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# Product Development in the Swedish and Finnish Sawmilling Industry – A Qualitative Study of Managerial Perceptions

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## ABSTRACT

The importance of product development in the wood industry has recently been pointed out by several industry experts. Despite this, few studies have investigated actual product development processes in this context. This comprehensive study investigates innovation, specifically product development, in the Swedish and Finnish sawmilling industry. The objective was to create broad, basic knowledge that facilitates further studies of the topic. Data were obtained from interviews with 19 product development managers in 14 sawmilling companies. Industry and market changes, leading to changing customer needs, were found to be the most common driver of product development. Companies commonly started product development projects to increase competitiveness of the product portfolio. However, respondents' narratives about these projects revealed that they also had a significant effect on the renewal of the companies' resources and capabilities. The product development process is described by respondents as informal and flexible and emphasizes testing and feedback procedures. Key factors for success include promotion of entrepreneurship and market orientation, and set up of rapid and informal, yet complete and well-defined development projects led by a strong leader. Respondents mentioned the allocation of competent people specifically to development work and access to flexible and versatile production equipment as important prerequisites for success. Finally, resource constraints, process uncertainties, weaknesses of the wood material, and structural shortcomings of supply chains to some market segments were identified by respondents as obstacles to product development.

*Keywords:* innovation, product development, strategy, resource-based view, forest industry, wood industry, sawmilling, exploratory study

## Introduction

The sawmilling industry has long been characterized as production-oriented. Efficient production of commodity products has been the norm and incremental process innovation has been favored (Korhonen and Niemelä 2005; Juslin and Hansen 2003; Schaan and Anderson 2002). The product standards set up in the Swedish Green book, the Finnish Green book and subsequently Nordic Timber (anon. 1995)[1] have significantly influenced the production and trade of Nordic sawn goods during the latter part of the 20th century (Juslin and Hansen 2003). Lately, customers have begun to demand

specially adapted products and services with more value added and the importance of product standards set up in Nordic Timber has decreased. At the same time, relatively high costs, over-capacity, volatile markets, and increased competitive pressure have resulted in lowered growth and profitability in the Nordic sawmilling industry (European Confederation of Woodworking Industries (ed.) 2004). The Nordic sawmilling industry is now focusing on improving its market position through regeneration of product and market strategies and restructuring of the value system (TTJ 2005). Development of the value proposition combined with a continuous focus on cost efficiency, consolidation, shortening of market channels, co-opetition, and generic wood promotion are strategies commonly suggested by researchers and consultants (Nord 2005, European Confederation of Woodworking Industries (ed.) 2004, Korhonen and Niemelä 2003, Jakobsen et al. 2001). Various product development initiatives can now also be seen in the industry (TTJ 2005).

(1) To facilitate sales and purchase of sawn wood, it is commonly sorted in classes based on its features. Sawn wood can be characterized according to species, dimension, quality grade (occurrence of knots and defects on a specific board), moisture content, and degree of processing. The Swedish and Finnish Green books and the Nordic Timber publication provide standardized rules for quality grading of sawn wood in classes adapted for different end-uses. See Juslin and Hansen (2003, pp. 90-96) for further explanation of the major grading systems used in world trade of sawn wood.

Innovation has received much attention from researchers over the years. With regard to the forest sector, however, the topic has only been briefly explored (Kubeczko and Rametsteiner 2002). Previous studies on innovation in the forest industry have recognized the distinct categories product, process and business systems innovation (Hovgaard and Hansen 2004). In the wood products industry, the focus of previous research has been on process innovation, while product innovation has received less attention (see Hansen et al. 2006 for a review). Consequently, research on product development in the wood industry is 'a wide open field' (Hansen et al. 2006), and further exploratory research is needed. Innovation research in the forest sector is currently expanding, and innovation in the wood industry is receiving increasing interest from researchers (Rametsteiner et al. 2006).

## Purpose of the Study

The purpose of this study is to explore product development in large and medium-sized sawmilling companies(2) in Sweden and Finland, a population called 'the Swedish and Finnish sawmilling industry' in this paper. The objective is to create broad, basic knowledge that facilitates further studies of the topic. The specific research questions are:

- What are the strategic objectives for product development?
- What are the outcomes of product development?
- What are the drivers of product development?
- What activities and actors are included in the product development process?

- What are the key factors for successful product development?
- What are the most important obstacles for product development?

(2) Swedish Standard Industrial Classification (SNI 2002) category 20101: 'sawmilling', respectively Statistics Finland's Standard Industrial Classification (TOL 2002) category 20100: 'sawmilling and planing of wood; impregnation of wood'.

## Theoretical Background

*Innovation* is the generation, acceptance, and implementation of new ideas, processes, products, or services (Thompson 1967). Newness is a relative concept, so in this study, the requirement for an idea, process, or product to be considered an innovation is that it must be new or significantly improved with respect to its characteristics or intended uses in the eyes of the focal company (OECD/Eurostat 2005). An innovation can also be new to the market or new to the world depending on whether it has been implemented by other companies in the market or in the world. Garcia and Calantone (2002) describe this continuum of newness as the degree of *product innovativeness. Organizational innovativeness* has mainly been conceptualized from two perspectives: as a behavioral variable, i.e., the rate of adoption of innovation, and as the willingness to change (Calantone et al. 2002). In this study, organizational innovativeness will be defined as the propensity to adopt or create, develop, and implement innovations (Hansen et al. 2006 referring to Knowles 2005, Hovgaard and Hansen 2004).

Four types of innovations can be distinguished (OECD/Eurostat 2005): A *product innovation* is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components, and materials, incorporated software, user friendliness or other functional characteristics. A *process innovation* is the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment, and/or software. A *marketing innovation* is the implementation of a new marketing method involving significant changes in product design or packaging, placement, promotion or pricing. An *organizational innovation* is the implementation of a new organizational method in the firm's business practices, workplace organization, or external relations. *Product development* is used as an ensemble term for the span of activities leading to, or that are intended to lead to, product innovations (OECD/Eurostat 2005).

