A COMPREHENSIVE MODEL OF SUPPLY CHAIN INTEGRATION IN AGRICULTURAL INDUSTRY

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ABSTRACT

Although successful supply chain management integration has yielded competitive advantage to those that embraced it in a wide range of industries, it has not yet achieved its full potential in the agricultural sector. Agricultural products are unique in this context, as logistics pertaining to this class of perishable goods has to ensure that duration of all operations and ambient temperatures at which the goods are transported and stored will maintain food safety and freshness, in order to guarantee the product quality the customers expect. As a result, special logistics facility is necessary for agricultural products, including special-purpose carrier vehicles, temperature and moisture-controlled warehouses and special-purpose loading, unloading and processing equipment. Consequently, logistics management in the agricultural sector is more complex than that pertinent to other products. While supply chain integration (SCI) is commonly used management strategy to improve logistics performance, given the many related frameworks/models, users often struggle to select the most suitable one and implement it correctly in practice. Hence, these agricultural supply chain integration models are summarised in this work, aiming to propose one integrated model. This model includes dimensions of both internal and external supply chain integration. It can thus be used to improve the logistics performance of agricultural firms.

Keywords: supply chain management, supply chain integration, logistics, agriculture.

INTRODUCTION

Supply chain logistics integration unifies and streamlines logistical activities in a chain (Stank, Keller & Daugherty, 2001). As previously noted, supply chain integration (SCI) is a strategy based on supply chain management (SCM), whose objective is to

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optimise the processes implicit in the product supply chain. Thus, it can be perceived as a degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra- and inter-organisational processes. The goal of this strategy is to achieve effective and efficient flows of products and services, information, funds and decisions, in order to provide maximum value to the customer cost-effectively and efficiently without compromising product safety and quality (Flynn, Huo & Zhao, 2010). SCI comprises of various models that are typically classified in terms of specific dimensions, namely customer, internal, supplier, technology and planning, measurement, and relationship integration (Bowersox, Closs & Stank, 2000). Moreover, empirical evidence supports the view of many researchers that SCI is one of the most important activities when leveraging company's internal and external networks (He & Lai, 2012). The review of the extant SCI literature revealed that three types of integration are typically utilised in practice—integration with suppliers, integration with customers, and internal integration across the supply chain (Frohlich, 2002; Frohlich & Westbrook, 2002; Narasimhan & Kim, 2002; Campbell & Sankaran, 2005; Kim, 2013). In addition to this classification, most researchers distinguish external from internal integration (Lee, Kwon & Severance, 2007; Flynn, Huo & Zhao, 2010; Zhao, Huo, Selen & Yeung, 2011). However, at present, SCI lacks one unified model that combines dimensions of external and internal integration in one comprehensive model. This makes it difficult for users to select a model that they can confidently apply in practice to ensure the desired logistics performance (see Table 1). This is particularly important for agricultural produce, as its perishable nature requires that SCI logistics incorporate certain conditions to ensure that goods reach customers in a timely manner and in the condition they expect. The main participants in the agricultural supply chain are farmers, wholesalers and retailers, who must coordinate their operations and cooperate across all dimensions (Cao, Yao & Lu, 2007; Pinmanee, 2016). Thus, the aim of this work in to review all SCI dimensions relevant to the agricultural sector in order to combine those pertinent to internal and external integration into one unified model that can be applied as a means of enhancing agricultural logistics performance. In the sections that follow, the main SCI concepts are delineated, followed by the relationship between SCI and SCM, and SCI in the agricultural sector. After identifying

the SCI dimensions discussed in pertinent literature, the newly developed comprehensive SCI model will be presented and its implications discussed.

SUPPLY CHAIN INTEGRATION (SCI)

SCI refers to collaborative intra- and inter-organisational management at the tactical, strategic and operational activity levels, from the treatment of raw materials, through finished products, to the efficient and cost-effective response to customer needs (Frohlich & Westbrook, 2001; Bagchi, Chun Ha, Skjoett-Larson & Soerensen, 2005; Flynn, Huo & Zhao, 2010; Alfalla-Luque, Medina-Lopez & Dey, 2013). Consequently, SCI is recognized as one of the key performance-improving factors in the supply chain management (Van Der Vaart & Van Donk, 2008). Indeed, integration is frequently mentioned as the main characteristic of successful SCM (Naslund & Hulthen, 2012).

SUPPLY CHAIN MANAGEMENT AND SUPPLY CHAIN INTEGRATION

Supply chain management is the collaborative effort of multiple channel participants whose aim is to implement, design and manage seamless value-added activities as a means of identifying and fulfilling customer needs. In the broadest sense, SCM refers to the development and integration of technology and people in order to coordinate management of information, materials, and financial flows essential for supply chain integration success (Fawcett & Magnan, 2001). Clearly, supply chain integration is a key component of supply chain management, as its aim is interlinking major business processes (Chen, Daugherty & Landry, 2009).

