internal integration, communication, information sharing and organizational linkages prior to external integration with the firm's supply chain partners (Fynes et al., 2005; Koufteros et al., 2005; Aryee et al., 2008; Huo, 2012; Gimenez & Dok, 2012; Basnet, 2013).

Fynes et al. (2005) in their study of manufacturing companies in the electronics industry of the Republic of Ireland reported the role played by communication and trust in developing supply chain relationships that will eventually lead to the players in the supply chain to agree to a joint decision making. This improvement in supply chain dynamics was found to have a significant effect on manufacturing performance in terms of improved product quality and cost reductions. The same finding about the impact of having cross-functional teams, communication, coordination, and affective relationships on performance was reported by Koufteros et al. (2005) and Basnet (2013). Similarly, Germain and Iyer (2006) observed that the effect of external integration on logistical performance is stronger when internal integration is present in the organization.

Aryee et al. (2008) studied UK manufacturing companies and reported that "soft" collaborative issues involving problems with internal process integration need to be addressed prior to the "harder" technological issues prior to supply chain integration. Huo (2012) analyzed the impact of internal and external integration on the supply chain performance of 617 Chinese manufacturing companies and reported the need for firms to have an established internal integration first (data integration, teamwork, communication, and conflict management) prior to external integration. The presence of an integrative data management, information sharing and close relationships with the customers and suppliers lead to better company performance. Gimenez and Dok (2012) also pointed out in their analyses of 145 manufacturing companies from Spain and the Netherlands, that supply chain integration measured in terms of cooperative behavior provided the most significant impact on service and cost measures, when supply complexity is high. Zhang et al. (2015) recommended that for supply chain integration to be realized, there is a need to identify and delineate the elements of integration to include strategic, planning and control, organization, process, information, and knowledge, among others.

3 Conceptual Framework

The relation of supply chain integration to performance and how the latter can be a source of competitive advantage was analyzed by looking at the resource-based view (RBV) of the firm and the dynamic capability theory. Wernerfelt (1984) tried to understand the resource-based perspective of the firm—specifically, on how firm resources can be a source of competitive advantage. He said that firms need to identify those resources and capabilities that can give the firms a strong resource

position, which could also serve as a resource barrier for other competing firms. Barney (1991) explained how the resource-based view approach of the firm could lead to competitive advantage. He explained that when a firm is able to identify the firm's strengths that will allow it to respond to external opportunities, and that will enable it to address external threats, taking into account the need to address internal weaknesses, then the firm will be able to utilize the RBV approach for competitive advantage.

According to Wernerfelt (1984), resources are "tangible and intangible assets tied semi-permanently to the firm" (p. 172). Firm resources can also be classified into three (Barney, 1991): (1) physical capital resources, (2) human capital resources, and (3) organizational capital resources. For these resources to be a source of competitive advantage, the firm should ensure that in the utilization of these resources, the firm will make it difficult for its competitors to catch up (Wernerfelt, 1984).

The dynamic capability theory posits that for organizations to maintain its competitive advantage especially in changing and uncertain environment, firms must have the ability to reassess its current situation, adjust rapidly, and regenerate its resources and capabilities (Teece, Pisano, & Shuen 1997). This school of thought extends the discussion of the resource-based view of the firm. While the RBV deals with how firms utilize their resources, which are rare, valuable, inimitable, and non-substitutable, the dynamic-capability theory espouses for these internal and external resources and capabilities to be sources of competitive advantage, they need to integrated and reconfigured. Development of knowledge resources and learning mechanisms help develop these dynamic capabilities and if properly utilized lead leads to better performance (Chien & Tsai, 2012).

Supply chain capabilities are an important source of competitive advantage (Day, 1994; Morash & Lynch, 2002). Day (1994) highlighted the need to have distinctive supply chain capabilities that are valuable and difficult to imitate. In particular, he noted that market-driven companies exhibit superior capabilities that attempt to link processes, customers, and partners of the supply chain. Rungtusanatham, Salvador, Forza, & Choi (2003) highlighted the importance of the linkages among the supply chain entities. Since SCI involves relationship and organizational learning, this provides firms with knowledge resources and capabilities that are very difficult to imitate, thereby giving the firm a source of competitive advantage (Chien & Tsai, 2012). Furthermore, Chen, Daughterty, & Landry (2009) observed that by linking the business processes of the supply chain entities (suppliers-firms-customers, even third-party logistics providers), firms are able to align their processes. This enables the entities to develop supply chain capabilities, which eventually provide them with the opportunities to reduce transaction- and production-related costs. Cost reductions are also achieved through economies of scale and better facilities and inventory management (Maloni & Benton, 2000). Ensign (2004) also emphasized the value of inter-firm linkages and relationships (achieved through supply chain integration) on the opportunity for synergy achieved through sharing of both tangible and intangible resources.