Proponents of the resource-based view on strategy (Barney 2001, 1991; Grant 1991; Wernerfelt 1984; Penrose 1959) assert that long-term profitability and growth is driven by competitive advantage, which in turn depends on the possession and well-organized utilization of valuable and unique resources and capabilities that are difficult to imitate or transfer. Contingency theory advocates that the success of firms depends on the fit between the firm's capabilities (manifested e.g. in product offerings) and the external environment, termed the 'strategic fit' (Grant 2002, Liedtka 2000 in DeWit and Meyer 2004, Zajac et al. 2000). The dynamic-capability view (Eisenhardt and Martin 2000, Teece et. al 1997) stresses the continuous change of external conditions and states that, in the long-run, the performance of a firm depends on the development and leverage of capabilities sooner, more inventively or more fortuitously than its competitors (Eisenhart and Martin 2000, Schumpeter 1934). Product development contributes to the development of capabilities through its role in the coordination,

integration, reconfiguration, recombination, transformation, creation, or release of resources (Ireland et al. 2003, Eisenhardt and Martin 2000, Teece et al. 1997). In fact, firm competencies and product development interact in a dynamic process of firm-renewal (Danneels 2002). Thus, product development contributes to value creation and sustained and/or increased competitiveness through revitalization of the product offerings and of the resource and capability portfolio of the firm. According to Rogers (2003) competitive capacity depends not only on the ability to create innovations internally, but also on the ability to adopt and internalize innovative ideas that are created in the environment.

Drucker (2002) concluded that the drivers of innovation are found in process needs, industry and market changes, new knowledge, unexpected success or failure, incongruities, demographic changes, and changes in perception. In the Nordic wood products industry, industry and market changes have led to new process needs, e.g., outsourcing strategies of the joinery and furniture industry causing a demand for customised blanks (Fransson 2005), a consolidating retail segment demanding product innovation and supply chain management (Henningsson 2005), and a general increased focus on environmental performance (Kärnä 2003). Changes in regulations and perceptions concerning wood in multi-story construction have resulted in increased interest in wood as a construction material, thus inducing a need for wood-based system solutions for the construction industry (Nord 2005). New knowledge is also visible in the industry, manifested in new wood processing technology such as automatic camera grading or x-ray-based grading, improved kiln-drying, and wood treatment techniques.

Product development is an example of a cross-functional organizational capability (Korhonen and Niemelä 2005) that includes the coordination and integration of R&D, marketing, manufacturing, financing, and strategic planning (Juslin and Hansen 2003, Grant 2002). Product development processes are typically dis-similar across market or industry contexts (Trott 2005, Juslin and Hansen 2003, Balachandra and Friar 1997). However, while the details of the process are often idiosyncratic and path dependent, the main features are more common and displayed in a well-known 'best practice' (Eisenhardt and Martin 2000). The product development process is commonly modeled according to the different activities and corresponding stages included. Activity-stage and decision-stage models are most commonly used (Trott 2005, Juslin and Hansen 2003). Juslin and Hansen (2003) identified a generic activity-stage model of product development:

- Idea generation
- Screening ideas or preliminary assessment
- Concept definition, concept testing and economic analysis
- Technical development of the product and marketing planning
- Test marketing
- Market launch of the product

Studies of product development in the North American and Scandinavian wood products industries have generally confirmed that these activities are parts of the product development process also in this industrial context (Crespell et al. 2006, Hovgaard and Hansen 2004, Vestlund and Hugosson 2004).

Although it may appear very structured when presented in generic models, product development in the wood products industry has also been described as informal and heavily influenced by intuition and common-sense (Hovgaard and Hansen 2004). Product development is commonly organized in the form of a project, i.e., activities that are specially organized, carried out with some demarcated purpose, and that have restrictions on use of time and resources (Trott 2005, Söderlund 2005). Finally, product development is not a process completely internal to organizations – it is carried out within the wider context of the innovation system (Çakmakçi 2005 in Trott 2005, Edquist 1997).

Previous cross-industry research (Trott 2005, Ernst 2002, Brown and Eisenhardt 1995, Cooper and Kleinschmidt 1995, Atuahene-Gima 1995, Montoya-Weiss and Calantone 1994) has identified some key factors for successful product development. Some of these factors (underlined in the list below) have been validated in studies of the forest industry (Crespell et al. 2006, Bull and Ferguson 2006, Vestlund and Hugosson 2004, Lee et al. 1999).

- A clearly specified product development strategy with a long-term focus, supported by the whole organization
- Support from senior management for product development
- A market oriented culture in the organization
- Product advantage (i.e., new product with superior customer value in relation to competing products) and synergy with the existing resource base
- A cross-functional, dedicated, autonomic, and accountable product development team
- Good external and internal communication ability in the product development team
- A project leader with power, vision, and management skill
- A structured and complete product development process including
    - proficient pre-analysis
    - clear specification of the new product concept
    - proficient market, technology, and business analysis
    - active monitoring of the project, including go/kill decisions
    - customer involvement
- High speed to market
- Large potential market

Product development is a resource-intensive investment with uncertain outcomes (Sivadas and Dwyer 2000, Balachandra and Friar 1997), and the risk of failure can keep companies from entering into product development projects. Nord (2005) concluded that the sawmilling industry struggles with uncertainties related to raw materials, the sawmilling production process and the market development.

Furthermore, the resource-based view on strategy points out that some resources are non-substitutable for certain capabilities (Barney 2001). Since product development involves building of capabilities, lack of necessary resources can hinder development efforts. Finally, the existing competencies of the firm can act as leveraging points for development of new products and new competencies. They can also, however, lock the company into previous behavior and act as constraints to further development (Danneels 2002, Leonard-Barton 1992). The wood industry is commonly judged to be traditionalistic and captured in 'old' core competencies (Nord 2005).

## Method

Current knowledge about product development in the wood industry is only at a basic level (Hansen et al. 2006). Therefore, further exploratory research on the topic is clearly motivated. The focus of this study was to investigate product development in the sawmilling industry. For this task, qualitative methods, including examination of a set of informative cases, were chosen (Yin 2003, Silverman 2001, Eisenhardt 1989). Qualitative case study research has also been used in other recent exploratory research about the forest industry (e.g., Hovgaard and Hansen 2004, Korhonen and Niemelä 2004).

To locate informative cases, purposive theoretical sampling was used (Silverman 2000). The goal was to include companies that could provide rich information about product development and that belonged to theoretically relevant categories of the population. The sampling procedure began with identification of companies in the Swedish and Finnish sawmilling industry (SIC code 20101) that have considerable product development experience. For this task, eight industry experts from trade and research organizations in Sweden and Finland were asked to mention companies that fit this description.

The nominated companies were then evaluated with respect to their basic characteristics. Organizational size has been connected to both innovativeness (Hurley and Hult 1998, Cohen and Sinclair 1990) and performance in general (e.g., Porter 1981, Caves and Porter 1977, Bain 1956, Mason 1939). The nominated companies were therefore classified based on their number of employees as medium-sized (50 to 249 employees) or large (> 249 employees) companies. Furthermore, since product development practices partly differ in different industry contexts (Juslin and Hansen 2003, Eisenhardt and Martin 2000), nominated companies were classified based on their industry structure as either 'independents' or 'fiber conglomerates'. The first category included companies that were active only in the wood products industry and the second category included companies that were active also in neighboring forest industry sectors, such as pulp, paper, and panels. Because this research was a part of a Swedish-Finnish research consortium focussing on processing and marketing of Nordic pine, it was also assured that the nominated companies produced and marketed Nordic pine.

