

# DISTRIBUTION CHANNEL STRUCTURE AND INTEGRATION

- Contingency variables in the sawmill industry

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## ABSTRACT

**Purpose;** The purpose of this paper is to identify and characterize structures and integration levels of distribution channels in the sawmill industry, as well as to discuss these characteristics and their association with different contingency variables.

**Design / methodology / approach;** Multiple case study

**Findings:** There is a variety of distribution channel structures and levels of integration in the sawmill industry: one extreme is small, one-unit firms delivering ex-works to export agents with unintegrated distribution channel processes and the other extreme is large, multi-unit firms with network flow structures delivering from their own stock on a market to clients with integrated distribution channel processes. By studying these contingency variables, a pattern of sawmill categories emerges; the first category, in which production is focused, are the small single sawmills (with a cost leadership or focus strategy) which aim to deliver their products to independent actors ex-works; the sawmills which comply to this category do not consider logistics or IT as important, neither do they take integration into consideration. The second category consists of larger multi-unit sawmills with a downstream focus, which strive to integrate and control the distribution channel (in the most extreme cases acquire strategic actors) in order to achieve stable presence on strategic markets. Sawmills included in this category regard logistics and IT as important.

**Research limitations / implications;**

This research is an exploratory pre-study based on five case studies implicating a limited possibility to draw general conclusions.

**Practical implications:**

This paper illustrates situations in which the distribution channel requires to be focused to higher degree which is important for strategic decisions for the actors in the industry.

**What is original/value of paper:**

This paper illustrates the variety of channel structures and integration levels within a single industry, and connects the variation with a number of contingency variables.

*Key Words: Sawmill industry, Distribution channel structure and integration, Contingency variables.*

## 1. INTRODUCTION

Concepts of the supply chain and of supply chain management are attracting management focus in many industries. Driven by the concept and development of SCM there is an ongoing realization that companies need to establish relationships with their suppliers and customers in order to assure their own competitiveness in an industry. Many firms realize that partnerships with customers and suppliers are important means of establishing competitive advantage (Gimenez and Ventura, 2005; Kalwani and Narayandas, 1995; Morgan and Hunt, 1994). There is a trend towards closer and more long-term relationships between the different actors in a supply chain, the driving forces being increased business complexity, shorter product life cycles, global competition and pressure on profit (Holmlund and Kock, 1996). However, not everybody agrees that integration and close collaboration is the best solution in every case, see for instance Bask and Juga, (2001) and Mouritsen et al., (2003). Bask and Juga, (2001) argue that it is necessary to reassess this dominant view of integrated supply chains, and they advocate a change from holistic towards semi-integrated supply chains. Mouritsen et al., (2003) question the general foundation of SCM “the more integration and transparency in the supply chain the better” by stressing different dilemmas of SCM research. Furthermore, Mouritsen et al (2003) stress the need for more research to explore how the management of supply chains is performed under different circumstances, as well as when the integration of activities and processes across the supply chain is beneficial for the participants, and when more arm’s length relations would be more appropriate.

Parallel to the focus on integration in supply chains there is also research done on the structure of supply chains. Stock et al (2000) studied the role of fit between supply chain structure, integration and organizational performance in the extended manufacturing enterprise. Wren (2007) studied how the structure of distribution channels influences decisions on competitive strategy. Structure is seen as a contingency variable on micro level, expressed as number and type of intermediaries as well as on macro level regarding transactional forms or bureaucratic forms of interaction. There are striking similarities between the two concepts of supply chain structure and distribution channel structure in these two studies.

The structure and integration of distribution channels could take almost any form, but the form it actually takes depends on several issues. The most important factor is the consumers' demand for service output. In order to work with the design of the distribution channel several steps are needed, such as; examining products/services that are sold, end-user segmentation, investigating external and internal constraints and opportunities, and confronting the constraints/objectives (Coughlan et al., 2006) The main product from the sawmilling industry, softwood lumber, is in many cases referred to as a commodity product (Roos, 2002). Competition amongst suppliers of commodity products is primarily based on the suppliers' total offer (i.e. product and service). Each individual company exists in a specific setting, affected by several contingency variables, making every company to some extent unique. The contingency approach proposes that organizational adaption and survival can be achieved in several ways and that one specific way is not equally effective under all circumstances (Zeithaml et al., 1988).

Research presented in this paper aims at answering the following questions; what are the structures of distribution channels in the sawmill industry, and how do sawmills integrate throughout the distribution chain? Which are the specific contingency variables in play, and

how do these variables affect DC structure and integration? This study is conducted as an explorative pre-study of five case companies constituting a point of departure for forthcoming research on structures, integration forms, effectiveness and efficiency regarding sawmill industry distribution channels.

The paper continues with a theoretical description of the concepts (distribution channel, and contingency variables), chapter three focuses on the sawmill industry; chapter four describes the methodology applied, whereas empirical study and analysis is presented in chapter five. The paper ends with chapter six, which provides for instance tentative findings and implications for the study.

## 2. THEORY

A distribution channel consists of interdependent institutions, and the different members perform one or several activities, such as: carrying of inventory, demand generation or physical distribution. A distribution channel consists of the manufacturer and a number of intermediaries. In general, the functions of the intermediaries are to sorting, accumulating, allocating and assorting (Coughlan et al., 2006). This implies that almost all organisations (except manufacturers) are engaged in intermediary functions such as wholesalers, retailers, distributors, and agents. Aspects that ought to be taken into consideration when describing physical flows are mainly structure and organization of actors (Haartveit et al 2004). Mattsson (1999) defined five material flow structures; V, A, T, X and I. Distribution channel structure will be expressed in this paper as the number and types of intermediaries together with patterns of physical flow and transportation.<sup>1</sup>

