

A CRITICAL ANALYSIS OF SUPPLY CHAIN INTEGRATION IN THE AGRO-FOOD INDUSTRY

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ABSTRACT

Supply chain integration has become the recent attention and debate in the supply chain management mainstream and literature. It also holds key elements to supply chain performances, through both internal and external integration. Furthermore, the discussion of the supply chain integration has shifted into broader view by including, but not limited to the customer relationship management, but also managing supplier more intensively. There are several papers have pointed out the importance of supply chain integration for the continuity of a corporation, and hence, this paper become relevant from both academic and practical point of view.

Many supply chains in the agro-food sector deal with commodities, where rather no supply chain management takes place (e.g. the difference between supply chain and supply chain management in Mentzer et al, 2001). Yet, in the agro-food sector, integration is viewed as an important lever in managing risk and information in the food chain. This has been influenced by the occurrences of food alerts and hazards in the last decades, which grows concern of consumers of the safety of the food that they consumed and damaging product brands and reputation. Yet, while the topic seems to be essential, few contributions are available explaining key factors of integration in the agro-food chain. Hence, overall, it seems unclear, what level of supply chain integration would be required based on what contingencies.

This aim of this paper is twofold. Firstly, it discusses requirements and limitations of supply chain integration in agro-food chains. Second, it proposes a conceptual framework to summarize the research in this field. The result shows that the level of trust, transparency and past collaboration becomes the major factors in the integration of agro-food chain. Furthermore, directions for further research in the field will be provided.

Keywords: Supply Chain Integration, Agro-Food Chain, Limit to Integration, Conceptual

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1. Introduction

Supply chain integration has been a recent attention and current debate in the supply chain management mainstream and literature (Childerhouse and Towill, 2011; van Donk and van der Vaart, 2005). Considering its importance to remain competitive in the global markets, firms started to re-shape their strategic management view by integrating themselves with their suppliers as well as with the costumers (Power, 2005). Current development in the literature showed that integration are moving towards broader sense that covers suppliers – companies – customers relationship and even extended to customer's customer and supplier's suppliers relationship (Fabbe-Costes and Jahre, 2008). Supply chain integration often considered as the sense of supply chain management (Mentzer *et al*, 2001) that stating: *"the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole"*. Given the terms coordination and tactics correlation with performances, the terms *supply chain integration* was formed. Typically supply chain integration is divided into 2 different types of integration that are internal integration and external integration, where the internal integration is referred as the degree of companies collaborates its own strategies, processes and practices in order to meet customers' needs (Kahn and Mentzer, 1996) while external integration often referred as the degree of collaboration between customers and suppliers in a synchronized process (Stank *et al*, 2001; Frohlich and Westbrook, 2001).

Beside the notion of internal and external integration, it can also be distinguished by dividing integration into (1) of physical flow and (2) of information flow (Cagliano *et al*, 2006), where physical flow sometimes is refer to logistical integration (Frohlich and Westbrook, 2001). On the application, Frohlich and Westbrook (2001) also investigate type of integration adopted by manufacturing industries using an arch model. The result showed that the majority of the samples considered the integration with their suppliers and customers rather than just to have one-sided integration with either of them. Yet, they also mentioned that the adoption of internal integration practices influences the adoption of external integration. Later, Childerhouse and Towill (2011) also confirmed that companies tend to increase their internal integration first, followed by integration upstream with key suppliers and then finally integration with their customers. In contrary, Stank *et al* (2001) reported that external supply chain integration impacts on internal supply chain integration that in turn, impacts on logistics performances. Beside discussion on the relevance of level of integration and performance, supply chain integration is also viewed as an alternative way to deal with resources' scarcity and uncertainty (van Donk and van der Vaart, 2005). Hence, supply chain integration is inseparable to strategic operation and management of a firm.

While there are extensive discussions in the literature of supply chain integration, it seems that there is limited contribution considering supply chain integration in the agro-food chain. Given consideration that the occurrences of food alerts and recalls in the recent decades, the integration in agro-food chains seems important. Thus, the aim of this paper is twofold; firstly, it discusses requirements and limitations of integration in agro-food chains. Second, it proposes a conceptual framework to summarize the research in this field. The paper is structured as follow: First, we outline the relevance features in the supply chain integration. Then we summarized the

relationship between supply chain integration and performances from the literature as well as the constructs that are important for supply chain integration. In the third section, we highlighted the determinants and construct for agro-food chain followed by the discussion on the topic and lastly we conclude the paper.