Richey, Roath, Whipple, & Fawcett (2010) emphasized that SCM requires different sets of supply chain capabilities, aside from information technology, skills, and knowledge. SCM needs internal and external integration, and that to achieve supply chain performance (measured in terms of service effectiveness and cost efficiency), the supply chain partners must have aligned goals and joint structures, have quantifiable performance measures, and must be open to sharing information and risks with their partners.

Peng et al. (2013) argue that firms that engage in internal and external integration with customers and suppliers develop a relational and collaborative competence that enables them to share knowledge and best practices. They are also able to share different and alternate perspectives in managing products and processes and even combine resources synergistically (Wei & Wang, 2010). With supply chain integration, supply chain partners get timely access to critical information which helps reduce demand distortion (Lee et al., 1997) and firms get to reconfigure certain resources to adapt to changing environments (Wei & Wang, 2010).

3.1 Hypothesis Development

Supply chain integration (SCI), which involves both internal and external integration, provides firms with a unique competitive advantage as integration of organizational capital resources (which refer to the formal and informal planning, organizing, and controlling systems in the organization) will

make the resources difficult to imitate. Chang Tsai, & Hsu (2013) noted the critical role played by supply chain integration in improving supply chain performance in the adoption of e-procurement systems. They highlighted that information sharing and partnerships are important components of SCI. The study, thus, hypothesizes that firms that implement supply chain integration have better supply chain performance.

A number of authors (e.g., Elrod et al., 2013; Cirtita & Glaser-Segura, 2012; Banomyong & Supatn, 2011) emphasized the importance of measuring supply chain performance in terms of several metrics that seek to measure not only supply chain costs but also supply chain efficiency, responsiveness, quality, and flexibility. Ramanathan, Gunasekaran, & Subramanian (2011) defined supply chain flexibility as "the ability to adapt to supply chain changes given available resources while supply chain responsiveness refers to the ability to respond to any unexpected changes in the demand. The study referred to supply chain effectiveness to include the measures on flexibility and responsiveness. Chang et al. (2013) found that partner relationships and information sharing are important prerequisites for supply chain integration, which in turn is positively related to supply chain performance, measured in terms of tangible measures (cost-based) and the intangible measures (customer-based, non-cost). According to Lee et al. (2007), internal integration has the greatest impact on cost containment.

To summarize, the study hypothesizes that supply chain integration (internal and external) is significantly associated with different types of supply chain performance measures, as follows:

Hypothesis 1: Supply chain integration is positively related to supply chain performance. (index).
Hypothesis 2: Supply chain integration is positively related to supply chain effectiveness (responsiveness measures).
Hypothesis 3: Supply chain integration is positively related to supply chain efficiency measures (cost-based measures).

The study looked mainly into the association of supply chain integration with supply performance. However, the research hypotheses were also tested with (1) industry category, (2) ownership structure, and (3) employee size as variables that could have an association with supply chain performance. Hsu (2005) observed that firms belonging to different industries with different ownership structures and firm size could have different organizational cultures and attitudes, and different levels of cooperative relationship, which could have an effect on their supply chain performance. Similarly, Soni and Kodali (2010) also reported in their analysis of different supply chains the possible role of internal and external factors in supply chain performance.

This paper presents the different supply chain integration strategies adopted by selected Philippine firms belonging to the manufacturing and service industry sectors, particularly those related to supply chain integration. The study also looks into the supply chain measures adopted by the respondent firms and the association between supply chain integration strategies and performance. The study contributes to the SCM literature as limited studies on supply chain practices and performance in the Philippines have been documented.