The companies in each class were then asked to participate in the study in an order based on the number of times mentioned by the industry experts. If a company refused to participate, the company with the next highest number of mentions was asked to participate. In total 8 Swedish and 6 Finnish case companies were included in the study (**Table 1**).

**Table 1.** Type, size class, origin, and respondents of case companies in the study.

| Type | Size class | Country | Respondent(s) |
|---|---|---|---|
| Fiber conglomerate | Large | Sweden | Marketing manager |
| Independent | Medium | Sweden | Marketing manager<br>Sales representative |
| Fiber conglomerate | Large | Sweden | Business line director<br>Sales representative |
| Independent | Medium | Sweden | Marketing manager |
| Independent | Medium | Sweden | CEO |
| Fiber conglomerate | Large | Sweden | Sawmill director |
| Independent | Large | Sweden | Sales and development director, pine<br>Raw material director, pine |
| Fiber conglomerate | Large | Sweden | Director product development<br>Product engineer |
| Fiber conglomerate | Large | Finland | Director R&D wood products |
| Independent | Large | Finland | Director sales, production, and development – Pine |
| Fiber conglomerate | Large | Finland | Director R&D wood products |
| Independent | Large | Finland | Vice president |
| Independent | Medium | Finland | Sales director |
| Fiber conglomerate | Large | Finland | Pine product portfolio director<br>Senior business analyst |

Semi-structured interviews (Trost 1997, Merriam 1994) was chosen as the method for data collection. The interviews were carried out during 2005. The first contact with the case companies was made by phone. CEOs, marketing managers, or development managers were contacted and asked whether their companies wished to participate. If they agreed to participate, key persons responsible for product development activities in the company were identified. Those key persons were targeted as respondents, and a time and place for a personal meeting was agreed with them personally. Before the meetings, a summary of the research project and the main topics for the interview were sent to the respondents.

The interviews were conducted at the office of the respondents, and lasted between 45 minutes and 4 hours. The interviews in Sweden were conducted in Swedish and the interviews in Finland were conducted in English. The interviews were tape-recorded and field notes were taken. The total time of recorded material from the interviews amounted to more than 23 hours. For each interview, an interview guide was used. It included the interview questions as well as general instructions for the conduct of the interview, and thus functioned as a case study protocol (Yin 2003). The interview guide was pre-tested and discussed with academics and industry practitioners (Silverman 2001). This discussion led to minor changes of the interview questions. Interview questions concerned product development, supply chain management, and customer relationship management. During the course of the study, however, the research questions were continuously developed as a result of our own analysis and feedback from academics and practitioners (Merriam 1994, Eisenhardt 1989). The research questions were narrowed to focus on the product development process and the meaning given to events in this process. Consequently, the interview questions were reformulated in order to answer the emerging set of final research questions. The final set of interview questions focused on product

development and was put to all respondents, partly using follow-up telephone interviews. The following set of final interview questions was used:

- How is product development work organized in your company?
- Please describe two recent product development projects.
- What was the new product idea?
- Why was the project started?
- What activities were carried out during the development process?
- What was the outcome of the process?
- Were you satisfied with the results?
- What were the key factors for success (or failure)?
- How is product development included in your business strategy?
- What are the strength and weaknesses of the Nordic pine sawmilling industry compared to competing industries?

The analysis of the final data set followed the strategy detailed below for qualitative data analysis recommended by Miles and Huberman (1994).

## Data Reduction

To facilitate further analysis, the first step was to concentrate and categorize the data (Kvale 1997). We started by reviewing the field notes, listening to the recorded interviews, and writing summaries of the information gained from each case. The information was concentrated with the aim of facilitating further analysis (Eisenhardt 1989). Summaries of all the interviews amounted to over 100 pages of single-spaced, 12-point, Arial text. To increase the validity of single accounts and the reliability of the data set as a whole, summaries were sent to each respondent for feedback (Yin 2003, Merriam 1994). Occasionally, this resulted in changes in the interview summaries, but only on the level of details. In the next step of the reduction phase, the data were categorized using thematic coding (Boyatzis 1998). Themes were formulated based on the research questions and a first read-through of the interview summaries. Each theme was assigned a label, a definition, and an indicator for categorization (Boyatzis 1998). Themes are displayed in **Table 2**. Two of the researchers then independently read through the concentrated data of each case study and categorized the information according to the themes. The researchers then read through the categorization of the other and any inconsistencies were discussed, resulting in a consensus final categorization (Silverman 2001).

**Table 2.** Themes from the interviews.

| |
|---|
| **THEME 1:** Strategic objectives for product development<br>**Definition:** Description of objectives for product development<br>**Indicator:** Coded when the respondent mentions objectives for product development projects |

| |
|---|
| **THEME 2:** Outcomes of product development<br>**Definition:** Description of effects, results, or consequences of product development.<br>**Indicator:** Coded when the respondent mentions effects, results, or consequences of product development. |
| **THEME 3:** Driving forces for product development<br>**Definition:** Descriptions of driving forces for product development.<br>**Indicator:** Coded when the respondent mentions specific factors that induce or create a need or opportunity for product development. |
| **THEME 4:** Product development process<br>**Definition:** Description of activities and actors in the product development process<br>**Indicators:** Coded when the respondent mentions activities or actors that are included or involved in the product development process. |
| **THEME 5:** Key factors for successful product development<br>**Definition:** Description of key factors for successful product development<br>**Indicator:** Coded when the respondent mentions factors that according to their view are responsible for the success of certain product development projects or that underpin successful product development in general. |
| **THEME 6:** Obstacles for product development<br>**Definition:** Description of factors that are seen as obstacles, problems, or risks associated with product development.<br>**Indicators:** Coded when the respondent mentions factors that have limited or may limit the chances of successful product development, or that ex-ante prevent the company from entering into product development projects. |

## Data Display

Following the categorization of data according to the themes listed above, the information gained from each case was displayed and compared for each theme. This cross-case analysis contributed to the exploration of the topic through the identification of patterns in the data within and across population categories.

## Conclusion – Drawing and Verification

Data reduction and display provided an overview of the data needed for drawing and verifying conclusions. In line with the principles of replication logic (Yin 2003), a view or opinion stated by several companies, at least three in our case, was considered to be a main finding of each theme. Main findings with response frequencies are presented in the section of Findings. It is important to point out that response frequencies are valid for the companies in this study, but are not statistically representative findings concerning the entire population. Furthermore, and as a tool to compare our findings with the literature, the pattern-matching-technique was used (Yin 2003, Eisenhardt 1989). This technique compares a theoretically predicted conceptual pattern with the empirical patterns from the actual study. The predicted theoretical pattern is thus refined through comparison with the empirical pattern. The product may be concepts, conceptual frameworks, propositions, or midrange theories (Eisenhardt 1989). The results of the pattern-matching are presented in the Discussion section.

