

Information exchange methods and disruptions in wood supply chains

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Abstract: Dependency of accurate and timeliness information is increasing in supply chains. A disruption in information exchange in supply chain can cause severe repercussions to the flow of materials within it. This paper is addressing this gap by assessing the information exchange methods and their disruption risks wood supply chains of an international pulp and paper manufacturer. In this study we illustrate the importance of different information exchange methods as well as the vulnerability reflected to the chain by the possible disruptions of them. The main risk identified by the interviewees raised from information intensive the logistics systems. Internet and phone connections as well as personal relations were found to be essential for fluent information exchange.

Keywords: Information Exchange Methods, Disruptions, Risks, Wood Supply Chain, Forest industry

1. Introduction

Global supply chains are becoming increasingly long generating a complex matrix in order to carry out their functions. Several drivers are causing these functions to be divided by a growing number of actors which decentralizes the knowledge in the supply chain. New methods of information exchange (i.e. ICT, mobile solutions etc.) are used to mend these lacks. However, increasing dependency from them opposes new challenges for the supply chain risk management (Christopher and Lee, 2004).

In Finland forest industry has an important position accounting for approximately 19% of the export trade values. In land logistics, every third large or medium size truck in Finland is serving the forest industry (Rumpunen, 2010). The supply chains serving forest industry are a part of complicated international

supply networks which requires constant information exchange to ensure the uninterrupted flow of materials. One of the origins of the Finnish forest industries wood supply is from the Baltic States. These cargo flows operate the Baltic Sea Region in the form of a multimodal supply chain.

In this paper the main aim is to assess information exchange and its risks in wood supply chains between Baltic States and Finland. This is done by presenting information exchange methods and possible disruptions in supply chain. The study is based on the literature concerning information exchange, information quality and supply chain risk management; as well as the empirical findings from interviews and questionnaires conducted.

2. Supply Chain Risks and Information Exchange

According to Paulsson (2004) risk is an event with negative consequences (The Royal Society, 1992) or “the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge”. In this study risk is defined as potential occurrence of an incident or failure opposing the free and uninterrupted flow of supply chain material, information and creating supply chain interruption (Tang and Musa, 2010). A standard formula for the quantitative definition of supply chain risk is:

$$\text{Risk} = P (\text{Probability}) * I(\text{Impact}) \quad (1)$$

The risk is defined as the product of the probability (P) of loss times the significance of its consequences (I) (Mentzer et al., 2001).

Supply chain risk management aims to deal with risks and uncertainties caused by, or impacting on, logistic related activities or resources. Supply chain risk management is executed collaboratively with partners in a supply chain by applying risk management process tools (Paulsson, 2004, Norrman & Lindroth, 2002). Supply chain risk management starts with the identification and computation of probable risks and their possible impact on operations in the supply process. First the direct risks to its operations should be identified.

Information within the supply chain has become a vital element for supply chain integration, performance and successful supply chain implementation (Chen et al., 2010). Information exchange in the supply chains is the extent to which information is communicated between supply chain partners. To enable dynamic actions and decision-making, the information exchange and information quality are very important issues for coordination operations within the supply chains (Li & Lin, 2006; Fiala, 2005).

3. Empirical Case Study and Methods

The data for the study was gathered through qualitative interviews from the logistic related tasks responsible personnel (Yin 1989). An Internet-based questionnaire was used to quantify and verify the interview data.

The focus of the interviews was in the wood supply chains of an international forestry products company's in, and to South-East Finland. The interviews were conducted with twelve persons from the studied supply chains. Interviewees were acting in responsible positions i.e. logistics operations and management, terminal operations, as well as procurement, were chosen.

By systematic research an understanding of the studied supply chains was obtained with possible risks and types of consequences information disruption could effect. The goal was, first to map the supply chain processes studied and the factors that are important in supply chain's information exchange, secondly to find out what kind of risks there were opposing the supply chains information exchange, and finally to assess the possible information disruption risks.