4 Methodology

The study involved construct and scale development for two sets of constructs: (1) supply chain integration and (2) supply chain performance. A thorough literature review was conducted to identify the operational definitions (also called as components) of the two constructs. The components were then subjected to an experts review to determine their content validity. The industry experts consisted of manufacturing managers from the following institutions: University of the Philippines College of Engineering Industry and Government Linkage with Academe Program (UP IGLAP) and other colleagues from the UP Cesar E. A. Virata School of Business.

The member firms of three industry associations—namely, (1) the Philippine Institute for Supply Management (PISM), (2) the UP IGLAP, and (3) the Production Management Association of the Philippines (PROMAP)—were the target participants of the study. Coordination was done for the participation of all the member firms of these associations. The questionnaire was sent to all member

firms totaling to about 310. A total of 57 firms participated in the survey. The manager respondents belonged to the supply chain management, demand management, or procurement departments.

Results from the industry experts' review were then reconciled with those included in the literature review to come up with the final list of items that will form part of the supply chain integration and supply chain performance constructs. The validity of the two constructs was determined through common factor analysis (using principal axis factoring). Several iterations of factor analysis were done to ensure that the study meets the requirements for sampling adequacy and content validity. Only items with factor loadings greater than or equal to 0.5 were selected (Hair, Black, & Babin, 2010). The validated items of supply chain integration and supply chain performance were then derived and subjected to reliability tests using Cronbach's alpha. Regression analysis was done to determine the association of supply chain integration and the other explanatory variables (industry category, ownership structure and employee size) with supply chain performance.

5 Results and Discussion

5.1 Profile of respondent firms

There were 57 respondent firms, 56% representing the manufacturing sector and 44%accounting for the service sector. Eighty-one percent of the respondent firms have employee size less than 500. The average employee size is 638. Seventy-two percent of the respondent firms is 100% Filipino-owned companies (see Table 1).

The respondent firms from the manufacturing industry came from the following industries: food production, leather, pharmaceuticals, soap, chemicals, steel, ice, industrial adhesives, cosmetics, medical devices and packaging, paper, batteries, agricultural products, automobile, and pest control products. Meanwhile, companies from the service sector include the following industries: power, utility, quick service restaurant/fast food, logistics, construction services, agricultural products distribution, and broadcasting.

Table 1. Profile of Respondent Firms

Category	*Description*	*No.*	*% to total*	*Mean*
Industry affiliation	Manufacturing	32	56	
	Service	25	44	
		57	**100%**	
Employee size	Less than 500	46	81	Average
	500–1,000	8	14	employee size
	More than 1,000	3	5	of 638
		57	**100%**	
% Ownership structure	100% local	41	72	
	With foreign ownership	10	18	Average of 82% local
	100% foreign	6	10	ownership
		57	**100%**	

5.2 Supply chain integration strategies

Talavera (2008b) assessed the extent of supply chain collaboration (SCC) in the Philippines using an SCC index, which consisted of reliable measures of customer and supplier collaboration in the areas of demand forecasting, materials planning & production planning, and sharing of databases. Results showed a very limited extent of supply chain collaboration in the Philippines.

In this study, an assessment of the extent of adoption of supply chain strategies in the following pillars of SCM (demand management, supply management, and logistics management) was conducted (refer to Exhibit 1). The respondent managers were asked to rate each supply chain strategy using a 5-point Likert scale with "5.0" as reflecting "very large extent of adoption." Results show that Philippine companies still implement to a large extent supply chain strategies involving traditional and/or paper-based systems: (1) coordination with suppliers and customers through regular

communication systems (telephone calls, letters), (2) regular face-to-face meetings with customers, (3) procurement through traditional and paper-based systems, (4) traditional ordering systems, and (5) use of own logistics departments. Strategies involving collaboration, sharing of information, and adoption of IT-based strategies were reported to be implemented in low extent.

Results of the factor analyses of the supply chain strategies included in **Exhibit 1** show the emergence of two factors related to supply chain integration (SCI) that are related to external integration to include the following: (1) Factor 1 (joint decision making with supply chain partners); and (2) Factor 2, information sharing with supply chain partners (refer to Table 2). Results of the reliability tests show that the items that comprised Factor 1 and Factor 2 were found to be internally consistent with Cronbach's alphas (α) of 0.851 and 0.831, respectively. According to DeVellis (1991) and Davis (2000), Cronbach's α for social researches that are in between 0.80 and 0.90 show high internal consistency. Around 62% of the variation is accounted for by these two validated supply chain integration factors.