To increase the validity and reliability of the research, several actions recommended by Yin (2003), Silverman (2000, 2001), Merriam (1994), and Eisenhardt (1989) were taken in different phases of the research (**Table 3**).

**Table 3.** Actions taken to safeguard validity and reliability of the study.

| Aspect of research quality | Actions taken in this study |
|---|---|
| Internal validity (The extent to which an account accurately represents the social phenomena to which it refers (Silverman 2000)). | – purposive and theoretical sampling<br>– respondents reviewed case study |

| | |
|---|---|
| | reports<br>– multiple coders for data categorization<br>– replication logic in the cross-case analysis |
| External validity (The extent to which the results from a study are applicable in other situations than the investigated one (Merriam 1994)). | – purposive and theoretical sampling<br>– replication logic in the cross-case analysis<br>– pattern matching during the conclusion-drawing and verification phase |
| Reliability (The degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions (Silverman 2000)). | – use of established qualitative methodology as the basis for research design<br>– use of a case-study protocol for interviews<br>– respondents reviewed case study reports<br>– detailed description of research methods |

## Findings

Findings are presented as text and **Tables 4 through 9**. Response frequencies in the tables indicate at how many companies each aspect was mentioned by respondents. Only aspects mentioned by at least three companies are reported in the tables. Because respondents mentioned several aspects or talked about several product development projects, the total response frequency can be higher than the number of companies in the study.

### Strategic Objectives for Product Development

All respondents mentioned improvement of growth or profitability of the company as the main reason for undertaking product development projects. Accordingly, when the respondents were asked if they considered a specific project to be successful, growth or increased profitability were the most frequent motivations for classification of a project as successful. "[The project was a success because ...] *we earned a lot of money* ..." (Independent, Sweden). Many respondents stated that product development was a tool to differentiate their products from competitors' products. Frequently mentioned objectives for differentiation strategy were price-skimming, standard setting, and inability or unwillingness to compete on price. This was most clearly expressed by the respondents representing medium-sized independents, who reported difficulties in matching cost-based competition from large companies. Another common objective was defense of current market position through updating of the product portfolio. Furthermore, forward integration or entrance into new markets was mentioned as direct reasons for developing new products. Several respondents also mentioned a positive effect on the relationship with customers as a reason for starting product development projects. Development of processes (e.g., supply-chain reengineering), marketing practices (e.g., sales promotion), and industry structure (i.e., consolidation) were frequently mentioned by respondents as complements to product development in the much-needed process of revitalising the industry.

Some respondents had a short-term operational perspective on product development, while others, commonly representing fiber conglomerates, had a more long-term perspective and described product development as an important part of an ongoing restructuring of the supply chain. The aim of the restructuring process was described as optimization of value in the supply chain as a whole through

improved efficiency and adaptation to customer needs. In the words of one respondent: "*Product development should work as a spear head-like process leading the development of value-optimized, integrated and segment-oriented supply chains.*" (Fiber conglomerate, Finland). The main strategic objectives for product development are summarized in **Table 4**.

**Table 4.** Strategic objectives for product development among case companies.

| Strategic objectives for product development | Response frequencies |
|---|---|
| Improved growth or profitability | 14 |
| Differentiation in current market position | 9 |
| Defend current market position | 8 |
| Forward integration | 7 |
| Improving relations with customers | 6 |
| Entrance into new markets | 5 |

## Outcomes of Product Development

In addition to the development and change of products, renewal of the integrative and functional resources and capabilities was commonly mentioned as an outcome of product development projects. Many respondents stated that they, because of the positive effect product development had on organizational capabilities, had become more positive toward product development projects even though they did not always yield the intended financial performance: "*At least, we gained a lot of new knowledge from the project …*" (Fiber conglomerate, Sweden). Some respondents pointed out the relatively high costs of learning through product development: " *…but sometimes I wonder; isn't there a simpler way of learning?*" (Fiber conglomerate, Sweden). Many respondents pointed out that there is a difference between 'product development' and 'continuous improvement'. The difference is based on the 'innovation height' of the intended outcome. Continuous improvement was described as more of an on-going process resulting in minor changes of current products, e.g., changes in quality grading, improved kiln-drying, or length specification. Product development, conversely, was described by respondents as a process aiming for an outcome with more 'innovation height'. Some respondents, however, hesitated regarding what should be classified as product development: "*Since we manufacture products according to customers' wishes, we develop new products all the time. But I do not think that is product development, it is more a continuous adaptation of the products according to customers' wishes. But it's the same old square piece of wood as it has always been.*" (Independent, Sweden). Outcomes of product development are summarized in **Table 5a and 5b**. All examples found for goods and services are reported, while only the main findings (mentioned by at least three respondents) are reported for resources and capabilities.

**Table 5a.** Outcomes of product development among case companies: goods and services.

| Outcomes: Goods and services |
|---|

| |
|---|
| Beam and joist system solution |
| Laminated construction components |
| Finger-jointed and/or laminated blanks for joinery industry |
| Decking system solution |
| Heat-treated outside panelling |
| Brushed flooring |
| Sawn goods graded on heartwood content |
| Sawn goods graded according to specific customer needs |
| Sawn goods graded according to product standards |
| Green-split sawn goods |
| Panelling with knot-bleeding-resistant surface treatment |
| Just-in-time delivery |
| Wholesaling |
| Pick-a-pack distribution |
| Merchandising and sales promotion activities at retailers |

**Table 5b.** Outcomes of product development among case companies: resources and capabilities.

| Outcomes: Resources and capabilities | Response frequencies |
|---|---|
| Customer relations | 7 |
| Willingness to innovate among personnel | 6 |
| Knowledge about management of product development | 6 |
| Machine equipment | 5 |
| Market and marketing knowledge | 3 |
| Technology knowledge | 3 |
| Company image | 3 |

## Drivers of Product Development

Many respondents referred to changing market conditions and new requirements for differentiation or even for participation in the traditional markets of Nordic pine as drivers of product development. Thus, product development projects were in most cases initiated as a reaction to changes in the micro environment, e.g., competitors' actions or changing customer needs. Examples of customer needs reported were: DIY-chains asking for user-friendly and fashionable products for end-consumers delivered just-in-time; the joinery and furniture industry asking for customized blanks and components instead of commodities; and the construction industry demanding prefabricated system solutions. Several respondents pointed out the increased general competition in the market as a driver of product development. Furthermore, some respondents reported that they had proactively started development projects. The main drivers cited for proactively starting a development project were: a desire among key persons within the firm to seek an improved market position "*We've got to do something!*" (Independent, Sweden), a recognition of a strategic opportunity (sometimes stemming from combining 'old' knowledge about wood with the processing possibilities inherent in new technology), or a need to take care of consequential products stemming from the diverging material flow. Drivers of product development are summarized in **Table 6**.