The different members in the distribution channel work more or less closely with each other and this is usually referred to as the degree of external integration. The advantages of integrating activities and functions amongst the actors in the distribution channel are perceived to be innumerable, one being increased performance (even though the number of empirical evidence has been questioned by for instance Fabbe-Costes and Jahre, (2008) and Fabbe-Costes and Jahre, (2007)). Cooperation and collaboration are used as alternative concepts to integration (Chen et al., 2009a). These concepts are similar, but they differ with regards to levels of trust, commitment, and mutual dependence (Golicic et al., 2003). Spekman et al., (1998) also include coordination in the terminology of integration, and identify the following criteria for each concept: *Cooperation*; firms exchange essential information and engage some suppliers/customers in longer-term contracts. In most cases, cooperation and coordination is achieved by each company with its segments of customers and suppliers. *Coordination*; both specified workflow and information are exchanged in a manner that permits JIT, EDI and other mechanisms that attempt to make seamless many of the traditional linkages between and among trading partners. *Collaboration*; engages partners in joint planning and processes beyond the levels reached in less intense trading relationships. Collaboration in the supply chain has been defined, by Singh and Power, (2009), as “ two or

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<sup>1</sup> The terms, supply chain structure and distribution channel structure, are in this paper used as synonyms. The concepts have different origins; DC comes from the marketing and retailing side and SC comes from procurement and logistics side, they rely to some degree on different generic concepts and they address somewhat different issues. However they are frequently used as synonyms which reflects the expanding scope of the concepts. In this paper we want to stress the distribution leg of the complete supply chain but rely on theory from both traditions. See also Bucklin et al (1996), Bucklin (1971), Mentzer et al (2001) and Cooper et al (1997) regarding similarities of definitions of DC and SC structure.

more chain members working together to create a competitive advantage through sharing information, making joint decisions, and sharing benefits which result from greater profitability of satisfying end customer needs than acting alone". A necessity for collaboration is trust and commitment from both parties. Literature, as well as previous studies on integration, varies with regards to definitions as well as operationalization<sup>2</sup> of the integration concept (Pagell, 2004). Several quantitative studies have been conducted focusing on different aspects of integration; underlying factors, relationships between parameters, model and framework<sup>3</sup>, supply chain integration practises and strategies<sup>4</sup>, and relationships and process analysis<sup>5</sup>. These studies differ with regards to objective (varies for instance presenting relationships, examine effects of integration, methodologies (mainly questionnaires, testing of hypothesis), and constructs (more or less based on theory).

Lawrence and Lorsch (1967) stated that contingency variables came first from the company's contextual domain and hence it was not possible for the company (or at least only to a small extent) to control these variables. Later on a second set of contingency variables, under company control, become known; those represent aspects of a company's strategic position. (Clinton, 1997) Aligned with the second set of contingency variables Chow et al, (1995) suggested the following five contingency variables related to the logistics processes for testing; *Strategy*; Chow et al (1995) refer to differentiation strategies as defined by Porter, (1980). Porter identified three generic strategies; overall cost leadership, differentiation, and focus based on strategic advantage and strategic target. Focus strategies aim for a particular market segment, while overall cost leadership and differentiation aim industry-wide, and differ with regards to implying either uniqueness perceived by the customer or low cost position. *Environmental uncertainty*; is described as "the extent to which outcomes are unpredictable". This holds two dimensions; first, the ability of the decision-maker to foresee coming actions and expectations of, for instance, competitors and suppliers, and secondly the range of these actions and expectations. *Environmental heterogeneity*; this is referred to as the degree of complexity in a firm's environment (product suppliers and markets/customers), and it may be reflected in, for instance, the number of products, customers, suppliers. *Importance of logistics*; this is described as the extent to which logistics activities constitute an important portion in the firm's value-adding activities, e.g. the relative cost of logistics to the company's total costs. The design of a company's logistics system sets the level of customer service that the company is able to offer. Revenues generated from customer sales, less the associated costs, establish the profit to be realized by the company (Ballou, 1992). From a logistics' perspective, costs could be divided amongst others into operative logistics costs, logistics quality deficiency costs and costs for tied-up capital. *Logistics costs* cover transportation, physical handling, and administrative handling, *Logistics quality deficiency costs* cover costs associated with not being able to meet service levels agreed. *Tied-up capital* in inventories along the supply chain affects the company's costs for carrying inventory. *Importance of information technology*; Logistics is to be considered as transactions- and information-intensive, and hence IT could play an important role in enabling activities that support primary value adding activities such as inbound and outbound logistics.

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<sup>2</sup> Overviews of definitions and operationalizations have been provided by for instance Van Deer Vaart, T. and Van Donk, D. P. (2008), Chen, et al. (2009b), and Arshinder, et al (2008).

<sup>3</sup> Bagchi et al., (2005), Chen et al., (2009b), Closs and Savitskie, (2003), Germain and Iyer, (2006), Sanders and Premus, (2005), Singh and Power, (2009), Lee et al., (2007), Paulraj and Chen, (2007), Stank et al., (2001), Kim, (2006a), Kim, (2006b), Kim, (2009), and Narasimhan and Soo, (2002),

<sup>4</sup> Frohlich and Westbrook, (2001), Fawcett and Maignan, (2002), Ohlager and Selldin, (2004), Sandberg, (2007), Soroor et al., (2009), Skjott-Larsen et al., (2003), Simatupang and Sridharan, (2004), and Simatupang and Sridharan, (2005)

<sup>5</sup> Gimenez, (2006), Gimenez and Ventura, (2005), and Romano, (2003)

A contingency model of logistics strategy has been developed by Kohn et al., (1990). Contingency factors from a logistical viewpoint, according to Pfohl and Zöllner, (1997), are; environmental relations (complexity and dynamics), the product line (degree of homogeneity among product, market), production technology, and the size of the organization (number of entities). These different aspects complement each other; environmental relations, product line, and production technology are aligned with environmental heterogeneity, while size is aligned with strategy. Hence these aspects are covered by the classification done by Chow et al (1995).