2. A View on Supply Chain Integration

In this section, we turn our attention to the framework of supply chain integration. The theory engulfed supply chain integration has been developed from many perspectives. While some researches mentioned about uni-dimensional approaches, others stressed multi dimensional directions, considering that supply chain integration includes the relationship between multi stakeholders with the focal company. As we mentioned in the introduction, the insight from Power (2005) showed that integration becomes strategically important for the survival of firms. Yet, although integration in supply chain becomes more obligatory, the implementation of doing so remains challenging (Awad and Nasar, 2010). Taking into account that supply chain integration consists of external and internal integration that was described in the introduction, Fawcett and Magnan (2002) outline 4 types of integration namely:

- a. Internal , cross functional process integration
- b. Backward integration with valued first – tier suppliers with the extension of integration to the second – tier suppliers
- c. Forward integration with valued first – tier customers, and
- d. Complete forward and backward integration or referred as integration between suppliers' supplier to the customers' customer or often referred as extended integration

The differentiation made by Fawcett and Magnan (2002) is also based on the size and nature of the firms. Large companies with strong capital and market power might consider having an extended integration as the core of their strategic management, which means not only strategic suppliers and customers considered, but also other related chains; while small – medium enterprises probably will focus on backward or forward integration independently and focusing only to key suppliers and customers. Furthermore, Beamon (2008) mentioned that naturally supply chain integration, whether it is a B2B, B2C or C2C, is characterized by the inputs required (e.g. human resources, energy, raw materials) into the transformation process in producing outputs such as products, services and waste. Earlier, Frohlich and Westbrook (2001) also measure the extension of integration into five different categories namely inward facing, periphery, suppliers-facing, customers-facing and extensive; where this extension strategically linked to the selection of firm's strategy and the performance. Different approach was taken by Swink *et al* (2007) that measure the integration based on, not only in the length of the relationship, but also cover product – process technology and corporate strategic management. Thus the comparison between different approaches of supply chain integration can be seen in table 1.

Table 1. Different Approaches for Supply Chain Integration

Fawcett and Magnan, 2002	Frohlich and Westbrook, 2001	Fabbe-Costes and Jahre, 2008	Swink <i>et al</i>, 2007
Internal, Cross Functional Integration	Internal Integration (Inward Facing)	Limited Downstream Integration	Dyadic Corporate Strategic Integration
Backward Integration	Medium Suppliers – Customers Integration (Periphery Facing)	Limited Upstream Integration	Dyadic Product – Process Technology Integration
Forward Integration	Extensive Suppliers Integration (Suppliers Facing)	Limited Integration	Dyadic Strategic Consumers Integration
Extended Integration	Extensive Customer Integration (Customers Facing)	Limited Integration	Triadic Strategic Suppliers Integration
	Extensive Suppliers – Customers Integration	Extended Integration	

2.1. Supply Chain Integration and Performance

While considering the advantage of integration in the supply chain, a broad extent of literature provided evidences on the connection between integration and performance. The main discussions in this direction was on the relationship between internal integration and supply chain performances (e.g. Gimenez and Ventura, 2005; Germain and Iyer, 2006; Zailani and Rajagopal, 2005; Saeed *et al*, 2005) and external integration on supply chain performances (Homburg and Stock, 2004; Song and Di Benedetto, 2008). An investigation was conducted by Kim (2009) on Japanese and Korean firms as samples where the results showed that there are direct effects of supply chain integration towards firm's performance for Korean subsample, while there are indirect effects of supply chain integration on performance of Japanese firms based on the sizes of the firms. The result also implies that, in large firms, supply chain integration may have a significant influence on the linkage between supply chain management practices and competition capabilities inversely.

Prajogo *et al* (2011) highlighted the relationship between operations management and supplier management towards firm performances. They found that logistics integration has positive impacts on the quality, flexibility and cost performances, confirming that integration leads to better outcomes for the firms. Earlier, Rosenzweig *et al* (2003) asserts that high integration intensity not only build capabilities, but also reduces the net costs of conducting business by interlocking supply chain elements. However, the benefits of integration then must be transformed by operational capabilities before valued by the customers. Furthermore, Sezen (2008) also confirmed that beside integration, supply chain design is to be considered as one determinant for successful firm's performances. While van der Vaart and van Donk (2008) propose different approaches for supply chain integration that is used supply chain attitude, practices and patterns to measure the performance of buyer – supplier relationships.

