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Pooled warehouse management: An empirical study

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ABSTRACT

Today, pooled warehouse presents a major issue for supply chain actors. Managing such structures establishes a more complex and little known actions system. In this paper, we provide the main specificities of a pooled warehouse examined from the perspectives of both a literature review and an exploratory qualitative study built on seven cases in France. This study is based on semi-structured interviews with 22 companies managing projects in the field of pooled warehouses. From this qualitative analysis, we distinguish the main characteristics of pooled warehouses, such as compatibility and partner maturity, shared Vendor Managed Inventory, and collaborative management. In addition, we identify new key performance indicators, uncertainty sources and risks of pooled warehouses. This work helps define pooled warehouse concept and brings practitioners a better understanding of how it can be managed. Furthermore, it allows researchers to develop new models of optimization considering the pooling context.

1. Introduction

In the context of a global economy characterized by increasing competition, companies try to improve their service level by intensifying means of distribution implementation (warehouses, transportation means). Moreover, environmental requirements in terms of CO_2 emissions reduction, limitation due to land taxes, logistics costs and retailers' requirements (increased delivery frequency, decreased inventory levels) have obliged supply chain actors to revise their distribution strategies (warehousing and transport). These evolutions engender reflections on the development of new collaboration strategies in order to create more synergies between supply chain actors. Several studies have shown that logistics pooling is one of the collaborative approaches which allows reducing costs and meeting both customer and environmental requirements (Moutaoukil, Derrouiche, & Neubert, 2012; Pan, Ballot, & Fontane, 2013). According to Pan et al. (2013) logistics pooling involves sharing physical resources (warehouse, platforms, trucks), and organizations (logistics schemes), but also data necessary for managers to improve economic performance and supply chain environmental impact. Logistics pooling is defined as "*pooling of logistics resources, organized by several actors, to group their flows to a single destination via transport and warehousing*" (ECR France, 2013). Logistics pooling concerns pooled warehouse and transport pooling. Transport pooling has been largely studied, but pooled warehouse less so. Here, we are only interested in the pooled warehouse concept. Pooled warehouse can be defined as a warehouse shared logistically between several actors (manufacturers, logistics providers and distribution companies) in order to share physical spaces, resources and logistics information to improve the global performance of the overall distribution process (Makaci, Reaidy, Samuel, Botta-Genoulaz, & Monteiro, 2015). This concept is relatively recent for companies, characterized by collaboration between actors and modifications of warehouse management in terms of organization, decision sharing and information sharing. The management of a Pooled Warehouse (PW) is considered as complex and dynamic (Reaidy, Gunasekaran, & Spalanzani, 2015). It is subject to uncertainties and constraints related to the operations of the warehouse such as demand variation, the departure and arrival of new partners, distribution company pressure, and operations rules. However, pooled warehouse decisions are not made unilaterally. They take into consideration all pooled warehouse actors. Thus, Gonzalez-Feliu and Morana (2014) stress the importance of developing new key performance indicators (KPI) for logistics pooling in order to improve decision making processes in a horizontal collaboration context. Likewise, the presence of several partners in pooled warehouse creates a

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dynamic environment which implies good coordination between partners. For these reasons, it is necessary to study more deeply the pooled warehouse concept by taking into consideration other management aspects such as collaborative and operational management of pooled warehouses (Makaci et al., 2015). Our research work aims to answer the following questions: "What are the specificities of a PW?" and "What are the uncertainty sources, risks, and new KPI of a PW?" We decided to explore these questions in agreement with the previous cited references. To do so, we conducted an exploratory study based on semi-structured interviews, which allows characterization of pooled warehouse.

The remainder of the paper is organized as follows. In Section 2, we study the concept of collaborative logistics and pooled warehouse in order to define pooled warehouse and its main processes. The research methodology based on semi-structured interviews is presented in Section 3. Section 4 is dedicated to the results of our exploratory study concerning motivations to set up a pooled warehouse, pooled warehouse specificities, risks and uncertainty. The last section presents a discussion of the results and future research perspectives.

2. Collaborative logistics and pooled warehouse

This section briefly reviews some concepts and collaborative mechanisms to be applied in the pooled warehouse context. They are intended to enable a better understanding of the pooled warehouse concept.