### 3. THE SAWMILL INDUSTRY

The sawmill industry is raw material based and differs from traditional industries in a number of ways; divergent material flows complemented by the fact that the material is not static and its characteristics are therefore changing. Further some of the big players among sawmills are business units within a larger corporate structure encompassing forestry, bio energy and paper pulp (pulp manufacturing often being the main business area). Sawmill operations are of a somewhat marginal position in such corporate contexts. There are large heterogeneity amongst sawmill even though they produce the same type of products. SCM and distribution channels in the Finnish sawmill industry has been elaborated in Holma (2006), while Haartveit et al (2004) studied SCM for the forest products industry in Canada. The sawmill industry could be characterized by the following contingency variables; *Strategy*; In general there are two approaches to the production of softwood lumber; either to focus on a fast production system with a predetermined sawing pattern, or to focus on the effective use of incoming material at the cost of speed in the production process (Alkbrink, 2003). A majority of Swedish sawmills is to a large extent focused on *cost differentiation* where maximizing sawing operations yield profit. Sawmill manufacturing technology is rather capital intense; hence economies of scale are evident, and industry structure is being gradually more concentrated.(Staland, 2002; Månsson, 2003). Large sawmill companies often operate a number of sawmill units. *Environmental uncertainty*; Raw material markets are susceptible to climate and other disturbances, making inbound logistics planning a difficult task. What comes from the forest will have to be taken care of, but it does not always correspond with market demand. Timber has high variability and unpredictability, making it difficult to plan for definite manufacturing programs. Further, the products are being produced in a divergent material flow structure (main products and consequential products). (Adolfsson et al., 2000) There are also uncertainties in sales markets and currencies, and sawmills are exposed to world *market price* fluctuations. Fluctuating prices between markets create incentives to move volumes to markets with increasing prices, at the cost of being a consistent and credible supplier on markets with decreasing prices. *Environmental heterogeneity*; There are different ways for sawmills to acquire timber; they can purchase directly from forest owners, purchase from other sawmills or forest owners' associations, or through direct import (Harstela, 1993). Softwood lumber is a commodity material with a low level of product modification, and there is thus a low level of heterogeneity in the product line. However, in order to segment itself, there are sawmills that are continuously developing their products, for instance by pre-painting (Roos, 2002), which add to heterogeneity of the product line. Sawmills have several types of customers; traditional retailers, DIY multiple retailers, house builders and other industries.(Gustafsson, 2006) *Importance of logistics*; Sawmill products are of large volume and low value, and are consequently transportation intense. Timber purchases account for about 60-65 percent of the total manufacturing cost for a sawmill (Bergqvist et al., 1988), and the production cost is about 30 % (Gustafsson, 2006); hence sawmills do not consider the

distribution function as a primary function. *Importance of information technology*; As the sawmill industry has focused its development of the production process IT is well developed in the production function, while it is not existent in inbound and outbound logistics.

#### 4. METHODOLOGY

In general, the case study research method is used for exploratory research, in which no specific hypotheses are proposed; rather a basic understanding is sought of how and why different phenomena occur. The case study research method is particularly useful when the object of the study is a contemporary phenomenon occurring in a real life setting over which the researcher has little control (Yin, 2003). According to the taxonomy of (Dinwoodie and Xu, 2008) this case study ought to be characterized as aiming to refine theory seeking to improve the understanding of the relationship between contingency variables, distribution channel structures and integration. This study has been conducted as a multiple-case study, in which the differences between sawmills, such as size and complexity, have been sought for rather than the similarities. The interviewed sawmills are located in the south of Sweden. Five sawmills were identified by using an industry directory of sawmills (<http://www.sawmilldatabase.com/>) combined with advice from the trade association in question. Each sawmill was visited and the interviews focused on distribution channel structure (organizational and physical flow), channel process integration and each contingency variable, as well as the development of the sawmill industry and its drivers. The interviews were conducted with each respective CEO during the end of 2009 and the beginning of 2010. The data has been analyzed by firstly finding patterns in the distribution channel structure, secondly by finding patterns amongst the contingency variables and thereafter to combine these and formulate tentative findings. The tentative findings are of descriptive in nature and will be operationalized in further studies (in which also will include a developed tentative model).<sup>6</sup>

#### 5. EMPIRICAL STUDY AND ANALYSIS

Empirical data and analysis is presented in three tables (with complementary texts); Table 1 is a description of the five case companies in the study. Table 2 identifies major characteristics of distribution channel structures and channel integration (considering their strategic market identified in table 2). Table 3 renders the perceived appearance of the contingency variables. The analysis takes its starting point in the distribution channel for a selected European market of high importance for the individual firm, and continues with a discussion on which specific contingency variables are connected with distribution channel structures and integration forms for this specific distribution channel.

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<sup>6</sup> This pre-study constitutes a base for an in-depth study of structure, integration and efficiency in the distribution channel for softwood lumber. In order to validate and expand these tentative findings, additional cases are needed. The aim of the in-depth study is to create a model mapping the sawmill distribution channel costs, tied-up capital and logistics service quality, by illustrating the cost structure in the distribution channel. The model should take contingency variables in account and it should be descriptive, explanative and predictive for different situations; in order to be suitable for scenario writing, and consequently a tool for taking decisions on distribution channel structures.