Under the domain of manufacturing strategies, Swink *et al* (2007) overviewed the integration of 4 types of integration namely corporate strategy integration, product – process technology integration, strategic consumer integration and strategic supplier integration towards business performance and through manufacturing competitive capabilities. They conclude several results in the study such as technology integration is associated with better quality and corporate strategy integration is significantly associated with better process flexibility capability. Hence, we concluded that supply chain integration has positive impacts on the overall performance such as *quality, flexibility, cost and logistics* which fall under SCM practices.

2.2. Enablers for Supply Chain Integration

Factors considered in the supply chain integration are varied and not limited on relationship between actors in the supply chain, but also covered processes, financial and information flows in the chain (see Flynn *et al*, 2010 for wide literature review on items of supply chain integration) and technological integration based on its maturity and advancement (Karlsson *et al*, 2010) such as the use of eProcurement in purchasing raw materials (Smart, 2008). Supply chain integration can also be done through product and international market diversifications (Narasimhan and Kim, 2002) and through the stage of product the life cycles (Stonebraker and Liao, 2006).

As describe in Beamon (2008), we can argue that information flow and information and computer technology (ICT) can be considered as the enabler for integration in supply chain management (Müller and Seuring, 2007; Trkman *et al*, 2007), depending on what technology is suitable in the process and the degree of integration of the supply chain. The finding of Müller and Seuring (2007) constitutes under the transaction cost activities, which underpin the practice of supply chain management. Regarding what and how IT can be implemented in the supply chain, Müller and Seuring (2007) highlighted the fundamental types of relationship that are: (1) *Managed business process link*; (2) *Monitored business process link*; (3) *Not – managed business process link* and (4) *Non – member business process link*.

Within these links, focal companies can determine the level of integration and adoption of IT that suitable for firm' strategies, including deciding how wide information transparency can be employed in certain relationship (link). Towards performance, using Korean' samples from various industries, Narasimhan and Kim (2001) also outline how information system influence the value creation management and supply chain management performances, thus lead to conclusion that utilization of information system as an enabler for internal integration will eventually affects the external integration between focal companies to its customers and suppliers. Similarly, Vickery *et al* (2003) reported information technology acted as an enabler for supply chain integration and thus, has positive impact on customer service and firm performance. Despite the relevance of information sharing in between different stage of supply chain, it must be deemed that overloading information can be detriment for the actors in the chain (Trkman *et al*, 2007) which will create less benefit for supply chain performance.

3. An Analysis for Supply Chain Integration in Agro-Food Industries

In this section, we highlighted what are the determinants and construct for supply chain integration and construct within agro – food industries. To do so, we have to consider the differences between agro-food chain compare to other supply chain (e.g. supply chain for manufacturing or for tourism). Many supply chains in the agro-food sector deal with commodities, where rather no supply chain management take place (see the difference between supply chain and supply chain management in Mentzer *et al*, 2001). Equivalent with other sector, integration in agro – food sector is viewed as an important lever in managing risk and information in the food chain (e.g. Bagchi *et al*, 2005). Moreover, Beamon (2008) pointed out that agro-food supply chain is a unique system that characterized differently from other supply chain (e.g manufacturing).

While considering this distinctiveness, we draw our attention to the differences between each agro-food chain, which can be distinguish into two categories based on how the products being produced; fresh and processed food that share different characteristics in terms of number of suppliers and variety of products (e.g. Aramyan *et al*, 2007; van Donk *et al*, 2008). Hence in this section, we examined several case studies on the two types of agro-food chain (fresh and processed food) and observed what are the key performances and enablers for agro-food chain integration later in table 2. To distinguish, we highlight several determinants in the agro-food chain such as *size, complexity of the supply chain, key performances measures, enablers for supply chain integration and supply integration approach*. Size constitute for how big are the companies in each supply chain. For example, in fresh food chain, it can be represented by numbers of growers, number of supermarkets etc. which can determined the level of integration (Fawcett and Magnan, 2002). Complexity holds for the length of the supply chain from the initial stage until the final costumers while key performances measures illustrated items (such as cost efficiency, high quality, flexible supply chain) expected by suppliers or costumers.

