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Information flows supporting hinterland transportation by rail: Applications in Sweden

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ABSTRACT

This article analyses how information and communication technology (ICT) is used to support the hinterland transport of maritime containers. It focuses on the way information is conveyed between actors using an ICT facility structure, and how integrative information is used by different partners' information systems to make different transport operations more efficient and to offer improved service.

The analysis includes the identification of the actor network and the management components in line with supply chain management perspectives. To support this analysis, a conceptual model showing the relationship between integrative information and integrative technology was constructed and related to business processes and an ICT maturity model found in the literature.

Interviews were conducted with actors involved in Swedish hinterland rail transport. The information flows were mapped and the analysis shows that while the current level of integration and ICT maturity is fairly low, several actors are currently modernising their systems. Their main motivation is to reduce the administrative task load, and at the same time achieve better supply chain integration. The actors are focused on their own tasks and do not see the advantages of advanced integration of the information flows. The risk is identified that the IT level is increasing faster than business integration processes between the companies, which might lead to inefficiencies.

1. Introduction

Efficient and effective hinterland transport is of key importance for successful maritime transport, particularly for short sea shipping. Hinterland transport can be organised by various traffic modes and different actor categories, using different business models and network operation principles. The recent deregulation of the railway sector in Europe has seen several new actors employing new business models emerging for the operations and management of hinterland transport. The field of hinterland container transport and dryports has attracted substantial attention from researchers (for an overview see, e.g., Roso, 2009a), but most studies have focused on the design of the transport services, geographical aspects and environmental consequences.

The development of global supply chains has increased the pressure on maritime hauling, seaport operations and inland freight distribution (Almotairi, 2010; Notteboom & Rodrigue, 2005). The success of a company depends on its ability to integrate into a network of business relationships (Bowersox, 1997; Christopher, 1998; Drucker, 1998). Lambert and Cooper (2000) named this phenomenon of managing the business and its relationships across the supply chain "supply chain management" (SCM). It deals with managing the business and their relationships with other members by integrating activities, functions, and systems throughout the supply chain (Vickery, Jayaram, Droge, & Calantone, 2003). The key to seamless supply chains is making available undistorted and updated information at every node within the supply chain (Towill, 1997). By taking the available data and sharing it with other parties within the supply chain, information can be used as a source of competitive advantage (Novack, Langley, & Rinehart, 1995). The existence of integrative information technology facilitates the flows of relevant information throughout the supply chain and enables business process integration that goes beyond firms boundaries (Bowersox & Daugherty, 1995; Lewis & Talalayevsky, 1997).

Thus far, the administrative systems used for hinterland operations have not been heavily explored, especially when compared to the abundant literature on information systems (ISs) for container terminal operations (for an overview, see Henesey, 2006).

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Nevertheless, many researchers highlight problems in information and management systems (Bichou & Gray, 2004). Shortcomings in reliable data and information exchange are often mentioned as a reason for inefficiencies as well as lost business opportunities, which are mostly needed for collaboration or partnership arrangement with other logistics channel-members.

The aim of this article is to analyse how information and communication technology is used to support the hinterland rail transport of maritime containers. The focus is on what information the actors exchange and by which means they do it. In addition, an analysis has been made in order to identify which actors drive the development of more advanced information technology (IT) and for what reasons. The scope includes how ISs are used for making the operations more efficient and prospects for facilitating an extension of the service offer.

The methodological approach used for preparing this paper can be divided into three steps. First, the relevant literature on freight transport, logistics, SCM, information and communication technology (ICT), IT, and ISs is explored. Secondly, a conceptual model is developed from the literature to analyse the empirical findings and reinforce the applied terminology. Finally, an empirical study was conducted in which interviews were carried out with a number of actors involved in handling maritime containers in hinterland transport in Sweden. Their inter-organisational information flow is surveyed and categorised, as is their intra-organisational information processing. The paper begins with introducing the frame of reference within which relevant issues from the literature are discussed, and based on that, the conceptual model is described. The empirical outcome is then presented, followed by an analysis and description of the final findings.