*Table 1. Description of case companies*

Saw-mill	Prod. volume/year	Number of units;	Line of products	Type of customers	Selected market studied	Suppliers
A	15 000 m <sup>3</sup>	1	Specific niche products	Specialising carpenters	Germany	Forest corporations
B	40 000 m <sup>3</sup>	2	Standard product line	House building industry and Building materials merchants	Germany	Directly from forest owners nearby
C	160 000 m <sup>3</sup>	1	Standard product line	House building industry and Building materials merchants	The Netherlands	Directly from nearby and purchase company
D	350 000 m <sup>3</sup>	3 sawmills and one facility for value-adding activities	Standard product line and value-added products	Building materials merchants	United Kingdom	Purchase company within the group
E	1 800 000 m <sup>3</sup>	10 sawmills + units for value-adding activities	Standard product line and value-added products	Building materials merchants	United Kingdom	Purchase company within the group

*Table 2. Case company characteristics regarding distribution channel structure and integration for selected markets.*

Saw-mill	Distribution channel structure	Distribution channel integration
A	- The company sells products to an export agent who in turn sells to an importer-wholesaler. This actor has contact with the customer. - Terms of delivery are ex-works. Shipments are made directly from sawmill to importer's/wholesaler's warehouse.	None –  "It feels good to have distance to the customers"
B	- The company sells products to an export agent who in turn sells to an importer-wholesaler. This actor has contact with the customer. - Shipments are made directly from sawmills to importer's/wholesaler's warehouse.	None –  "because as we know what the customer will order we do not need to cooperate"
C	- The company sells products to an importer-wholesaler. This actor has contact with the customer. - Shipments are made directly from sawmill to importer's/wholesaler's warehouse	The company carries inventory dedicated for the customer at the sawmill. The customer follows stock-levels and places orders through a website interface.
D	- The company sells products to an importer-wholesaler (owned by the sawmill). This actor has contact with the customer. - Shipments from saw mills are arranged into complete shipments and consolidated at their own terminal and thereafter shipped either to customer or to own warehouse on market.	Ownership of resources in DC to selected market. Web-based access for customer to select its softwood lumber.
E	- The company sells products to an importer-wholesaler (partly owned by the sawmill). This actor has contact with the customer. - Shipments from different sawmills are arranged into complete shipments and consolidated at own terminal and thereafter shipped to customer.	Ownership of resources in DC to selected market. Web-based access for customer to select its softwood lumber.

The distribution channels for sawmill companies A, B and C appear to be as simple as possible; and in cases A and B they even strive to get the customers to arrange delivery, while

companies with several specialized sawmill units focus on transport either to a facility for special treatment, and thereafter to a facility for reloading and the final arrangements of the shipment. Two companies (D and E) carry stock on strategic markets in order to be considered reliable suppliers and to be able to meet customer requirements. Domestic and regular customers are handled by the companies' own staff, while other contacts are handled by an intermediary, in general an export agent or an importer, who in turn has contact with the respective sawmill. Hence there are different actors involved in the respective distribution channels, depending on, for instance, complexity, and the market. The smallest firms (A and B) do not seem to set priorities for direct end-customer contact; feeling that distance to end-customers is preferable. Three companies integrate to some extent; one with a special VMI solution (C), another by carrying stock at the port (D), and one (E) by acquiring important actors on strategic markets. Two of the studied sawmills (C and D) are at the integration level "cooperation", as they exchange essential information and engage customers in longer-term contracts. The largest sawmill (E) is more integrated with its customers in order to create competitive advantage by, for instance, sharing information and making joint decisions, and have hence fulfilled the criteria for "collaboration". There are future plans among some of the companies to raise the level of DC integration. Company C is planning to offer a VMI-solution to additional strategic markets/customers. Company D is aiming for a more in-depth relationship with its customers in general. Company E is actively searching for actors on strategic markets for joint ventures or ownership. Among the five case companies there seem to be two categories of sawmill companies. The first category is companies with several sawmill units acting more like networks, with complex distribution settings and in depth involvement with customers; the other category is single-unit sawmill firms appearing to focus on the production role, and only to a limited extent getting involved in the distribution channel.

*Table 3. Case Company contingency variables*

Saw-mill	<i>Focus and Competitive Strategy</i>	<i>Environmental uncertainties</i>	<i>Environmental heterogeneities</i>	<i>Importance of logistics</i>	<i>Importance of IT</i>
A	Production oriented Focus strategy	Supply of raw material	Niche products and focused market segment	Transportation	Computerization important in prod
B	Upstream oriented Cost leadership strategy	Supply of raw material  Customer market; -Demand -Currency	Product attribute; Broad product line	Transportation	Computerization important in prod
C	Production oriented Cost leadership strategy	Supply of raw material  Customer market; -Demand -Currency	Product attribute; Broad product line	Transportation Tied up capital	A facilitator for the VMI solution  Computerization important in prod
D	Downstream oriented*  Cost leadership strategy	Supply of raw material  Customer market; -Demand -Currency	Product attribute; Broad product line, products adjusted at a separate facility	Transportation Tied up capital Log service	Have a web-based interface for order placement.  A facilitator for the customer service (order placement)

					Computerization important in prod
E	Downstream*** oriented  Cost leadership strategy**	Supply of raw material  Customer market; -Demand -Currency	Product attribute; Broad product line, products adjusted at a separate facility	Transportation Tied up capital Log service	Have a web-based interface for order placement.  A facilitator for the customer service (order placement)

\* Has acquired one facility for value-adding activities, has developed a web-based interface for order placement.

\*\* Decided on building the largest sawmill in Sweden

\*\*\* Acquired Sales companies in Denmark, The Netherlands, United Kingdom, Interior products, House Builder, and a waterproofing facility

Four of the companies are characterised by a cost leadership *strategy*, in which they sell softwood lumber industry-wide and focus on cost reductions in every situation. Sawmill A on the other hand produces its specific type of product for a particular segment and thereby complies with a focus strategy. The studied firms have differences in company focus; sawmill A and C focus production by stressing maximizing saw yield, whereas sawmill B focuses on the availability of raw material. The largest sawmills (D and E) focus on their customers and their being able to meet their requirements in a cost effective way (according to the overall cost leadership strategy).