Table 2 further shows that the relevant items under Factor 1 (Joint decision making with supply chain partners) refer to collaborative demand and supply planning strategies of the company, while the validated items under Factor 2 (Information sharing with supply chain partners) deal with IT-based strategies meant to effectively coordinate with the firm's customers. In this study, the sharing of databases with suppliers to indicate external supplier integration was not validated.

Table 2. Validated Supply Chain Integration Constructs

Construct		Measures	Item Loading	Cronbach's Alpha (α)
Joint decision making (with supply chain partners)	1	Materials and production planning done in collaboration with customers	.856	.851
	2	Materials and production planning done in collaboration with suppliers	.762	
	3	Demand forecast done in collaboration with suppliers	.659	
	4	Demand forecast done in collaboration with customers	.596	
Information sharing (with supply chain partners)	1	Coordination with customers through Web-based tools (electronic data interchange and mail-enabled transactions)	.823	.831
	2	Online ordering	.726	
	3	Shared databases with customers	.681	

5.3 Supply chain performance measures

Talavera (2010) measured supply chain performance using objective measures to assess supply chain performance. For this study, subjective measures using a 5-point Likert scale for SCI and a 7-point Likert scale for SCP were used (refer to Exhibits 1 and 2). While objective measures are considered more robust and are preferred over subjective measures, the difficulty and feasibility of getting objective measures, especially financial measures, led the author to use subjective measures. Furthermore, Choi and Eboch (1998) noted that when the respondent managers are very familiar with the performance data, they are in the position to give better judgment of the company's performance. The respondent managers in the study were responsible and familiar with the general supply chain operations and/or in the position to coordinate the different departments measuring supply chain performance. Since the measures involve broad and multi-dimensional constructs, which cannot just be measured by a single department, the respondent managers can give better judgment on enterprise-wide supply chain performance (Dess & Robinson, 1984). Lastly, Wall et al. (2004) reported that the subjective and objective measures were found to be positively associated and subjective measures resulted to equivalent relationships with the study's independent variables.

In this study, a more holistic set of supply chain measures was developed that sought to measure supply chain efficiency, responsiveness, flexibility, customer satisfaction, and cost efficiency (refer to Exhibit 2). Respondent firms were asked to rate using a 7-point Likert scale (subjective) each performance measure. Results show that, in general, the respondent firms reported improvement in the supply chain measures in Exhibit 2.

The original 11 items in Exhibit 2 were reduced to two supply chain performance factors consisting of 8 items (see Table 3). A review of the items in each factor shows that the validated supply chain measures can be classified into the following: (1) supply chain effectiveness and (2) supply chain efficiency measures. The relevant items under Factor 1 (supply chain effectiveness) seek to determine overall supply chain effectiveness and responsiveness in terms of the following: (1) ability to fulfill order according to the time requirements and specifications of the customers; (2) ability to respond to rush orders; and (3) reduction in lead time (order fill time and supplier lead time). The relevant items under Factor 2 (supply chain efficiency) that deal with cost-based measures aim to measure the overall supply chain efficiency in terms of the following: (1) reduction in total supply chain costs and (2) increase in inventory turns. Seventy-eight percent of the variation is accounted for by these two factors. Reliability analyses showed very high Cronbach's α for Factor 1 (0.923) and Factor 2 (0.890).

Table 3. Validated Supply Chain Performance Measures

Factor		Component	Item Loading	Cronbach's Alpha (α)
FACTOR Supply chain effectiveness measures (responsiveness)	1	Improvement in order fulfillment performance (% complete)	.907	.923
	2	Improvement in volume and line item performance against schedule	.880	
	3	Improvement in order fulfillment performance (% on time)	.855	
	4	Improvement in ability to respond to rush orders (quantity)	.834	
	5	Reduction in order fill time (no. of days)	.671	
	6	Reduction in supplier lead time (no. of days)	.609	
FACTOR 2 Supply chain efficiency measures (cost-based)	1	Reduction in total supply chain costs	.908	.890
	2	Increase in inventory turns	.848	

5.4 Relationship of supply chain integration and supply chain performance

Regression analyses were conducted to determine the relationship between the validated supply chain integration and supply chain performance constructs. Several models were investigated to test the research hypotheses to include determining the association of industry sector category, employee size, and ownership structures with supply chain performance.