4. Focal Supply Chain and its Information Exchange

In order to gain systematic understanding to the supply chains, a step by step process maps were created based on the description of the interviewees. The process maps allowed a deeper operations level examination without losing the holistic understanding of the overall supply chain processes.

Based on the interviews typically used wood supply chain process were discovered: An international inter-modal maritime supply chain in the Baltic Sea Region (Figure 1), On the left-hand side of the Figure, the organizations, or different departments of organizations, are illustrated, while in the right-hand column the main functions of the supply chain can be seen.

Procurement	Contracts Wood		
Logistics management	Contracts Logistics	Booking of the vessels	Scheduling of the vessel
Transport company	Transportation by truck to the port	Unloading the truck to the terminal	
Port / Operator	Loading the vessel		
Shipping company (Broker/ Agent)	Paperwork (Bill of lading)	Sea transport	
Port / Operator	Unloading the vessel	Transportation to the short term warehouse with truck	Unloading to the short term warehouse
Terminal Short term warehouse	Short term warehousing	Loading the truck	
Transport company	Transportation to the mill	Unloading the truck	
Mill	Acceptance	Sorting	Handling
Terminal Operator	Short term warehousing		
			Use

Figure 1: Maritime supply chain process

Table 1: Identified information exchange methods

Information exchange method	Description	Importance
Bookkeeping system 1	Invoice, payment and financial reporting	Low
Bookkeeping system 2	Invoice handling	Low
Bookkeeping system 3	Invoice handling and financial reporting	Low
Coffee table discussions and own network	Discussions with colleagues; a social network of colleagues/partners	Medium
Communications Applications	The organization's internal instant messaging system	Medium
EDI Messages	Electronic Data Interchange -messages, structured data transmissions between organizations by electronic means	Low
E-mail	Bookings, information concerning raw-material demands, changes in schedules, raw-material quality and assortments	High
Fax	Confirmations, wagon data from Russia	Low
Logistics system (planning and operate.)	Planned and delivered volumes, and freight contracts: rail, truck and vessel	High
Logistics system (planning)	Planned and delivered volumes, and invoice handling: rail, truck and vessel	Medium
Logistics system (sea logistics)	Planned and delivered volumes, schedules, quality, assortment and destination information and also freight contracts: vessel	High
Meetings (face-to-face and group phone)	Regular group phone meetings, face-to-face meetings when needed	Medium
Office applications	Excel, Word and PowerPoint	Medium
Phone	Problem solving and double checking	High
Planning and sales system 1	Mill(s) system including planned volumes, orders and schedules	Low
Planning and sales system 2	Mills' system including planned volumes, orders and schedules	Low
Planning and sales system 3	Invoicing information and mill's production programs and plans	Low
Planning and sales system 4	Invoicing information and mill's production programs and plans	Low
Planning and sales system 5	Corporation-level information on all planned raw-material volumes globally	Low
Planning and sales system 6	Bookkeeping, planned and delivered volumes: rail, truck and vessel	High
Planning and sales system 7	Product/sales information: quantities, prices, invoices and loading orders	Low
Planning and sales system 8	Information about planned and delivered volumes, payments and freight contracts: rail, truck and vessel	Medium
Reporting system	Mill's reporting system	Low

The interviewees had different opinions about the importance of different information exchange methods. Typically the most important was the Sea logistic system that had information not only about the logistic operations, but

many things relating it. Also the email, the telephone, the planning and sales system 6 were mentioned in most of the interviews.

One surprising point discovered was that in a case of sudden changes the emphasis of importance of the systems changed. The information systems used were not very capable to handle sudden changes, therefore were typically solved by the use of telephones and emails for the primary method of exchanging the new information. Therefore the importance of those can be considered higher in case of changes or high uncertainty. The significance of the personal knowledge was found to be surprisingly high in the interviews. The tacit knowledge gained by a long work experience in the operations of the supply chain was viewed as highly important. To the interviewees' way of thinking the meaning of knowledge could not overlooked.