**Table 6.** Drivers of product development among case companies.

| Drivers of product development | Response frequencies |
|---|---|
| Customer demands | 14 |
| A need to find use for consequential products | 6 |
| New technology | 4 |
| Increased general competition in the market | 3 |
| A desire among key persons within the firm to seek improvement of the firm's current market position | 3 |

## Product Development Process

### *Idea generation and evaluation*

Idea generation and evaluation was reported to be the starting point of the product development process at all companies. Generation of ideas for new products was most commonly reported to be carried out by sales personnel. Typically the sales representative either proposes a new product concept that he or she has come up with by him or herself or together with customers, or reports about market conditions that the organization needs to consider and possibly tackle with product development. "*The ideas are often generated through discussions between the sales representative and the customer. Or, the sales representative sees something at the customers that leads to an idea of what we should do, for example something that our competitors do.*" (Independent, Sweden). In a few cases, the idea was generated by the production personnel, by senior management, or by the R&D department. One respondent mentioned that 'external innovators' sometimes approached them with ideas for further development and commercialization. The ideas generated are typically initially assessed through a basic analysis where market, technical, and raw material prerequisites are considered. Simple pre-calculation and 'gut feeling' are important tools in this process. A managerial decision then precedes the start up of the development project. "*I want three green lights before I decide if we should go ahead with the project: big interest from the customer, proper processing facilities available, and the right raw material.*" (Fiber conglomerate, Sweden).

### *Project start*

If a decision to go ahead is taken, a dynamic testing and problem-solving process aiming for development of the new product and production process started. The activities of the development work were reported to be going on in parallel and intertwined with frequent feedback-loops. Some respondents stated that the product development work is organized in project form. The formality of the projects differed from case to case. The most formally set up projects included distinct framing of the project with a separate budget, a time schedule, and the appointment and organization of project members (functional experts), a management committee, a leader, and external partners. "*And then we set up a project, and I was appointed as the responsible project manager. I put together a group consisting of the right people, which also included persons from* [a research institute]. *The customer also set up a project group, which was our contact-point for feedback and joint problem solving.*" (Fiber conglomerate, Sweden). The more informally set up projects were managed by one or a few members from the sales or production staff who included personnel from other functional units or

senior management on an ad-hoc basis. Some respondents reported that product development projects were managed through inclusion in the regular sales and production meetings. "*We are a tight management team and we discuss these things round the coffee table and in our regular meetings.*" (Independent, Sweden).

### Analysis of raw-material, technology, and market prerequisites

An analysis of prerequisites and implications of the new product and its production, marketing and delivery was reported as the next step in all companies. This analysis was commonly reported to be carried out by functionally specialized expertise. "*Everyone works on their respective area and reports the results in the project meeting. Of course there is also a lot of discussion outside the meetings.*" (Independent, Sweden). Common functions involved in the projects were production (including quality control and production planning) and marketing and sales (including outbound distribution and occasionally sales agents). When the new product needed special raw material, the timber supply function played an important role.

### Development of processes and business systems

When describing the product development work, almost all interviewees also described some type of development of processes or business systems. This was seen as an integrated part of product development leading to everything from major investments in equipment to smaller changes in production processes or logistic flows. Some respondents also described the development of new marketing or organizational practices as an integrated part of product development. Due to the integrated nature of process and product development, investment analysis and decisions were frequently included. Some respondents stated that the machine investments could come some time after the new product had been developed. In that case, the new product was initially produced with current production facilities or by a sub-contractor. The investment was then made when the new product proved to be endurably successful, with the aim of more efficiently exploiting its value. "*We had a working product concept, but could not produce it efficiently. After a while we decided to invest in a more efficient production solution.*" (Fiber conglomerate, Sweden).

### Test production followed by customer and employee feedback

Test production followed by customer and employee input was mentioned at all companies as a very important part of the development work. Test production was commonly started without much detailed pre-calculation, since such analysis was considered to yield insufficient, imprecise information and also to be very difficult. "*If we believe in the product, we simply make a trial-run.*" (Independent, Sweden). For the development projects targeting industrial customers, the respondents reported the acquisition of feedback to be simple and natural. "*I find it much more rewarding to do product development for the industrial customers. They know what they want and are open to discussions.*" (Fiber conglomerate, Finland). For projects targeting retail, the most common feedback from the retailers was statements on the relative sales performance the new product reached: "*You know, the purchasing managers do not have a clue about what their customers think about the new product other than that he sees how much they sell of it.*" (Fiber conglomerate, Sweden). Some respondents describing projects targeting retail customers reported that they actively sought more detailed information from the retailers' end-consumers concerning their perceptions of the new product. "*The best way of getting feedback is to go out in the stores and ask people what they*

*think*." (Fiber conglomerate, Sweden). Overall, customer feedback was described as a crucial part of the development process.

### *New product launch, project end, and post-calculation*

If the product development project was triggered by a concrete customer inquiry, and the new product was evaluated to be satisfactory by both producer and receiver, the product launch was not difficult and followed naturally. If, however, the new product was developed on a proactive initiative, respondents reported that the launch of the new product was a demanding activity that was crucial for commercial success, especially in the retail and construction segments. Communication of product benefits, building of confidence for the new product through relationship marketing, and point-of-sales activities were mentioned as important launch activities. "*One of the most important parts in product development projects for the retail segment is a powerful and proficient new product launch*." (Fiber conglomerate, Sweden). Some respondents ended the description of product development projects with the comment " *...and when does the development project end? It is an ongoing process which aims for continuous improvement*." After the introduction of the new product, however, the actual development project is brought to an end and the product is included in the ordinary product portfolio and production planning. But, as some respondents pointed out, this does not mean that the development work has ended; it is transformed into continuous improvement accomplished through minor changes. Some respondents described projects that had been terminated without the launch of a new product. A few respondents also mentioned that some product ideas that did not work at one point in time would be 'put in the freezer' and later 'defrosted' when the conditions were judged to be better.

Post-project calculation was considered to be an important part of the final evaluation of the project. Some respondents reported that despite its perceived significance, detailed post-project calculation was quite rare: "*Post-project calculation is very valuable, so it is a pity that we don't do it more. We should do it more*." (Independent, Finland).