SCI IN THE AGRICULTURAL SECTOR

Although SCM is a well-known and frequently utilised framework, there is paucity of studies focusing on supply chain and logistics integration within the agricultural sector, as most of the extant research pertains to business and manufacturing logistics (Salin, 1998). Agricultural logistics is unique in this respect, as its aim is to ensure quality and timely delivery of a wide range of natural products (Shukla & Jharkharia, 2013). Consequently, the logistics models applicable in business or industry cannot be simply adopted without any modifications, given that most agricultural products are

characterised by easy putrescence and mandatory freshness (Yingxia & Xiangyu, 2006). Given the aforementioned factors that heavily influence the success and, ultimately, profitability of the agricultural sector, in particular when dealing with highly perishable and fragile produce, supply chain management is one of the most important issues the stakeholders must address (Opara, 2003; Rong, Akkerman & Grunow, 2011). Thus, SCI in agricultural sector is particularly significant when managing a supply of perishable goods, such as eggs, milk and dairy products, the quality of which can easily be compromised in the course of storage and transportation (Shen, Lai, Wang & Liang, 2009).

RECENT TRENDS IN AGRICULTURAL SUPPLY CHAIN INTEGRATION RESEARCH

Review of extant literature focusing on agricultural logistics has revealed several research streams, which can be broadly classified by research methods adopted (e.g., case study, survey, literature review), products (i.e., tomato, pork, beef, fish, chicken, meat, agro-food, vegetables, fruit, milk, cheese, strawberry, pineapple, sugar, rice, potato), and geographical area to which the analyses pertain (Sweden, UK, Spain, Eastern Europe, Eastern Africa, Asian, South Africa, India, Norway, UAE, Australia, Hungary, China, Kazakhstan, Netherlands, Senegal, Ghana, France, Italy, Nepal, Germany, Austria, Switzerland, Ethiopia, Hong Kong, US, Peru, Canada, Brazil, Morocco, Turkey, Asia, Vietnam, EU, etc.). When conducting the literature review, the focus was on extant studies examining agricultural supply chain integration. Relevant articles were identified via a keyword search, using “supply chain integration” or “supply chain collaboration” search strings, retaining only peer-reviewed articles published in journals specialising in the agricultural sector in the last 10 years (2005-2015). The search was conducted via Emerald, ScienceDirect, and EBSCO Business Source Complete databases. All papers that met the aforementioned inclusion criteria were reviewed, revealing 56 studies in which SCI was classified under one or more of the following dimensions: information integration, operations coordination, organisational relationship, and institutional support. In addition, articles included in the review were classified in terms of their applicability to external and/or internal integration. This classification of extant studies allowed arranging the four dimensions of agricultural SCI into those applicable

to external integration, internal integration, or both, thus assisting in developing the new framework that combines all relevant SCI strategies into one model that can be applied in the agricultural sector (see Table 1) (Pinmanee, 2016).

Table 1: Dimensions of agricultural logistics integration and their scope (internal and external)

Dimension	Variables on scope	
	Internal integration	External Integration
Information integration	Internal information integration	External information integration
Operations coordination	Internal operations coordination	External operations coordination
Organisational relationship	Internal organisational relationship	External organisational relationship
Institutional support	-	External institutional support

According to Table 1, the definition of dimensions was presented in the following descriptions:

Information integration refers to the sharing of key information along the supply chain network, facilitated by the use of information technology (IT) (Prajogo & Olhager, 2012).

Operations coordination pertains to the cooperation between firms and third party logistics companies in some or all logistic operations. When executed successfully through logistics operation coordination, it is expected to result in greater standardisation of services, greater market segmentation, as well as more intense competition and improved services (Mortensen & Lemoine, 2008).

Organisational relationship refers to stable interactions and transparent relationships among all supply chain partners. Among other aspects, it pertains to maintaining long-term relationships, promoting teamwork, incentive realignment, and sharing of knowledge, skills and ideas (Alfalla-Luque, Medina-Lopez & Dey, 2013).

Institutional support requires the relevant institutional forces to assist firms in addressing financial, legislative, social and environmental issues that may arise in the

course of running the business. The primary institutions that can offer this type of support are state and local government, social networks, and powerful non-government organisations (Lau, Tse & Zhou, 2002; Cai, Jun & Yang, 2010).

Internal integration refers to the degree to which a company can organise its practices, procedures, information, and decisions, as well as conduct business, in a collaborative and synchronised manner. This pertains not only different operational areas, but also its external relationships and is essential in order to comply with client requirements and effectively interact with its suppliers (Flynn, Huo & Zhao, 2010; Zhao, Huo, Selen & Yeung, 2011).

External integration refers to the degree to which a company understands the needs of its clients and collaborates with clients and/or suppliers to develop inter-organisational strategies, as well as shared practices and processes, with the aim of meeting common objectives and ultimately address client requirements (Flynn, Huo & Zhao, 2010).

Table 2: Comparison of new model and empirical models in supply chain integration

Dimensions of new model	Dimensions of empirical models
Information integration	Information integration
Operations coordination	Operations coordination
Organisational relationship	Organisational relationship
Institutional support	-

As reviewed articles of agricultural SCI in the last 10 years, there is an additional dimension of logistic integration that is institutional support (see in Table 2).

CONCLUSION

Researchers aiming to enhance agricultural supply chain management tend to offer a variety of models that are typically based on specific aspects of SCI, such as dimensions and scope. However, given that agricultural products are unique due to the demand for freshness, agricultural SCI is more complex than that applicable to

other industries. In this paper, a review of existing models was presented, allowing a new model that combines all four dimensions (information integration, operations coordination, organisational relationship, and institutional support) and two scope (internal and external integration) to be integrated. Usage of this comprehensive model will allow participants in the agricultural chain to improve their performance.

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