5. Risk Analysis

While the interviews provided a holistic view of the supply chain information exchange, a questionnaire was used to verify the results. In the questionnaire the participants could describe the likelihood and impact and importance of disruption in each information exchange method which was coded as: 0 = non-existing, 1 = very low, 2 = low, 3 = high and 4 = very high. The risks were then calculated by multiplying the likelihood and risk impact values.

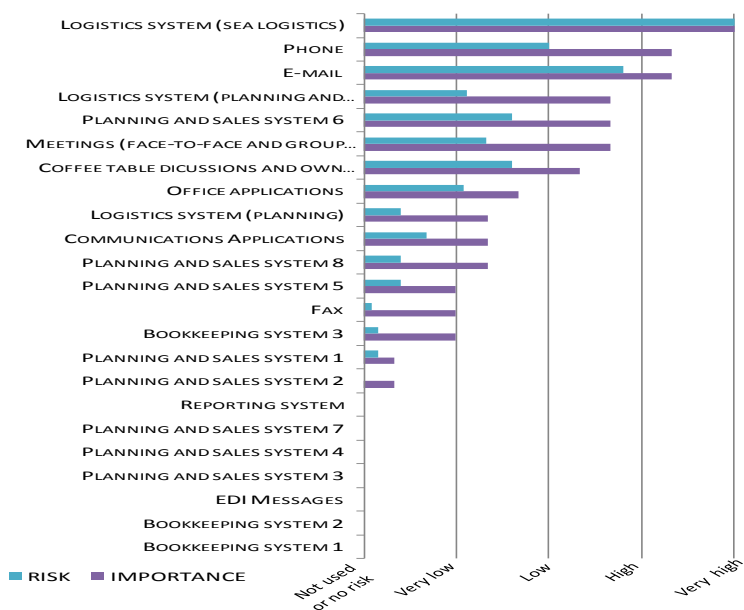


Figure 4: Importance and Information exchange method disruption risk values

Figure 4 shows that the highest single disruption risk value in the investigated supply chain was of the Logistics system that operates sea traffic. This concurs with the importance assessment results given by the interviewees, but at the same time highlights both the likelihood and severity of a possible disruption to this method. Email was rated to have the second highest relative risk value, and thirdly was the phone with its. In the interviews the email and telephone were both mentioned to be tools to exchange new information or to solve problems; therefore it was not surprising that the disruption effects are rather high with these methods.

6. Discussion and Conclusions

In this paper present our preliminary research concepts in identifying and assessing the importance of supply chain information exchange methods and risk of their disruptions.

The systemic studying supply chain process revealed there to be a number of information exchange methods. The importance of different information exchange methods was discovered to vary to different extents. Some of the systems were integrated and some held serious voids concerning integration. Poor integration concerning some methods was mentioned to be one of the key problems that had to be compensated for by using other methods.

The risks involved in the information exchange varied. One of the risks mentioned often was the accuracy of the information. This inaccuracy was usually caused by the forefront of the supply chain when the persons in charge did not have a clear understanding of the consequences that inaccurate information could have on the system as a whole. The information needed in the supply chain did not always coincide with the actual systems' capabilities, and in that like in many other cases, email and the telephone acted as a backup method creating additional work for the managing personnel. Also the positions in managing the flow appeared to be quite information intensive. The knowledge acquired through long work experience in the operations of the supply chain, combined with good network of supply chain partners, enabled the actors to compensate the possible inaccurate information.

The highest information exchange disruptions risk was seen to rise from the sea logistic system. If the system were down, replacing it would prove to be an immeasurable task while still maintaining the same level of efficiency. The email connections were also seen to cause high risk and disruption in that they would clearly hinder the operations. The phone was used extensively in the supply chain to exchange information and to ensure its arrival, maintain good

personal connections with the other actors in the supply chain, and most important as an aid in extenuating circumstances.

The conducted case study provides a holistic view of the information exchange risks in a wood supply chain. As a case study however it has some limitations in generalisability as the sampling was quite small and the data subjective. Further empirical studies should be conducted with more extensive data.

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