Research findings show that Supply Chain Integration (SCI index) is significantly associated with Supply Chain Performance (SCP index) as well as with SCP Factor 1 (supply chain effectiveness measures) supporting Hypotheses 1 and 2 at $p < .05$ level of significance (refer to Table 4). Taking into account the ownership structure, results still show the significant association between SCI index and SCP index. On the other hand, the association of the SCI index with SCP Factor 2 (supply chain efficiency measures) was not supported by the data *(Hypothesis 3)*.

Table 4. Association between Supply Chain Integration (Index) and Supply Chain Performance

No.	Independent Variables	Dependent Variable	R^2	F	Sig Var	T	Sig
H1	Supply chain integration (index) Industry category Employee size Ownership structure	Supply chain performance (index)	.19	3.091	Supply chain integration (index) Ownership structure	2.323 2.339	.024* .023*

No.	Independent Variables	Dependent Variable	R^2	F	Sig Var	T	Sig
H2	Supply chain integration (index) Industry category Employee size Ownership structure	Supply chain effectiveness measures	.18	2.910	Supply chain integration (index) Ownership structure	2.477 2.543	.017* .014*

* *Significant at p <.05 level of significance*

Additional regression analyses were conducted to determine the association of the validated SCI factors with the validated SCP measures. Only SCI Factor 2 (information sharing with supply chain partners) was found to be significantly associated with the SCP index at a significance level of p<.05. On the other hand, both SCI Factors, namely, SCI Factor 1 (joint decision making with supply chain partners) and SCI Factor 2 (information sharing with supply chain partners) were found to be significantly associated with SCP Factor 1 (supply chain effectiveness measures) at a significance level of p<.05 (refer to Table 5). These operations-related and responsiveness measures include the following:

(a) Improvement in order fulfillment performance (% complete)
(b) Improvement in volume and line item performance against schedule
(c) Improvement in order fulfillment performance (% on time)
(d) Improvement in ability to respond to rush orders (quantity)
(e) Reduction in order fill time (no. of days)
(f) Reduction in supplier lead time (no. of days)

Table 5. Association between Validated Supply Chain Integration Factors and Supply Chain Performance

Independent Variables	Dependent Variable	R^2	F	Sig Var	T	Sig
Information Sharing Industry category Employee size Ownership structure	Supply chain performance (index)	.21	3.425	External integration Ownership structure	2.566 2.610	.013* .012*
Joint decision making Industry category Employee size Ownership structure	Supply chain effectiveness measures	.16	2.472	Internal integration Ownership structure	2.180 2.130	.034* .038*
Information sharing Industry category Employee size Ownership structure	Supply chain effectiveness measures	.16	2.570	External integration Ownership structure	2.212 2.647	.031* .011*

* *Significant at p <.05 level of significance*

The data was not able to support the association of the independent variables with SCP Factor 2 (supply chain efficiency or the cost-based measures). Results further show that when ownership structure is considered in the regression analyses, significant association between the SCI factors and SCP Factor 1 (supply chain effectiveness measures) was observed.

While the above research works on SCI clearly delineated between internal and external integration, research findings indicate that with the Philippine data, the validated supply chain integration factors grouped the SCI items based on the process integration involved, for example, the joint or collaborative decision making process between the supply chain partners and the information

sharing process among the supply chain entities. In the case of information sharing, the data was able to support only this process with respect to the firm's downstream integration or integration with the customers. Zailani and Rajagopal (2005) explain that firms would have different ways of supply chain integration depending on the direction and degree of similarity of their supply chain activities. Zhang et al. (2015) also recommended the use of a more comprehensive model of supply chain integration that will cover the different layers of integration (from strategic to operational) and the elements of integration that deal with resource flows, processes, organizational management and supply chain strategy of the organization.

With regard to the supply chain performance measures, the study was able to validate supply chain performance metrics that measure supply chain effectiveness (responsiveness measures that focus on the improvement in operations-related metrics) and supply chain efficiency measures (measures that focus on the cost-based measures). While the study was not able to support the association of SCI Factor 1 (joint decision-making with supply partners) with the SCP index, taken together with SCI Factor 2 (the information sharing with the supply chain partners), the overall SCI index was found significantly associated with the SCP index. The findings are consistent with the general findings of Peng et al. (2013) on the positive relationship between external integration and performance. Kache and Seuring (2014) emphasized the role of information sharing and trust in supply chain relationships. This culture of sharing information, risks, and even rewards provides the firms with a powerful set of capabilities, which in the RBV literature are important strategic intangible assets that are difficult to imitate or duplicate and therefore provide the firms with competitive advantage (Barney, 1991).