2. Hinterland transport in a supply chain management perspective

Considerable attention has been given to SCM in the popular business press and some academic literature (Lambert & Cooper, 2000). According to Mentzer, Stank, and Esper (2008), SCM is a phenomenon that resembles different disciplines and consequently touches nearly all areas of business. SCM requires full systems visibility that manages the total flows of a distribution channel from early supplier to the end customer (Houlihan, 1993; Stevens, 1989). This is with the aim of achieving goals related to total system performance rather than optimisation of a single phase in a logistics chain. In this section, the SCM perspective is introduced along with IS and IT issues in a maritime and hinterland transport setting, in order to arrive at a conceptual model for further use in the analysis.

2.1. Coordination of transport network

While transport is one of the major activities within logistics where a creation of time and place utility is performed (Coyle, Bardi, & Langley, 1996), transport network (links in supply chains) and transport infrastructure (nodes in the supply chains) are key elements in efficient logistics systems (Lumsden, 2006). It is now generally accepted that supply chains, and not individual firms or products, are the basis of most marketplace competition (Christopher, 1992). At the most fundamental level, a supply chain is considered to be a series of inter-firm relationships (Cooper, Lambert, & Pagh, 1997). In order to coordinate a transport network, SCM takes an integrative approach, which implies managing relational exchange with other supply chain entities. These relational exchanges can be expressed in the form of supply chain flows: both the information and the physical flows. The information flow relates to transfer of all relevant data and information related to the operational procedures involved in various logistics activities. The second flow, the physical flow, relates to the movement and handling of cargo through ports and/or terminals, including transportation activities (Paixão & Marlow, 2003). Organisational relationships tie firms to each other and may tie their success to the chain as a whole (Schary & Coakley, 1991). Thus, the main focus here is the integration of key business processes, which encompass a network of relationships that offers an opportunity to capture synergy of intra- and intercompany coordination and linkage optimisation (Lambert & Cooper, 2000).

2.2. Freight transport and the container shipping industry

Globalization and new distribution systems are imposing significant structural and functional changes in hinterland logistics (Robinson, 2002 and 2006). For instance, liner shipping has experienced an explosion in container ship size. The maritime element of the hinterland transport chains has employed ever-larger ships to cope with increasing transport demand and to facilitate lower unit costs as discussed by Cullinane and Khanna (2000). With the number of latest vessels on order reaching 18000 TEU (Maersk Line, 2011) to fully utilise the economies of scale, progress in ports and hinterland operations must match (McCalla, 2007 and Parola & Sciomachen, 2005). Fleming and Baird (1999) noted that there have been many recent remarks and written comments to the effect that the real future competition will not be between seaports and individual transport carriers per se, but between a handful of "total logistics chains." Heaver, Meersman, Moglia, and Van De Voorde (2000, p. 1), in their research into the European seaports and shipping sectors, noted that "the role of the port and the port authorities has to be redefined to guarantee that it remains a fully-fledged player in this fast evolving integrated market." By recognising that an enterprise can no longer effectively compete unilaterally or autonomously, SCM represents one of the most significant paradigm shifts in modern business management practice (Lambert & Cooper, 2000). It has been argued that partners' (supplier/customer) integration into the firms' value/supply chains is critical if the firm is to add value to its product and service offerings (Ragatz, Handfield, & Petersen, 2002, p. 28).

What is becoming increasingly important for seaports, as well as seaport users, is not merely the efficiency of the seaport per se, but the efficiency of the supply chain in which the seaport and its users are involved (Panayides & Song, 2008). Based on this understanding, the logistics or distribution chain, elements of which are the seaports/terminals, shipping lines and transport operators, needs to achieve a higher degree of integration in order to be successful (De Souza Jr., Beresford, & Pettit, 2003).

2.3. Information system support

As SCM became a prominent concept, IS, IT and ICT were identified as critical enablers of the integration of logistics processes (Auramo, Kauremaa, & Tanskanen, 2005; Mabert & Venkataramanan, 1998). The firm's goals for IT in an SCM context include ensuring information availability at a single point of data access, creating visibility to upstream and downstream changes in demand or supply, and enabling effective decision-making based on this broad base of information about the supply chain (Simchi-Levi & Simchi-Levi, 2008). The availability of real-time information puts more emphasis on flexible IT systems that deal with a large amount of data and are easy to interconnect (Helo & Szekely, 2005). Predominately, the ability of IT to make information available eases the implementation of integrated logistics processes (Gustin, Daugherty, & Stank, 1995).