3.1. Integration in Fresh Food Chain

Firstly, we consider the case study from Barrett *et al* (1999) on fresh horticulture produces (cut flowers, vegetables, fruits) commodities that exported from Kenya to the United Kingdom. There are two chains illustrated in this paper which are supermarket chains and wholesaler chain, where supermarket chain is slightly more complex than wholesaler chain. The finding showed that there are supply chain integration for such products through information flow, level trust, long term collaboration and certification. The performance of the supply was also measure based on the quality and responsiveness of the suppliers to the demand of customers. Furthermore, the paper also pointed out that there is an extended integration in the cut flowers chain, where for vegetables and fruits, customer and suppliers integration were likely to occur. Similar finding was provided by Loader (1997) on the fresh potato industry. He found that quality and flexibility accounted as the key performance measures for the industry where information flow and supply chain governance are among that to be considered as the enablers for potato chain's integration. Another case study on tomato industry by Aramyan *et al* (2007) highlighted that integration in the fresh agro-food chain can also be done by elaborating key performance measurements such as flexibility, quality, efficiency and responsiveness of each member in the chain driven by certification and information flow as the enablers for the integration.

3.2. Integration in Processed Food Chain

Different approaches were used in the processed food chain. As it contained a mixture of several food products, we focus our attention into the integration inside the manufacturing plant as the key point to be considered. We taking into account two case studies provided by Gimenez (2006) and van Donk *et al* (2008), which we considered as case A and case B consecutively, as both case studies fit our purposes due to its complexity of the supply chain and level of integration presented in it. Gimenez (2006) studied three different level of integration namely logistics – production, logistics – marketing and external integration across several Spanish food manufacturers. The result showed that most of the food manufacturers choose to do integration on logistics – production first, then logistics – marketing integration and later external integration, which means that internal integration inside the manufacturing plants, integration with key suppliers and customers are prioritized before food manufacturer expand their integration processes further up and downstream. The second example of processed food chain was provided by van Donk *et al* (2008) focusing on production and packaging stage in several food manufacturers. They examined supply chain integration through shared resources and integrated planning which entails to four different levels of supply chain integration strategies namely buyer-focused operations, virtual buyer focus operations, aggregated hierarchical planning and integrated planning and scheduling decisions. Similar with Gimenez (2006), the result showed that integration was driven by information flow and integrated planning, while the integration approaches are more buyers driven.

3.3. Key Performances Measures and Enablers for Agro-Food Chain Integration

Thus, after observing several case studies in agro-food chain, we presented a summary on key performance measures and enablers for agro-food chain integration in table 2. Overall, flexibility is dominant key figure for the performance measures followed by quality and responsiveness. This entices our opinion that, as the market for agro-food chain become more dynamic, there is necessity for rapid adjustment to handle uncertainty in the demand side, which will be explain later in the discussion section. In the enabler side, similar to the other sectors, the flow of information becomes the principal component for supply chain integration. Beside that integrated strategic planning also viewed as one of the important factor for the integration.

Table 2. Key Performances Measures and Enablers in Agro-Food Chain Integration

Industries	Size	Supply Chain Complexity	Key Performances Measure	Enablers	Integration Approach(es)
Fresh Food					
Tomato	Small to Medium	Medium	<ul style="list-style-type: none"> - Flexibility - Quality - Efficiency - Responsiveness 	<ul style="list-style-type: none"> - Certifications / Standards (EUREPGAP) - Information and Technology 	<ul style="list-style-type: none"> - Customers Integration - Internal Integration
Potato	Small to Large	High	<ul style="list-style-type: none"> - Quality - Flexibility 	<ul style="list-style-type: none"> - Long Term Collaboration - Trust - Information Flow - Supply Chain Governance 	<ul style="list-style-type: none"> - Customers Integration - Suppliers Integration - Extended Integration - Internal Integration
Fresh Horticulture Produces	Small to Large	High	<ul style="list-style-type: none"> - Quality - Responsiveness 	<ul style="list-style-type: none"> - Certifications - Information Flow - Trust - Long Term Collaboration 	<ul style="list-style-type: none"> - Customers Integration - Suppliers Integration - Extended Integration
Processed Food					
Case A	Large	High	<ul style="list-style-type: none"> - Responsiveness - Efficiency - Flexibility 	<ul style="list-style-type: none"> - Information Flow - Integration of Strategic Planning - Top Management Commitment 	<ul style="list-style-type: none"> - Logistics – Productions Integration - Logistics – Marketing Integration - External Integration
Case B	Large	Medium	<ul style="list-style-type: none"> - Efficiency - Responsiveness - Flexibility 	<ul style="list-style-type: none"> - Information Flow - Integration of Strategic Planning 	<ul style="list-style-type: none"> - Buyers Integration