6 Conclusion

This study was conducted to determine the extent of supply chain integration practices implemented by selected Philippine manufacturing and service companies. It also sought to identify the critical performance metrics used by the respondent firms to measure the efficiency and effectiveness of their supply chain strategies. Results show that supply chain integration (SCI index) was found significantly associated with supply chain performance (SCP index). Both SCI Factor 1 (joint decision making with supply chain partners) and SCI Factor 2 (information sharing with supply chain partners) were found observed to have a significant association with SCP Factor 1 (supply chain effectiveness measures).

Research findings support earlier works on SCI-SCP relationship, particularly on supply chain responsiveness and operational measures (Tan, 2002; Lockamy & McComark, 2004; Corsten & Felde, 2005; Gimenez & Ventura, 2005; Eng, 2005; Koh et al., 2007; Lee et al., 2007; Kannan & Tan, 2010; Narasimhan et al., 2010; Talavera, 2010; Huo, 2012; Thatte et al., 2013; Seo et al., 2014). Information sharing was also found to be significantly related to SCP supporting the studies made by Huo (2012) and Ibrahim and Ogunyemi (2012). The findings on the significant association between supply chain integration and supply chain responsiveness measures were also consistent with the findings of Eng (2005) and Thatte et al. (2013). On the other hand, the significant association between external integration and the supply chain efficiency (or cost-based measures) supports the research findings of Gimenez and Ventura (2005).

The research supports the Resource-Based View of the Firm and the Dynamic Capability Theory. Supply chain integration leads to the development of both internal and external learning in planning and problem-solving. Coordination with suppliers in materials planning and with customers in demand planning also provide firms with tacit knowledge and expertise that competitors will have difficulty imitating, as espoused by the Resource-Based View of the Firm (Schroeder, Bates, & Junttila, 2002). Supply chain integration in terms of information sharing between the supply chain partners, particularly with the customers, provide for better supply chain visibility that will lead to better supply chain performance (Wei & Wang, 2010). This unique ability to communicate, coordinate, and share critical information solidifies and strengthens the supply chain relationship, thereby allowing the firms to reconfigure and respond to supply chain uncertainties, as espoused by the Dynamic Capability Theory (Wei & Wang, 2010; Chien & Tsai, 2012; Kim, Song, & Triche, 2015).

7 Implications of the Study

The study contributes to the literature by putting forward relevant findings on SCI dimensions, SCP measures, and provided strong indication of the significant association between SCI and SCP highlighting the experience of the Philippine manufacturing and service companies. While the literature described supply chain integration in terms of internal and external integration or in terms of upstream (supplier) and downstream (customer) integration, results showed that another way of defining integration is in terms of how firms should actually integrate. The validated supply chain integration factors indicated two processes for integration with suppliers and with customers. This involves having joint decision making in critical processes with supply chain partners and having information sharing with the supply chain partners. While these findings have already been indicated in the literature, the study provides fresh insights about the SCI strategies of selected Philippine manufacturing and service companies.

The study also tried to measure supply chain performance measures holistically by focusing on two dimensions: (a) supply chain effectiveness measures (that refer to the output measures that reflect the responsiveness of the supply chain to respond to the needs of the supply chain partners) and (b) supply chain efficiency measures (that refer to the cost-based or financial measures to assess the efficiency of the supply chain).

In terms of managerial implications, there is a need for supply chain managers to look at supply chain operations from a holistic perspective and not just from a functional, departmental or fragmented perspective. This will necessitate an adjustment in the organizational structure to have an SCM structure to coordinate the demand management, supply management and logistics management functions of the organization. The SCM structure shall not only coordinate the different departments handling the supply chain functions but shall also be responsible for developing an enterprise-wide supply chain performance management system that will: (a) identify the key supply chain metrics relevant to their industry that will measure the performance of their respective chains in an integrative manner and (b) set-up a mechanism so that there is an organized system of measuring, storing and analyzing enterprise-wide supply chain performance metrics.