Four of the five sawmills regard *environmental uncertainty* identically; supplies of raw material (the total supply of timber and the usage of existing timber) and the customer market (demand and currency) are particularly important to sawmills. Sawmill A on the other hand only considers the supply of timber, on account of its specific timber requirements (regarding, for instance, dimensions). Not only are raw material markets susceptible to climate and other disturbances, these markets are also managed by numerous forest owners who individually decide on when to sell or not, and this unpredictability needs to be handled by the purchasing sawmills. Further, there is continuous competition on what to do with existing timber, which could be handled, for instance, as pulpwood, or as an input material for making pellets. Hence there is a competition on two fronts; total access to timber, and what to do with existing timber. As softwood is a commodity type material, sawmills are exposed to world market price fluctuations. Fluctuating prices between markets create incentives to move volumes to markets with increasing prices, at the cost of being a consistent and credible supplier on markets with decreasing prices. Further there are also changes on the customer side, where large actors with specified requirements are entering the market and forcing suppliers to meet their requirements. Sawmill A is an exception compared to the other studied sawmills, as it produces a specific product aimed for a particular segment. Sawmills B and C produce a standard product line of commodity products, and well-established customers are buying their products regularly. Hence *environmental heterogeneity* for these sawmills (A, B, and C) could be considered as low. Sawmill D and E have extended their product line by adjusting the products at separate facilities (for instance to include timber preservation), and they are continuously working on extending their customer base (both with regards to existing customers but also to finding new fields of applications). Hence, these sawmills could be considered to have a medium level of environmental heterogeneity. All sawmills consider transportation to be the most important. However, sawmills carrying stock outside their own mill/s also consider tied-up capital and logistics service levels to be important. The reasons for carrying stocks on strategic markets is to be able to offer good service to the customers, and aligned with that follows tied-up capital. The studied sawmills differ with regards to the

*importance of IT.* The smallest sawmills do not consider IT to be that important, and while considering instead that computerization is important in production control, all other usage is unnecessary. Hence their perception is that the importance of IT is low. The other sawmills consider IT to be important as it is the way for their customers to place orders.

## 6. TENTATIVE FINDINGS AND IMPLICATIONS

The concluding discussion on findings is based on the pattern exposed in Table 4 below.

The distribution channel characteristics for softwood lumber vary with regards to both organizational structure and physical flow structure. The organizational structure differs slightly between the case companies, while the physical flow structures exhibit variations to a higher degree; between the two extremes from i) direct distribution (arranged by the customers) to ii) distribution through consolidating terminals and deliveries to customers' sites (arranged by the sawmill). Large sawmills with specialized units appear to have more complex physical flows (for instance consolidation terminals) than do the smaller sawmills. Small sawmills appear to strive for simplicity i.e. delivering ex-works and leaving the distribution planning and arrangement to the customers (for instance an export agent) and hence do not desire to integrate. On the other hand larger sawmills appear to strive for a fewer number of external intermediaries in the distribution channel; delivering from consolidating terminals to the customer by conducting the activities themselves. Further, the level of integration differs between the studied sawmills, from rudimentary levels to the first steps of collaboration as defined by Singh and Power, (2009)) and Chen et al., (2009a) depending on complexity; large sawmills strive for integration, whilst small sawmills leave the distribution channel functions to the customers.

Four of the studied sawmills have a cost strategy, but only one has a focus strategy. Further, one sawmill has an upstream focus (i.e. supplier focus), two have a production focus, and two a downstream focus (i.e. customer focus). The studied sawmill with a focus strategy purchases timber from forest cooperatives, and as the sawmill knows its customers and purchases the timber it needs for the customers' specific production, its focus is on efficient production. One of the studied sawmills (cost leadership strategy) has an upstream focus in which it is totally dependent on nearby forest owners, and purchases all products the forest owners are willing to sell at any time. The studied sawmills with a cost leadership strategy and downstream focus (who have secured the supply of timber by using purchasing companies) are aware of business opportunities by getting closer to the customer, allowing for the possibility of cost reductions in the long-run. These sawmills feel the need of control over the distribution channel, and consequently strive to integrate (i.e. collaborate) with their customers. On the other hand, not surprisingly, sawmills with an upstream or production focus have a straightforward distribution channel to selected customers (with whom they do not actively strive for integration, not even cooperation). Further, large sawmills with specialized units need network flows of raw materials and finished products, and their distribution channels therefore become complex.

Table 4. Tentative findings on distribution channel characteristics, and contingency variables

Firm characteristics		Distribution Channel Characteristics			Contingency Variables				
<i>Firm id</i>	<i>Firm size and no of units</i>	<i>Channel organization structure</i>	<i>Channel Physical Flow Structure</i>	<i>Channel Process Int.</i>	<i>Firm Focus and Competitive Strategy</i>	<i>Environ-mental Uncertainties</i>	<i>Environ-mental Heterogeneity</i>	<i>Imp. of Logistics</i>	<i>Imp. of IT</i>
A	Small 1	Mill – Export agent – Importer/wholesaler – Customer (D)	Direct from mill to Importer/wholesaler stock	Low level	Production focus. Focus strategy.	Raw materials supply, sales market currencies and demand.	Low level – Narrow product line and focused customer group	Transportation	Low
B	Small 1	Mill – Export agent – Importer/wholesaler – Customer (D)	Direct from mill to Importer/wholesaler stock	Low level	Upstream focus. Cost leadership strategy.	Raw materials supply, sales market currencies and demand.	Low level – Standard product line and well established customers	Transportation	Low
C	Small/Medium 1	Mill – Importer/wholesaler – Customer (NL)	Direct from mill - Importer/wholesaler stock	Cooperati on level	Production focus. Cost leadership strategy.	Raw materials supply, sales market currencies and demand.	Low level – Standard product line and well established customers	Transportation Tied up capital for customer stock	Medium – Facilitator for customer service
D	Medium size 3	Mill – Importer/Wholesaler (owned) – Customer (UK)	From mill to arranging complete shipment at terminal to shipment to customer	Cooperati on level	Downstream focus. Cost leadership strategy.	Raw materials supply, sales market currencies and demand.	Medium level – Extended product line and several customer types	Transportation Tied-up capital on markets Logistics service levels	High – Web-based interface for order placement
E	Large 10	Mill – Importer/Wholesaler (owned) – Customer (UK)	From mill – arranging complete shipment at terminal – shipment to customer	Collaborat ion level	Downstream focus. Cost leadership strategy.	Raw materials supply, sales market currencies and demand.	Medium level – Extended product line and several customer types	Transportation Tied-up capital on markets Logistics service levels	High – Web-based interface for order placement