Lastly, we viewed the integration approach adopted in different cases of agro-food chain. The length of integration is varied from buyers integration to extended integration. This means that agro-food chain integration structure mostly followed Fabbe-Costes and Jahre (2008), Frohlich and Westbrook (2001) and Fawcett and Magnan (2002) but slightly different from Swink *et al* (2007).

So, with the accordance of Fabbe-Costes and Jahre (2008), the integration in agro – food chains can be distinguished by its dimensions, whether the integration is *limited dyadic*, *limited triadic* or even *extended integration*. This differentiation constitutes of the actors, type of relationship and level of integration in the agro – food chain.

4. Discussion

As we can see in table 2, long term collaboration and trust become important determinants for agro-food chain integration. This is in line with Matopoulos *et al* (2007), stressing on the importance of collaboration in the integration of agro – food chain. The level of collaboration in this respective was mainly determined by the level of trust invested in the suppliers – manufactures – customers relationship, while on the other hand, power can be considered as a deterrent for supply chain integration. The significance of coordination in the integration was outlined by Simatupang *et al* (2002) stating that different coordination modes are required to synchronize interdependent activities, [...] align actions and decisions with the chain profitability.

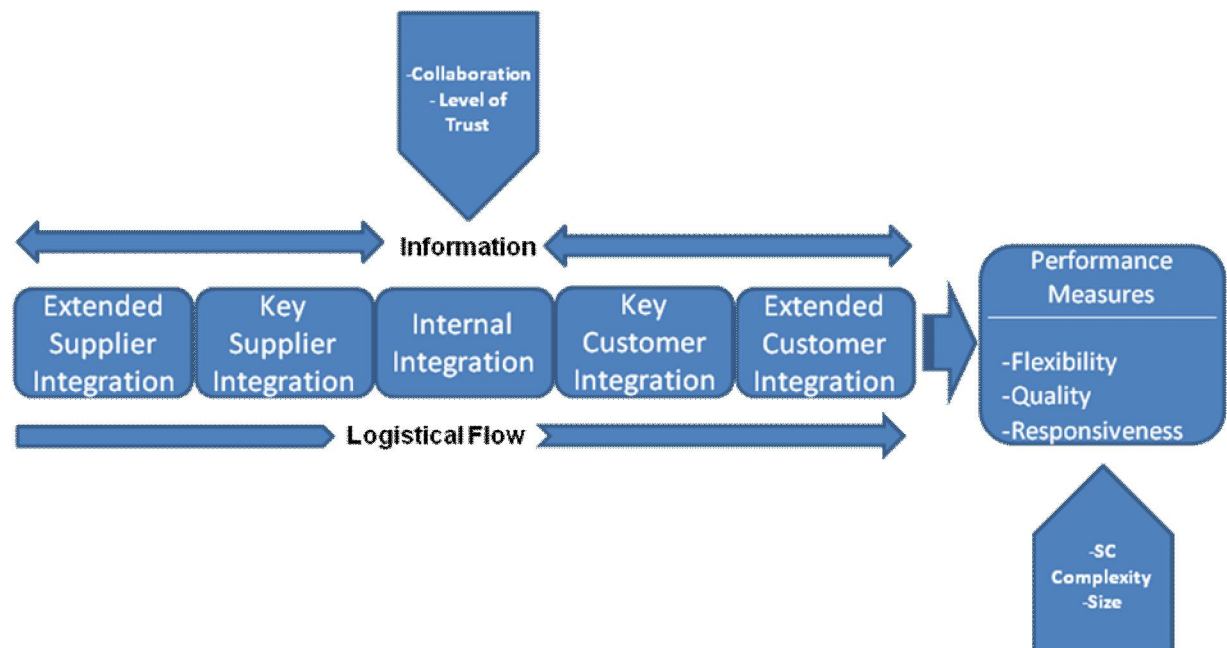
Furthermore, doing internal integration followed by external integration is preferable for food manufacturers. The result also suggested that sharing information was the highest selectable option in the external integration between manufacturers and customers. Beside processes, information and financial flows; integration between manufacturers and suppliers can also be done by employing quality standards through standardization that have to be fulfilled by the suppliers (Hampract *et al*, 2005). Furthermore, the supply chain integration in the agro – food chain can be done by information sharing and supply chain coordination, for example through the use of EDI (Hill and Scudder, 2002) and elaborating quality standards (Shokri *et al*, 2010). Integration also can be done by information connectivity that divided into the integration of the flows of goods with information through good identification procedures and the integration of different supply chains through the combined use of product and information standards (Engelseth, 2009). Although integration in the food chain seems to be the fair answer for the supply chain problems, there are possibilities of significant risks, such as information disclosure, in doing so (Wu *et al*, 2004).