Based on the research findings, there is a need for industry-academe linkage so that both groups can understand better the following: (1) the value of and key success factors for supply chain integration; (2) the IT-based strategies important for effective supply and customer integration; and (3) the soft skills needed to achieve internal and external integration. To encourage the industry to adopt supply chain management and embrace supply chain integration in the Philippines, industry practitioners, in coordination with the academe and industry associations, need to document the industry best practices on SCM and SCI in the Philippines. Firms that are more open to SCM and SCI adoption shall serve as the industry champions. The industry champions could document the impact of SCM adoption on their operations and financial performance and present these to interested industry practitioners. In this way, there is a core group of industry practitioners that will slowly influence the industry and present the strategic benefits of adopting SCM-based strategies and a holistic set of supply chain performance metrics.

8 Limitations and Areas for Further Study

Results of the reliability and validity tests conducted by the researcher for the internal integration construct resulted in validated internal integration items, which focused mainly on the internal interaction during the preparation of demand and materials forecasts. This limited definition of internal integration may not have captured the other facets of internal integration. Future studies should therefore consider the more encompassing definition of internal integration to include interdepartmental interfaces and other forms of coordination not just in the areas of demand forecasting and materials planning. Likewise, the resulting items for the external integration construct were limited to IT-based strategies applicable to the buyer or customer supply chain. The integration of the firm and its suppliers was not captured by the study. Future studies should include both the supply and demand chain integration strategies, such as strategic customer and supplier alliances or partnerships and information sharing of critical and relevant information to suppliers and customers.

Given that the sample consisted of about 80% having a small employee size of less than 500, this implies that the respondent firms still belonged to organizations that may have limited resources and management systems that are still not open to a strategic initiative like SCM. The use of the survey method with terms in the instrument that are much better understood by large corporations may not be familiar to the respondent firms. The low adoption scores reported therefore may not necessarily mean that the respondent firms are not implementing the supply chain strategies but may just have a different nomenclature for the terms used. In the future, the survey instrument could be constructed using a language or nomenclature that can be understood by firms belonging to large, medium, and small-scale manufacturing or service companies. Focus group discussions with industry experts could also be held after the survey results have been processed so as to understand better the research findings and also to give them feedback about the policy implications of the study.

Supply chain performance measures included in this study focused on supply chain effectiveness and efficiency. While the measures seem encompassing, the measures can still be improved by identifying measures that are objective and quantifiable and that will include measures to assess the other dimensions of supply chain performance, like agility and responsiveness to supply chain risks. Statistical analysis to determine the relationship of supply chain integration and supply chain performance was not able to utilize a more robust methodology, such as structural equation modeling, given the limited number of company respondents vis-à-vis the variables under consideration. Future studies should aim for a bigger sample size, stratified according to industry sectors.

With regard to the effect of SCM strategies on business performance, literature showed mixed results. A significant relationship between SCM strategies and business performance was observed by some authors (Tracey et al., 2005; Mzoughi, Bahri, & Ghachem, 2008). However, Koh et al. (2007) noted the positive effect of SCM strategies on operational performance but they were not able to support their hypothesis that SCM strategies have positive impact on organizational performance (increase in sales; accurate costing; and increase in department, supplier, and customer coordination). Fynes et al. (2005) explained why the effect of SCM strategies on performance could have mixed results. They noted the reality of trade-offs in trying to meet various operational and business performance measures. Leuschner, Rogers, & Charvet (2013) observed a significant relationship between supply chain integration, particularly informational and relational integration, and firm performance, but they recommended more research on this. Future studies should look at the impact of supply chain management, particularly of supply chain integration on financial performance of the firms.

Future studies should also study the other determinants of supply chain performance other than supply chain integration. Sun, Hsu, & Hwang (2009) noted that an alignment between the supply chain strategies and environmental uncertainty strategies was positively associated with SCP. Soni and Kodali (2010) observed that the performance of different supply chains in different countries was affected by several factors, such as the interplay of socioeconomic, cultural, and technological factors, among others. Gopal and Thakkar (2012) also noted that SCP measurement will vary depending on the following factors: (1) supply chain length, (2) supply chain width, (3) supply chain depth, (4) validity of measures, (5) external and competitive environment of the chains, (6) cross-functional fit and flexibility of measures, and (7) link of measures to overall company strategies, among others. Morash and Lynch (2002) in their study of 3,500 firms from North America, Europe, and the Pacific Basin found the strong relationship of global public policy and support (trade policies, infrastructure development, information technology) in enhancing supply chain relationships and alliances, thereby leading to better supply chain performance (cost and customer service). Trust and a cooperative relationship are critical determinants of supply chain performance, and cooperative relationship was best achieved through a fair allocation of the benefits of cooperation (Hsu, 2005). Finally, organizational culture and attitude differences of companies affect the SCM implementation of the companies studied (Hsu, 2005).