*Tentative statement 1: Sawmill focus differs between the studied sawmills: the more downstream focus, the more elaborated are the distribution channel characteristics. Further, there is a variety of competitive strategies amongst the studied sawmills: however a majority of the sawmills appear to apply to cost leadership strategies, though the distribution channel characteristics differ both with regards to structure and integration. All of the studied sawmills have identified the same environmental uncertainties; supply, sales market currencies and demand. These are uncertainties whose outcomes are unpredictable for the individual sawmill, and which force the sawmills to consider strategic level issues, for instance identifying new stable markets (both with regard to customers but also with regard to currencies). All sawmills are closely connected to their suppliers, and the individual sawmill needs to purchase all the products (timber and pulpwood) that the suppliers want to sell. Hence variations in the supply of raw materials set limits for the stability of the distribution channel, where there is a certain need for flexibility in order to be able to re-arrange amongst, for instance, intermediaries. The larger sawmills have decreased their level of flexibility due to their strategic choices regarding instant integration (i.e. collaboration).*

*Tentative statement 2: All of the studied sawmills perceive the same environmental uncertainties, regardless of distribution channel characteristics and integration. According to Chow et al, environmental heterogeneity consists of suppliers, products, and customers. The smallest sawmills purchase timber from other forest corporations and thereby have the possibility of purchasing the timber they need. Four of the five studied sawmills purchase timber on the open market, either directly or through a purchase company owned within the group. These sawmill are therefore dependent upon the willingness of private forest owners to sell. Further inherent in the production of softwood lumber is that all parts of the log need to be taken care of. Hence one log of timber consists of many variants of softwood lumber, and each individual sawmill needs to find customers for each of the products, either as they are or refined. The studied sawmills differ with regards to experienced environmental heterogeneities; the smaller sawmills with either a standard or narrow product line aimed at a specific customer group experience a low level of environmental heterogeneity, whereas the larger sawmills with extended product lines and several customer types experience a medium level of environmental heterogeneity. The product line (either narrow or broad) defines the specification for the distribution channel; sawmills with a standard or narrow product line aimed for a specific customer group have an uncomplicated distribution channel structure with direct distribution and an aim for ex-works delivery terms; on the other hand, sawmills with extended product lines and several customers have a need for terminals, and hence there will be a complex structure of the distribution channel. The number of customer groups, as well as selected groups, defines the amount of work for integration and distribution channel structure, where sawmills with broad groups and large number of customers need sales and SCM-organisation close to the market, whereas sawmills with few customers have a possibility of focusing on the distribution channel.*

*Tentative statement 3: Environmental heterogeneities differ between the studied sawmills: studied sawmills with a higher level of environmental heterogeneities have a more complex distribution channel structure and higher levels of integration than do the other sawmills. According to theory, logistics aspects are costs, tied-up capital, and service. All of these aspects exist in the distribution channel for softwood lumber; costs for transportation (softwood lumber being bulky with a low value) are intensive, and hence there is a need to control transportation resources; storage and consequently tied-up capital exist in stock at mill and on market, while value is created by offering services, rendered by logistics, to the customers. Costs for transportation occur in all types of sawmill, independently of organizational structure, physical flow structure and process integration. The other aspects differ with regards to physical flow structure and*

process integration, where the studied sawmills, aiming for integration (either on cooperation, coordination, or collaboration) appear to also focus on tied-up capital and logistics service levels. Not surprisingly, as these sawmills have identified meeting customers' requirements as important, and uses integration as a means for that. *Tentative statement 4; The importance of logistics differs between the sawmills studied: studied sawmills that consider logistics to be more important have a more complex distribution channel structure and higher levels of integration than do the other sawmills.* The studied sawmills regard the importance of IT differently; the smallest sawmills do not regard IT as important, whereas the larger sawmills consider IT as an enabler in meeting customer requirements, where the largest sawmills offer a web-shop for their customers. This is in line with theory, as IT plays an important role in supporting primary value adding activities. *Tentative statement 5; The importance of IT differs between the studied sawmills: studied sawmills that appear to perceive IT to be more important than do the other sawmills have a more complex distribution channel structure and higher levels of integration.* By studying these contingency variables, a pattern of sawmill categories emerges; the first category, in which production is focused, are the small single sawmills (with a cost leadership or focus strategy) which aim to deliver their products to independent actors ex-works; the sawmills which comply to this category do not consider logistics or IT as important, neither do they take integration into consideration. The second category consists of larger multi-unit sawmills with a downstream focus, which strive to integrate and control the distribution channel (in the most extreme cases acquire strategic actors) in order to achieve stable presence on strategic markets. Sawmills included in this category regard logistics and IT as important.

The sawmill industry logic is different from the majority of industries in focus for main stream research on SCM and DC. It is an industry with divergent material flows, slowly developing from a commodity logic into a product industry logic, and undergoing industry restructuring from fragmented to concentrated industry structure. The interesting question is how these changes affect structure and integration in the distribution channel and what are the specific contingencies driving this change. The answers to these questions will make a contribution to the overall understanding of differences in DC and SC design between industries with different structural characteristics. Contingency variables that seem to have an influence on DC structure and integration are i) the change from the single unit firm to the network structured firm, ii) the change from commodity product line to differentiated product line, and iii) the change of market and competitive strategy vs customers and international markets. These findings seem to be complementary to research done by Bucklin et al (1996), Wren (2007) and Stonebreaker & Afifi (2004).