### *Actors involved in the development project*

Although mainly involving the personnel of the company, respondents reported that external actors could also be included in the product development process if needed. The most frequently mentioned external actors were: customers for product feed-back; universities and research institutes for product testing, development of equipment, or market analysis; equipment suppliers for development of equipment; raw material suppliers for adaptation of raw material; and sub-contractors for special processing capacity. The type of exchange differed depending on the partner and the situation from formal or informal strategic alliances to transactional market exchange. A few Swedish respondents mentioned the possibilities of acquiring external financial resources for product development projects, with county administration and governmental innovation agencies as possible sources. Activities and actors included in the product development process are summarized in **Tables 7a and 7b**. Activities are sorted by chronological order. Actors are sorted by response frequency.

**Table 7a.** Activities in the case companies' product development process.

| The process: Activities | Response frequencies |
|---|---|
| Idea generation and evaluation | 14 |

| | |
|---|---|
| Project start | 6 |
| Analysis of raw-material, technology, and market prerequisites | 14 |
| Process and business system development, sometimes including investment analysis and decision | 11 |
| Test production, including customer and employee feedback | 14 |
| Launch, project end, and post-calculation | 7 |

**Table 7b.** Actors in the case companies' product development process.

| The process: Actors involved | Response frequencies |
|---|---|
| Internal personnel | 14 |
| Universities and research institutes | 11 |
| Customers | 7 |
| Sub-contractors | 6 |
| Suppliers of equipment | 4 |
| Suppliers of raw-material | 3 |

## Key Factors for Successful Product Development

### *Prioritizing product development in the everyday stress*

Referring to the high work-load of the daily operations, many respondents highlighted the need to specifically designate resources for product development. Many of the fiber conglomerates had human resources especially designated for product development, e.g., 'development engineers' in business units or centrally organized R&D departments. Furthermore, and especially among large companies, the benefits of organization based on product/market segments in contrast to organization based on functions was pointed out. The examples of market-segment-based organization that were referred to comprised both industrial and personal organization. "*Since we had a* [market-segment-oriented marketing group], *the idea had somewhere to land*." (Fiber conglomerate, Sweden.) Furthermore, respondents established that strong support for development work from senior management made it easier to prioritize product development work.

Market orientation, a feeling of involvement and commitment, acceptance of change, and a go-ahead spirit among the employees were mentioned as catalysts both for idea creation and problem solving during development work. The importance of these factors was most frequently pointed out by respondents representing independents. Many respondents pointed out the positive influence of previous successful development projects on these factors. "*After the success with* [a past product development project] *it has been easier to work with product development in the organization because people are more interested in it. We have carried out several other product development projects since then*." (Fiber conglomerate, Sweden). Support from senior management was also considered to be important to avoid defensive behavior among personnel due to the risk of failure: "*Mistakes are allowed in this company. It implies that people dare trying things and we can be creative and offensive*." (Independent, Sweden).

### Strong customer relations

A common remark from respondents was the importance of good customer relations. Customers were considered valuable by respondents both for idea creation and for joint problem solving during projects. Since product development implies an investment both from the producer and the customer, a commitment to joint problem-solving is important. Many pointed out the need for good communication with users, decision-makers, and influencers at the customer organization, especially so-called 'key persons'. Some respondents reported that customer relations involving more interactions than simply seller-purchaser were especially fruitful. "*I find it very important that we are present on the market. Not only the sales representatives, but also us senior managers and the production people*." (Independent, Sweden).

### Competence

In principle, all respondents pointed out the importance of competence among personnel during a development project. Many respondents recommended a mix between experienced and inexperienced, and academically trained and practically trained personnel, advocating that both categories are necessary for achieving the exploration and effective exploitation of new ideas. "*We have a couple of crazy youngsters, who came from the university. We let them try their ideas, partly because they learn a lot from their mistakes and partly because sometimes they have a good idea*." (Independent, Finland). The importance of a highly skilled product development team was pointed out by most respondents. Broad functional knowledge (especially about product end-use, market conditions, and processing technology), analytic ability, creativity, endurance, and communication ability were mentioned as important characteristics among the team members. Respondents also mentioned the importance of 'understanding of the whole situation' among team members, i.e., understanding of the complex flow of raw materials and production and the sales of both main and consequential products. Furthermore, respondents referring to development projects targeting the retail and construction segments emphasized knowledge of product launch as very important for success. "*We have realized how much work is involved in product launch in the retail segment and how important it is that it is managed well. It is really the key to success for new products*." (Fiber conglomerate, Sweden). "*You really have to work hard to convince the construction industry that your new products are worth trying*." (Fiber conglomerate, Sweden).

### Versatile and flexible production equipment

Versatile and flexible production equipment was reported to facilitate trial-runs of new products and production flows, which was reported to be an important analytic procedure (see the Product Development Process section). Therefore, versatile and flexible production equipment was mentioned as an important resource for successful product development.

### Product advantage and relatedness

A new product idea with high competitive advantage was mentioned by almost all respondents as a basic factor underpinning successful product development. A large potential value for the customer and a good fit between the current resource base of the company and the required resource base of the new product was considered important for likely commercial success. One case of resource fit that was specifically pointed out was the fit of raw-material quality with regard to product and production

requirements. Several respondents stated that because product development was considered complicated and strenuous by personnel, it was important that they had a positive feeling about the project. The positive influence of product advantage and relatedness contributed to that feeling.

### *Combining structure and formality with speed and informality in the development project*

Many respondents highlighted the benefits of a rapid and non-bureaucratic development process. Product development is a complex challenge, but taking the complexity too seriously and analyzing every aspect of the problem limits creativity and takes too much energy, many respondents pointed out. "*Too much analysis kills the energy and creativity in the project. By the way, I am more creative when I have a tight schedule*." (Fiber conglomerate, Sweden). Many respondents promoted a go-ahead spirit and trial-and-error testing as more productive than detailed analysis. One respondent representing a fiber conglomerate, however, advocated formality and accurateness as more important for the successful accomplishment of development projects: "*We thoroughly analyzed every aspect of the customers' needs, and carefully optimized the supply chain according to that. When we then entered the market, we had exactly what the customers wanted*." (Fiber conglomerate, Finland). Whether formal and detailed or informal and rapid, the importance of a clearly defined project in terms of product concept, performance targets, and time schedule was pointed out by many respondents. The outcome of the project was also pointed out to be highly dependent on the leadership abilities of the project manager. "*We have a very energetic and creative foreman at* [the factory]. *He led the project and was very important for its successful outcome. He is really valuable to us.*" (Independent, Sweden). The following capabilities were mentioned as important for project management: coordination of internal and external resources, inspiring other people, and the ability to delegate responsibility to others and showing trust. Key factors for successful product development are summarized in **Table 8**.