2.1. Collaborative logistics

Collaborative logistics is a set of interactions between several supply chain actors to achieve the goals set for sharing resources, decisions, risks and benefits. Establishing an effective logistic collaboration can be vertical, horizontal, or lateral. Lambert, Emmelhainz, and Gardner (1996) define vertical collaboration in logistics partnerships as "*the process of working together among independent firms (two or more companies) along a supply chain in delivering products to end-customers for the basic purpose of optimizing long-range profit for all chain members and creating a competitive advantage*". Cruijssen, Dullaert, and Fleuren (2007) define horizontal collaboration as "*active collaboration between two or more firms that operate on the same level of the supply chain and perform a comparable logistics function on the landside*". According to Simatupang and Sridharan (2002) "*A lateral collaboration aims to gain more flexibility by combining and sharing capabilities in both vertical and horizontal manners*". As stated earlier, previous research on collaboration logistics focuses mainly on the development of key factors of success and the ways to implement them. Audy, Lehoux, D'Amours, and Rönnqvist (2012) develop five coordination mechanisms to implement the collaboration between supply chain actors to ensure information sharing, the coordination of logistics activities, and benefits sharing. The collaboration of the various supply chain actors allows making a profit via resource pooling, and sharing the strengths and capabilities of the different firms (Bartlett & Ghoshal, 2004) Implementation of collaborative logistics requires the presence of a third party to ensure transparency and to develop a reliable climate. Partnering with a third-party logistics provider (3PL) can lead to better performance in warehousing operations (Sinkovics & Roath, 2004; Stank, Keller, & Daugherty, 2001). The majority of collaborative logistic warehouses are piloted by logistic service providers; a subject explored in many studies and having a strong presence in the literature. For example, Gunnar (2006) shows the interest and the role of 3PL in the management of this collaboration. Hingley, Lindgreen, Grant, and Kane (2011) also show the interest of a 4PL presence to improve collaborative management.

2.2. Logistics pooling

Logistics pooling is considered a form of logistics collaboration between several actors, allowing development of synergies between logistics actors to improve their performance (Moutaoukil et al., 2012). It involves sharing physical resources (warehouses, platforms, trucks), and organizations (logistics schemes), but also data necessary for managers to improve economic performance and supply chain environmental impact (Pan et al., 2013). According to ECR France (2013), logistics pooling is defined as "*pooling of logistics resources, organized by several actors, to group their flows to a single destination via transport and warehousing*". Pooley and Stenger (1992) propose several forms of logistics pooling, such as pooled warehouse, platform pooling and transport pooling. The research developed in logistics pooling predominantly focuses on transport pooling and inventory pooling and less on pooled warehouse. For example, Ballot and Fontane (2010) show that transport pooling allows reducing CO_2 emissions by 25%. Li, Lv, and Guan (2014) demonstrate that the performance of collaborative planning for a logistics hub is superior to that resulting from decisions taken separately by suppliers and manufacturers. Wang and Yue (2015) develop a decision making model to determine the number of companies in a coalition that can share the storage cost of spare units. Kim and Benjaafar (2002) examine the benefits of inventory pooling in systems with finite capacity. Finally, Wanke and Saliby (2009) develop a framework for deciding whether and how inventories should be pooled.

2.3. Pooled warehouse

The warehouse is considered a major component of a supply chain. It allows strengthening product consolidation to reduce costs by means of economies of scale (Bartholdi & Hackman, 2010). According to Higginson and Bookbinder (2005), a warehouse is a place where products are stored during a long period. Hence, these authors define the logistics platform (hub or cross-docking) as a place of goods reception and forwarding in a very short time, the main objective of which is to redirect flows towards another destination. Several research studies have been developed on warehouse management. Gu, Goetschalckx, and McGinnis (2007) establish a complete literature review on warehouse operation management including storage, order picking, handling, receiving and shipping. van den Berg and Zijm (1999) propose a typology of warehouse management problems. Shiau and Lee (2010) develop a hybrid algorithm to combine the operations of picking and packaging through a specific picking sequence. Another strand of research tries to implement production solutions. For example, Chen et al. (2013) introduce the integration of lean production and radiofrequency identification (RFID) as a technology to improve the efficiency of warehouse management. Other researchers (Gong & Koster, 2011; Gu, Goetschalckx, & McGinnis, 2010) focus on warehouse design and operations but do not integrate the pooling concept.

Several studies emphasize the role of pooled warehouse in transport. Plögera, Haasisa, and Siestrupc (2008) consider it as a strategy to reduce costs and to use resources effectively to meet customer demand. Tuzkaya and Önüt (2009) develop a linear programming model to optimize logistics networks (warehouse and transport) between suppliers and plants in order to maximize the profit of all members. Franklin and Spinler (2011) consider that PW implementation improves performance thus reducing risks, and improves the eco-efficiency of logistics systems. The research developed in logistics pooling largely focuses on the pooling of