## References

- Adolfsson, G., Melin, U. & Markgren, U. (2000), *Samverkan och affärsutveckling i träkedjan - sågverk och nätverk i förändring*. Stockholm, Trätek.
- Alkbrink, M. (2003), *Branschreceptets dubbelhet*, In Economics, U.S.O.B.A. (Ed.) 214. Umeå Univeristy.
- Arshinder, A., Kanda, A. & Deshmukh, S. (2008), Supply chain coordination: Perspectives, empirical studies and research directions, *International Journal of Production Economics*, Vol. 115, pp. 316-335.
- Bagchi, P., Ha, B., Skjott-Larsen, T. & Soerensen, L. (2005), Supply chain integration: a European survey, *The International Journal of Logistics Management*, Vol. 16, pp. 275-294.
- Ballou, R. (1992) *Business Logistics Management*, Prentice Hall

- Bask, A. & Juga, J. (2001), Semi-integrated Supply Chains: Towards the New Era of Supply Chain Management, *International Journal of Logistics Research and Applications*, Vol. 4, pp. 127-152.
- Bergqvist, B., Karlsson, G. & Palm, R. (1988) *Sågverkens kostnader*, In 8806039, Trätæk.
- Bucklin, L.P., ed., (1971). *Vertical marketing systems* (Scott Foresman and Company, Glenview, IL).
- Bucklin, L. P., Ramaswamy, V. & Majumdar, S. K. (1996), Analyzing channel structures of business markets via the Structure-Output Paradigm, *International Journal. of Research in Marketing*, 13 (1996)73-87
- Chen, H., Daugherty, P. J. & Landry, T. (2009a), Supply Chain Process Integration: A Theoretical Framework, *Journal of Business Logistics*, Vol. 30, pp. 27-46.
- Chen, H., Daugherty, P. J. & Roath, A. S. (2009b), Defining and operationalizing supply chain process integration, *Journal of Business Logistics*, Vol. 30, pp. 63-84.
- Chow, G., Heaver, T.D. & Henriksson, L.E. (1995), Strategy, Structure, and Performance: A Framework for Logistics Research, *Logistics & Transportation Review*, Vol. 31, pp. 285-309.
- Clinton, S. R. (1997), *Context-Strategy-Structure-Performance in logistics: a contingency approach*. Dept of Marketing and Supply Chain Management. Michigan State University.
- Closs, D. & Savitskie, K. (2003), Internal and External Information Technology Integration. *The International Journal of Logistics Management*, Vol. 14, pp. 63-76.
- Couglan, A., Anderson, E., Stern, L. & El-Ansary, A. (2006), *Marketing channels*, Pearson International Edition.
- Dinwoodie, J. & Xu, J. (2008), Case studies on logistics: a review and tentative taxonomy, *International Journal of Logistics: Research and Applications*, Vol. 11, pp. 393-408.
- Fabbe-Costes, N. & Jahre, M. (2007), Supply Chain Integration improves performance: the Emperor's new suit?, *International Journal of Physical Distribution and Logistics Management*, Vol. 37, pp. 835-855.
- Fabbe-Costes, N. & Jahre, M. (2008), Supply chain integration: a review of evidence, *The International Journal of Logistics Management*, Vol. 19, pp. 130-154.
- Fawcett, S. E. & Magnan, G. M. (2002), The rhetoric and reality of supply chain integration, *International Journal of Physical Distribution & Logistics Management*, Vol. 32, pp. 339-361.
- Frohlich, M., T. & Westbrook, R. (2001), Arcs of integration: an international study of supply chain strategies, *Journal of Operations Management*, Vol. 19, pp. 185-200.
- Germain, R. & Iyer, K. (2006), The interaction of internal and downstream integration and its association with performance, *Journal of Business Logistics*, Vol. 27, pp. 29-51.
- Gimenez, C. (2006), Logistics integration processes in the food industry, *International Journal of Physical Distribution & Logistics Management*, Vol. 36, pp. 231-249.
- Gimenez, C. & Ventura, E. (2005), Logistics-production, logistics-marketing and external integration. *International Journal of Operations & Production Management*, Vol. 25, pp. 20-38.
- Golicic, S. L., Foggin, J. H. & Mentzer, J. (2003), Relationship magnitude and its role in interorganizational relationship structure. *Journal of Business Logistics*, Vol. 24, pp. 57-75.
- Gustafsson, Å. (2006), *Customer service requirements and logistics strategies in the Swedish Sawmill Industry* School of Technology and Design. Växjö, Växjö University.
- Haartveit, E.Y., Kozak, R. A. & Maness, T. C. (2004). Supply Chain Management Mapping for the Forest Products Industry: Three cases for Western Canada. *Journal of Forest Products Business Research*, Vol 1, No 5