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Exhibit 1
Extent of Adoption of Supply Chain Strategies in the Philippines 2013 (n=57 Philippine firms)

	Supply Chain Operation	Component	Mean	SD
1	Demand forecasting	1. Demand forecasting done by marketing department only	2.68	1.974
		2. Collaborative demand forecasting using multifunctional team	**3.19**	**1.652**
		3. Demand forecast done in collaboration with customers	2.70	1.742
		4. Demand forecast done in collaboration with suppliers	1.68	1.764
2	Materials and production planning	5. Materials and production planning done by production department only	**2.30**	**2.079**
		6. Collaborative materials and production planning using multifunctional team	**2.30**	**1.973**
		7. Materials and production planning done in collaboration with customers	1.81	1.885
		8. Materials and production planning done in collaboration with suppliers	2.19	1.894
3	Supplier coordination	9. Coordination with suppliers through regular communication systems (telephone calls, letters)	**4.18**	**1.071**
		10. Coordination with suppliers through Web-based tools (electronic data interchange and mail-enabled transactions)	2.46	2.010
		11. Shared databases with suppliers	1.26	1.598
		12. Regular face-to-face meetings with suppliers	2.96	1.679
4	Customer coordination	13. Coordination with customers through regular communication systems (telephone calls, letters)	**4.07**	**1.307**
		14. Coordination with customers through Web-based tools (electronic data interchange and mail-enabled transactions)	2.74	1.885
		15. Shared databases with customers	1.77	1.909
		16. Regular face-to-face meetings with customers	**3.53**	**1.428**
5	Procurement	17. Procurement through traditional and paper-based systems	**3.88**	**1.402**
		18. Online purchasing (e-procurement)	2.05	1.950
		19. Centralized procurement	2.96	2.000
6	Customer order taking	20. Traditional ordering systems	**3.72**	**1.645**
		21. Online ordering	2.07	1.860
		22. Efficient customer response through point-of-sale system	1.49	1.900
7	Materials requirements planning	23. Managing materials requirements through manual system	**3.21**	**1.859**
		24. Managing materials requirements using partial computerization	2.32	1.929
		25. Managing materials requirements through computer software	2.19	2.248
8	Customer demand monitoring	26. Monitoring and capturing demand through manual system	**3.21**	**1.800**
		27. Monitoring and capturing demand through partial computerization	2.29	1.878
		28. Monitoring and capturing demand through computer software	2.36	2.133
9	Logistics management	29. Own logistics department	**3.38**	**1.828**
		30. Outsourced (3PL)	2.20	1.865

Scale: 1 – Very limited extent, 2 – Limited extent, 3 – Moderate Extent, 4 – Large extent, 5 – Very large extent

Exhibit 2

Extent of Adoption of Supply Chain Performance Measures
2013 (n=57 Philippine Firms)

	Performance Measure	Mean	SD
1.	Reduction in order delivery time (no. of days)	4.67	1.058
2.	Reduction in order fill time (no. of days)	4.68	1.105
3.	Improvement in order fulfillment performance (% complete)	4.91	1.106
4.	Improvement in order fulfillment performance (% on time)	4.88	1.135
5.	Improvement in volume and line item performance against schedule	4.82	1.002
6.	Reduction in supplier lead time (no. of days)	4.49	.928
7.	Improvement in customer satisfaction	5.07	1.208
8.	Reduction in total supply chain costs	4.51	1.325
9.	Increase in inventory turns	4.49	1.241
10.	Improvement in ability to respond to rush orders (quantity)	5.07	1.193
11.	Improvement in ability to respond to rush order (product variety)	4.93	1.400

Scale:

	DETERIORATED BY			NO CHANGE	IMPROVED BY		
	> 20%	10-20%	1-10%		1-10%	10-20%	>20%
Scale	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**