**Table 8.** Key factors for successful product development among case companies.

| Key factors for successful product development | Response frequencies |
|---|---|
| Support from senior managers for product development | 10 |
| A new product idea including competitive advantage and relatedness with current resources and capabilities | 10 |
| Informal and rapid, yet complete and well-defined projects led by a strong leader | 10 |
| Commitment and acceptance of change among the personnel | 9 |
| Previous experience of product development | 8 |
| Deep and strong customer relations | 7 |
| Mix of academic and experience-based knowledge about the market and technology | 6 |
| Understanding of "the whole situation" among development team members | 6 |
| Human resources specifically designated to product development | 4 |
| Good internal and external communication ability in the development team | 4 |
| Versatile and flexible production equipment | 3 |
| Specific strategy for the launch of innovative products | 3 |

## Obstacles for Product Development

### *Factors related to the wood material*

The processing and marketing of consequential products resulting from the diverging material flow complicates and hinders the development of new products. Respondents reported that this was most significant for the relatively more heterogeneous Nordic pine. "*Pine is more difficult than spruce. Sometimes it feels like the pine is a millstone around the neck.*" (Independent, Sweden). On the other hand, a few respondents noted that the complex material flow of pine production contributes to an increased difficulty for competitors to imitate a new pine product. But, improved technologies for wood property determination, such as camera grading and log x-ray, and a stronger integration of log supply flow were also noted to decrease these types of uncertainties. Integration can be achieved through company internal integration among fiber conglomerates and through strategic alliances for raw material procurement among independents. Furthermore, some respondents pointed out weaknesses of the wood material that hinder further development of some product segments. Issues such as deformation, splitting, and poor fire resistance still cannot be controlled. These challenges were considered too large to be taken care of by a single company. Instead industry-wide collaboration, or as some of the respondents from smaller independents advocated, initiatives from the largest companies of the industry, were considered to be necessary.

### *Resource constraints*

Many respondents referred to the shortages of time and resources and the focus on short-term financial performance as factors restraining investment in product development. The shortage of resources was generally blamed on the low margins of the Nordic wood industry.

### *Industry factors*

Some respondents highlighted the structural short-comings of the supply chains to some market segments (e.g., the construction industry). The structural short-comings limit product development in the wood industry since the exchange of knowledge and goods with further processors and end-users is blocked and knowledge is missing. "*We decided to drop the project, simply because* [the product] *was not enough, it had to be incorporated in a whole system, a system that did not exist on the market and that we did not have the resources to develop.*" (Fiber conglomerate, Sweden). Obstacles for product development are summarized in **Table 9**.

**Table 9.** Obstacles of product development among case companies.

| Obstacles for product development | Response frequencies |
|---|---|
| Uncertainties related to diverging material flow | 10 |
| Focus on daily operations and short-term financial performance leading to a shortage of time and resources | 5 |
| Weaknesses of wood material that cannot be controlled | 3 |
| Structural shortcomings of the supply chains to some market segments | 3 |

## Discussion

When speaking about *objectives* for product development, most respondents primarily referred to renewal of the product portfolio rather than renewal of the company's resources and capabilities. When speaking about *outcomes* from product development, however, respondents frequently mentioned development of resources and capabilities. Hamel and Prahalad (1994) referred to a strategic focus on products as product-market myopia, something that can impede both competence exploitation and exploration. Furthermore, respondents validated our theoretical definition of product development when describing product development as a process yielding the outcome of a certain 'innovation height'. But, the comment made by some respondents that it is 'still only the same old piece of wood' suggests that they perceive that product development yields product innovations with a relatively low degree of innovativeness.

In the development process, the investigated companies seem to apply a trial-and-error approach more than an analytic one. An emphasis on the analysis of availability and suitability of raw materials, however, highlights the relatively high importance of integration of raw material supply in the value adding process. Analysis of raw material is not mentioned to our knowledge as a core activity in either wood-industry related nor in general literature about product development. But, the sawmilling industry has historically focused more on uncertainties related to raw materials and the production processes in comparison to uncertainties related to market conditions and customer demands (Nord 2005). Furthermore, our respondents stated that the generation of ideas for new products and the basic analysis of those ideas were activities commonly reported to be carried out in daily work without the organization of a project. Thus, product development was described by our respondents as a process partly included in the daily operations and partly organized within the frame of projects. Finally, the statements describing idea generation as partly done by customers or through adoption of competitors' ideas, suggests that product development in the investigated companies to a large extent is a question of adoption rather than creation of new ideas.

The description of process, marketing, and organizational development as a part of the product development process suggests that these innovation types commonly are subject to parallel and integrated development in the investigated companies. The importance and role of each type is, however, context and project-specific. This integrated view of innovation is somewhat less emphasized by other scholars, who commonly depict product, process, marketing, and organizational innovation as separate processes (e.g., Hovgaard and Hansen 2004). The integration of innovation types in the sawmilling industry has however been acknowledged by Crespell et al. (2006).

The key factors for successful product development reported by the respondents of this study generally conformed to those acknowledged by previous research (e.g., Crespell et al. 2006, Bull and Ferguson 2006, Trott 2005, Vestlund and Hugosson 2004, Ernst 2002, Lee et al. 1999, Brown and Eisenhardt 1995, Cooper and Kleinschmidt 1995, Atuahene-Gima 1995, Montoya-Weiss and Calantone 1994). Some aspects of our findings, however, illustrate the special conditions and requirements for product development in the Swedish and Finnish sawmilling industries.

In an industry such as sawmilling with a historically low intensity of innovation and a shortage of resources for development work, the ability to manage uncertainty and complexity under resource constraints becomes essential. Many respondents referred to the attitude of the employees when

describing this issue. Willingness to innovate and willingness to take risks, two elements of an entrepreneurial orientation (Naman and Slevin 1993), were identified by respondents as crucial components of the company culture to manage uncertainty and complexity. The former was reported to be strengthened by previous successful development projects, and the latter was increased primarily through support for product development initiatives from senior management. Specific allocation of human resources to development work was also mentioned in this context.

The concept of 'market orientation', a widely recognized success factor for product development (e.g., Kahn 2001, Atuahene-Gima 1995), was also pointed out by our respondents. The term was used by the respondents as a term to generally describe the company culture, but a market-segment based organization, understanding of customers' needs, and strong customer relations were specifically pointed out as valuable aspects. Thus, the conceptualization of market orientation by respondents was relatively broad. This finding supports the view held by Hurley and Hult (1998) who argue that market orientation is manifested at various levels in an organization (e.g., strategy, processes, structure, behaviors, and culture).

In addition to the strategic benefits, the contribution of product advantage and relatedness to the establishment of a positive feeling around the project in the organization is less emphasized by previous research. The acknowledgement of the benefits of a positive feeling around the project might illustrate the importance of inspiration and confidence when setting about a project that is perceived to be strenuous and risky. But, even though relatedness positively contributes to product development success, companies should not avoid more radical development projects with a future perspective, since these will enable necessary development of competences for the future (Danneels 2002, Hamel and Prahalad 1994, Leonard-Barton 1992).