The underlined message for the passage above is the integration in the agro- food chain shared the same characteristic with other sector. The example from Gimenez (2006) and Hampracht *et al* (2005) clearly pointing out the preference of having internal integration prior to external integration. Associating with the food alerts and recalls, it seems that the quality has become the major concern for the customer thus accentuating onto *integrated quality standards* might be an option in the company – customer relationship. Moving towards the enablers, it appears that information flow is the main enabler for agro-food chain integration. This entails that a more transparent supply chain, the more likely integration will work within that supply chain which lead to better performances of a supply chain. The degree of trust and commitment are amongst the factors that determined the integration in the supply chain and it requires close collaboration among suppliers and customers (Barratt, 2004). The length of collaboration also taken into account in creating a successful integration in the supply chain where contractual relationship normally disabling the integration due to the lack of trust (Dainty *et al*, 2001). Developing trust between organizational members might also lead to better performance (Hansen *et al*, 2002). Similarly, while pointing out that trust is accounted as one of the key factor for successful supply chain

collaboration and integration, past collaboration between supplier and customer also determined the degree of the integration (Fritz and Fischer, 2007).

One of the challenges faced by the food industries is that the supply chain getting more decentralizes while there are requirements to fulfill the need for food products worldwide. The dilemma of the food manufacturers that they have to face a very dynamic business environment that demand for high quality and safe food products, mainly driven by customer preferences, while from the manufacturing and corporate perspective, there is necessity to produce food products at lower cost possible. This matter was pointed by van Donk *et al* (2008) articulating the barriers of supply chain integration in food chain such as volume uncertainties, different demand characteristics, uncertainties in the markets and high complexity of the plant. Hence, we conceptualize our framework of agro-food chain integration in figure 1.

Figure 1. Conceptual Framework for Agro-Food Chain Integration



5. Conclusion

Achieving integration in the food chain is challenging and a complex task, yet very difficult to oppose because its logical opposite is disintegration and sub-optimization, which nobody favors (Mouritzen *et al*, 2003). The strategies opted variously and the processes spanned from managing the suppliers until handling the consumer requirements, both products and information flows, as well as managing internal organizations functionally. While considering the internal and external integration, supply chain integration in the agro-food industry might also consider the integration

framework proposed by Jüttner *et al* (2010) by also including the integration of marketing and supply pipeline strategies to achieve better performances.

Ahead, supply chain integration must considered broader aspects, not only limited to the betterment of organizational or supply chain performances, but also taken into account sustainability aspect such as environmental and social facets into its integration. This has been highlighted by Vachon and Klassen (2006) particularly investigating the link between supply chain integration with green supply chain practices. The outcomes showed that technological integration with primary suppliers influenced environmental monitoring and collaboration while integration in logistical part induces environmental monitoring of the suppliers. Moreover, not only considering ecological aspects, companies also need to emphasize the social values of the organization as means of acquiring sustainable competitive advantage (Wu *et al*, 2004). To comprehend supply chain integration and sustainability, company needs to better defined its internal strategies by fostering leadership support and create sustainability performance metric within the firm and later conjointly integrating external factors such as supplier management and risk management as well as taking into account multi stakeholder expectations into firm's strategic decision (Wolf, 2011).

Acknowledgement

Syahrudin acknowledges financial support from the Università degli Studi di Bergamo, Italy (PhD scholarship). A part of this research was conducted while the first author was visiting the Chair of Supply Chain Management at the Universität Kassel, Germany. Any opinions, findings, or conclusions expressed in this paper are those of the authors and do not necessarily reflect the views of any institutions including the Ministry of Agriculture, Republic of Indonesia.

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