- Harstela, P. (1993), *Forest work Science and Technology*, Part 1, Joensuu: Jounsuun ypiopisto. Silva Carelica 25.
- Holma, H. (2006). *Supply chain management and industry cyclicalilty*. Dept of Marketing, University of Oulu
- Holmlund, M. & Kock, S. (1996), Buyer Dominated Relationships in a supply chain - A case study of four small-sized suppliers. *International Small Business Journal*, Vol. 15, pp. 26-31.
- Kalwani, M. U. & Narayandas, N. (1995), Long-Term Manufacturer-Supplier Relationships: Do They Pay off for Supplier Firms?, *The Journal of Marketing* Vol. 59, pp. 1-16.
- Kim, S. (2006a), The effect of supply chain integration on alignment between corporate competitive capability and supply chain operational capability, *International Journal of Operations & Production Management*, Vol. 26, pp. 1084-1107.
- Kim, S. (2006b), Effects of supply chain management practices, integration and competition capability on performance, *Supply Chain Management: An International Journal*, Vol. 11, pp. 241-248.
- Kim, S. (2009), An investigation on the direct and indirect effect of supply chain integration on firm performance, *International Journal of Production Economics*, Vol. 119, pp. 328-346.
- Kohn, J., McGinnis, M. & Kesava, P. (1990), Organisational Environment and Logistics Strategy: An empirical Study, *International Journal of Physical Distribution & Logistics Management*, Vol. 20, pp. 22-30.
- Lee, C., Kwon, I.-K. & Severance, D. (2007), Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer, *Supply Chain Management: An International Journal*, Vol. 12, pp. 444-452.
- Mattsson, S-A. (1999). *Effektivisering av materialflöden i supply chains*. Acta Wexionensia. No 2. Växjö University
- Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C.D. and Zacharia, Z. G. (2001), Defining Supply Chain Management, *Journal of Business Logistics*, Vol.22, No. 2
- Morgan, R. M. & Hunt, S. D. (1994), The Commitment-Trust Theory of Relationship Marketing, *The Journal of Marketing*, Vol. 58, pp. 20-38.
- Mouritsen, J., Skjøtt-Larsen, T. & Kotzab, H. (2003), Exploring the contours of supply chain management. *Integrated Manufacturing Systems*, Vol. 14, pp. 686-695.
- Månsson, J. (2003), Economies of scale in the Swedish sawmill industry. *Journal of Forest Economics*, Vol. 9, pp. 169-179.
- Narasimhan, R. & Soo, W. K. (2002), Effect of supply chain integration on the relationship between diversification and performance: evidence from Japanese and Korean firms, *Journal of Operations Management*, Vol. 20, pp. 303-323.
- Olhager, J. & Selldin, E. (2004), Supply chain management survey of Swedish manufacturing firms, *International Journal of Production Economics*, Vol. 89, pp. 353-361.
- Pagell, M. (2004), Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics, *Journal of Operations Management*, Vol. 22, pp. 459-487.
- Paulraj, A. & Chen, I. (2007), Strategic Buyer-Supplier Relationships, Information Technology and External Logistics Integration, *The Journal of Supply Chain Management*, Spring, pp. 2-14.
- Pfohl, H.-C. & Zöllner, W. (1997), Organization for logistics: the contingency approach. *International Journal of Physical Distribution & Logistics Management*, Vol. 27, pp. 306-320.
- Porter, M. (1980) *Competitive strategy*, Free Press.

- Romano, P. (2003), Co-ordination and integration mechanisms to manage logistics processes across supply networks, *Journal of Purchasing & Supply Management*, Vol. 9, pp. 119-134.
- Roos, A., Flinkman, M., Jäppinen, A., and Warensjö, M. (2002), Identification of Value-adding Strategies in the Swedish Sawn Wood Industry, *Scandinavian Journal of Forest Research*, Vol. 17, pp. 90-96.
- Sandberg, E. (2007), Logistics collaboration in supply chains: practice vs. theory, *The International Journal of Logistics Management*, Vol. 18, pp. 274-293.
- Sanders, N. & Premus, R. (2005), Modelling the relationship between firm IT capability, collaboration, and performance, *Journal of Business Logistics*, Vol. 26, pp. 1-23.
- Simatupang, T. M. & Sridharan, R. (2004), Benchmarking supply chain collaboration - An empirical study, *Benchmarking: An International Journal*, Vol. 11, pp. 484-503.
- Simatupang, T. M. & Sridharan, R. (2005), The collaboration index: a measure for supply chain collaboration, *The International Journal of Physical Distribution & Logistical Management*, Vol. 35, pp. 44-62.
- Singh, P. J. & Power, D. (2009), The nature and effectiveness of collaboration between firms, their customers and suppliers: a supply chain perspective, *Supply Chain Management: An International Journal*, Vol. 14, pp. 189-200.
- Skjøtt-Larsen, T., Thernoe, C. & Andersen, C. (2003), Supply chain collaboration Theoretical perspectives and empirical evidence, *International Journal of Physical Distribution & Logistics Management*, Vol. 33, pp. 351-549.
- Soroor, J., Tarokh, M. & Shemshadi, A. (2009), Theoretical and practical study of supply chain coordination, *Journal of business & Industrial Marketing*, Vol. 24, pp. 131-142.
- Spekman, R. E., Kamauff, J. J. W. & Myhr, N. (1998), An empirical investigation into supply chain management: A perspective on partnerships, *International Journal of Physical Distribution & Logistics Management*, Vol. 28, pp. 630-650.
- Staland, J., Navrén, M. and Nylinder, M. (2002), *Resultat från sågverksinventeringen 2000*, SLU, Sweden.
- Stank, T., Keller, S. & Daugherty, P. J. (2001), Supply chain collaboration and logistical service performance, *Journal of Business Logistics*, Vol. 22, pp. 29-48.
- Stock, G. N., Greis, N. P. & Kasarda, J. P. (2000) Enterprise logistics and supply chain structure: the role of fit, *Journal of Operations Management* 18 \_2000. 531-547
- Stonebraker, P. W. & Afifi, R. (2004), Toward a contingency theory of supply chains, *Management Decision*, Vol. 42 No. 9, pp. 1131-1144
- Van Deer Vaart, T. & Van Donk, D. P. (2008), A Critical Review of Survey-based Research in Supply Chain Integration, *International Journal of Production Economics*, Vol. 111, No. 1, pp. 42-55.
- Wren, B., Channel Structure and Strategic Choice in Distribution Channels, *Journal of Management Research*, Vol. 7, No. 2, pp 78-86
- Yin, R. (2003), *Case study research Design and Methods*, Sage Publications.
- Zeithaml, V. A., Varadarajan, P. R. & Zeithaml, C. P. (1988), The Contingency Approach: Its Foundations and Relevance to Theory Building and Research in Marketing, *European Journal of Marketing*, Vol. 22, pp. 37-63.