In contrast to the benefits of structure, completeness and proficiency in the development process advocated by previous research (e.g., Cooper and Kleinschmidt 1995), the respondents in our study stressed informality, flexibility, trial-and-error, and speed as key factors for maintaining energy and creativity in a project. This contradiction suggests a need for careful balancing of organic and mechanistic management (Burns and Stalker 1994) of product development in this industry.

The importance of knowledge about market launch indicated by many respondents is also acknowledged in cross-industry research on the product development process (e.g., Cooper 1996). This, however, has not, to our knowledge, been mentioned in previous research in the wood industry context. Respondents stated that product launch was especially important for the retail and construction industry segments. The development projects for these segments score relatively high on product innovativeness, which suggests that launch capabilities are especially important for 'radical' or 'really new' products (Garcia and Calantone 2002). Referring to the complexity of the diverging material flow, the respondents in our study pointed out the importance of an understanding of 'the whole situation' among product development team members. This suggests that both cross-functional knowledge among individuals and cross-functional composition of the development team is a key success factor for product development. Cross-functional competence is also a widely recognized success factor (see e.g., Ernst 2002, Brown and Eisenhardt 1995). The benefits of a mix between experience-based and academic competence was also highlighted by our respondents. According to our knowledge, this aspect has not been mentioned by previous scholars.

The importance of trial-runs as an analytic tool was emphasized by the respondents. As a consequence, flexible production equipment that allows for different types of products to be run as trials was frequently mentioned as a key success factor. This comment is, to our knowledge, not found in previous research.

Finally, our results show that both resource constraints and uncertainties are seen as major obstacles for product development among the investigated companies. The propensity to take risks is, however, an organizational characteristic (Naman and Slevin 1993) and risk affects different companies in different ways. Firms can in fact create wealth by identifying opportunities out of uncertainty in their environment, and then develop a competitive advantage to exploit them (Ireland et al. 2003). Accordingly, as some respondents in our study pointed out, the relatively high complexity of the Nordic pine material flow also constitutes a powerful barrier to imitation, which promotes the sustainability of such a competitive advantage (Barney 2001). Traditionalism and captivity in 'old' core competencies were not mentioned by the respondents as frequently as expected. The reason could possibly be an awareness of the weak position of the Nordic sawmilling industry in some segments. Finally, structural shortcomings in the supply chains to some market segments were pointed out by some respondents in our study. This obstacle has also been acknowledged by Nord (2005), especially regarding supply chains to the Swedish construction industry.

## Limitations of the Study

The case companies in this study were purposively chosen because they were assumed to have extensive experience in product development. Purposive sampling is commonly used in qualitative research aiming for depiction and generation of theory about a complex phenomenon. This qualitative research design implies that we focus on *occurrence* rather than *frequency* of phenomena and that the possibilities for generalization of results to the larger population are limited.

The interviews in Sweden were conducted in Swedish and the interviews in Finland were conducted in English. Even though the knowledge and experience of English was assessed to be sufficient for the purpose among both the interviewer and the Finnish interviewees, language problems might have caused misunderstandings that influenced the results of the study.

Due to the changing nature of the data used in this study, i.e., managers' perception of reality, it is problematic to use congruence over repeated observations as a measure of reliability. The use of established qualitative methodology is however an alternative way to strengthen the reliability of research (Merriam 1994). A detailed description of the methodology can be found in the Method section.

## Implications for Managers

We recommend that managers increase their attention to the resource and capability-developing effects of product development when assessing investments in product development projects. The positive effects of product development on customer relations, investment in new machine equipment, company image, willingness to innovate among personnel and knowledge related to markets and technology identified in this study are striking examples of such effects.

To achieve successful outcomes of product development, managers are advised to evaluate business opportunities and focus on those that combine high customer value and relatedness between required and current resources and capabilities. But, even though relatedness positively contributes to product development success, it has been pointed out in the literature that companies should not avoid more radical development projects with a forward-looking perspective, since this enables necessary development of competencies for the future. Furthermore, managers are advised to promote resource allocation to development work through the establishment of positions or departments specifically designated for development work, to apply a market oriented organizational structure, to organize development work in project form, and to promote development work and support the risk-taking inherent in this process. A broad knowledge base, consisting of both academic and experience-based knowledge, supports both idea creation and problem-solving. Knowledge about processing technology and customer needs is especially important. The latter can be strengthened through recruiting people that have been previously active in the main customer segments. For product development targeting new market segments (e.g., wood in multi-story construction), end-consumers (e.g., retail), or that include radically new technology or product functionality, knowledge and other resources for new product launch are very important. Product development projects should be well-defined and product development teams should be staffed with cross-functional expertise, be given autonomy and responsibility and be led by a strong and competent leader. For the actual development work, vertical analysis and integration including raw-material supply is crucial. It should be assured that all steps of the product development process are included while still maintaining creativity and energy by running the projects in a rapid, informal and flexible way. Flexible and versatile production resources facilitate trial-runs of new products. To combine flexibility and versatility with the ever important demand on efficiency might, however, be problematic. Cooperation with subcontractors during test production stages can then be beneficial. Finally, key success factors such as the willingness to innovate among personnel, the capability of managing product development projects, and customer relations were reported to be strengthened by repeated product development, so a cumulative positive effect of continuous development efforts can be expected.

Some resource deficiencies hampering product development can be addressed through industry-wide collaboration. Better knowledge about the properties and functionality of wood, better technology for wood processing and control of raw-material and production flow and development of proper product standards were all referred to as projects too large for a single company, but well-suited for broad collaboration. Managers are therefore advised to promote such cooperation, e.g., through the allocation of resources to industry research institutes and universities. Practitioners are finally reminded that the difficult and strenuous product development of Nordic Pine is not only a ‘mill stone around the neck’, but also, due to its complexity, can yield solutions with a sustainable competitive advantage.

## Further Research

Since product development in the wood industry is a complex and poorly understood organizational process, further exploratory research is encouraged. Both case study methods and more quantitative approaches can yield valuable new knowledge. Case study research could be conducted to study the interactions between different actors in the product development process (e.g., suppliers, customers, and research institutes), study the processing and marketing of consequential products, and to study the important testing and feedback procedures applied in the industry. Quantitative

approaches could be used to operationalize and validate key success factors for product development, the antecedents of organizational innovativeness, and to examine the relationship between organizational innovativeness and financial performance. Finally, research on the properties and functionality of wood, on processing technology, and on the actors and structure of the market are encouraged to overcome some of the factors perceived by managers to hamper product development initiatives.

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