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Product development in the sawmilling industry - drivers, obstacles and key success factors

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Abstract

Although several wood industry experts advocate the need for more product development in the industry, few studies have investigated the actual product development process in this context. This explorative study investigates innovation, specifically product development, in the Swedish and Finnish Nordic pine sawmilling industry. The data consists of interviews with product development managers in 14 sawmilling companies, which were viewed by industry experts to have vast experience of product development. The results reveal that product development has a central role for competitive position and self-image of the companies. The study also identifies drivers and motives that underlie the innovation process, the structure of the product development process, key success factors and obstacles for product development. The results are applicable on industry, company and project-level.

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

1. Introduction

The customers of the Nordic sawmilling industry have started to demand specially adapted products and services with more value added. The importance of the product standards set up in 'Nordic Timber' (Assoc. of Swedish sawmillmen et al. 1995) has decreased. At the same time, relatively high costs, over-capacity, volatile markets and increased competitive pressure have resulted in low growth and profitability in the Nordic sawmilling industry (European Confederation of Woodworking Industries (ed.) 2004). The Nordic sawmilling industry is now aiming to develop its market position through regeneration of product- and market strategies and restructuring of the value system (TTJ October 2005 vol 415, p. 21). Development of new customer benefits combined with a continuous focus on cost efficiency, consolidation, shortening of the market channels, co-opetition and generic wood promotion are commonly suggested by researchers and consultants (Jakobsen et al. 2001; Korhonen & Niemelä 2003; European Confederation of Woodworking Industries (ed.) 2004; Nord 2005). Various product development initiatives can now also be seen in the industry (TTJ October 2005 vol 415, p. 21).

The topic of innovation has received much attention from researchers over the years. However, in the context of the forest sector, the topic of innovation is only briefly explored (Kubeczko & Rametsteiner 2002). Previous studies on innovation in the forest industry have acknowledged product, process and business systems innovation (Hovgaard & Hansen 2004). 'Investments in R&D' and 'new products and processes achieved' have been identified as important indicators of innovativeness (Välimäki et al. 2004). In the wood products industry, the focus of previous innovation-related research has been on process innovation, while product innovation has received less attention (see Hansen et al. 2005 for a review). Consequently, research on product development is 'a wide open field' (ibid.), and further exploratory research is motivated. Innovation research in the forest sector is in an expanding stage, and innovation and innovativeness in the wood industry receive increasing interest from researchers (Rametsteiner et al. in press).

2. Purpose of the study

The purpose of this research effort is to explore product development in large and mediumsized companies in the Nordic pine sector of the Swedish and Finnish sawmilling industry (SIC code 20101), a population called 'Swedish and Finnish Nordic pine sawmilling industry' in this paper. The objective is to find answers to the following research questions:

- What are the drivers, motives and outcomes of product development in the Swedish and Finnish Nordic pine sawmilling industry?
- What activities are included in the product development process in the Swedish and Finnish Nordic pine sawmilling industry, and how are those activities organised?
- What factors are the keys to successful product development in the Swedish and Finnish Nordic pine sawmilling industry?
- What are the most important obstacles for product development in the Swedish and Finnish Nordic pine sawmilling industry?

3. Theoretical background

Innovation is the generation, acceptance and implementation of new ideas, processes, products or services (Thompson 1967). Newness is a relative concept. In this study, the entry level for 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/European Communities 2005, p. 57). An innovation can also be new to the market or new to the world depending on if it has been implemented by other companies in the market or even in the world. Garcia & Calantone (2002, p. 124) defines product innovativeness as the continuum of product newness, from incremental to radical, as a second order factor consisting of market and technology newness on micro (firm) and macro level (industry). Furthermore, four types of innovations can be distinguished (OECD/European Communities 2005, p. 48-50): 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, product placement, product promotion or pricing. An organisational innovation is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations. Product development is used as an assembly term for the span of innovation activities leading to, or that are intended to lead to, product innovations (OECD/European Communities 2005, p. 47).

Product development contributes to value creation and sustained and/or increased competitiveness during change of external conditions through facilitating adaptation to or influence of external conditions such as customer needs or competitors actions (Cooper 1996; Amit & Zott 2001, p. 497; Danneels 2002; Grant 2002, p. 316; Hult et. al 2004, p. 429, 430). Product development contributes to development of capabilities through its role in the coordination, integration, reconfiguration, recombination, transformation, creation or release of resources (Teece et al., 1997; Eisenhardt & Martin, 2000, Ireland et al. 2003, p. 980). In fact, firm competences and product development interact in a dynamic process of firm-renewal (Danneels 2002). A positive relationship between organisational innovativeness and performance has been found in many industrial contexts (Han et al. 1998, Hurley & Hult 1998; Hult et al. 2004) and also in the wood products industry (Cohen & Sinclair 1990; Korhonen & Niemelä 2004, p. 37; Välimäki et al. 2004).

On an organisational level, previous research have identified the following key factors for successful product development: clearly specified product development strategy in line with corporate strategy; resources specifically designated for product development; large and diverse knowledge base; support from senior management for development work; and market orientation (Montova-Weiss & Calantone 1994: Brown & Eisenhardt 1995: Cooper & Kleinschmidt 1995; Atuahene-Gima 1995; Kahn 2001; Ernst 2002; Trott 2005). On a project level, the following factors have been pointed out; new product with superior customer value in relation to competing products; relatedness between required and existing resources and capabilities; clear specification of the new product concept; structured and complete product development process; cross-functional composition of the product development team, especially including market and processing technology competence; structure and attention to detail in projects with low uncertainty: flexibility and trial-and-error approach in projects with high uncertainty; autonomy of the product development team and full responsibility of the result; good communication within the product development team; power, vision and management skill of the project leader; and continuous active monitoring and management of the running project, including decisions about changes or termination (Montova-Weiss & Calantone 1994; Brown & Eisenhardt 1995; Cooper & Kleinschmidt 1995; Tatikonda & Montoya-Weiss 2001; Ernst 2002; Trott 2005). In studies of the wood industry specifically, the following organisational-level factors have been identified by previous research as important prerequisites for successful product development (Lee et al. 1999; Crespell et. al forthcoming; Bull & Ferguson in press; Vestlund & Hugosson 2004): market orientation; clear specification of the company's 'arena'; proficient market, technical and commercial knowledge; firm-wide support for the innovation strategy; support from senior management for development work. On project-level, a structured and complete new product development process has been pointed out as a key factor (Crespell et. al forthcoming).

4. Methodology

A qualitative methodology, including examination of a set of informative cases, was chosen for this study (Eisenhardt 1989, p. 548; Merriam 1994, p. 175; Trost 1997, p. 15-16; Silverman 2001, p. 32; Yin 2003). Semi-structured interviews (Merriam 1994, p. 86-88; Trost 1997, p. 19-20) was chosen as method for data collection, which was carried out during year 2005.

When choosing cases to study, purposive sampling was used (Silverman 2000, p. 102). In order to locate informative cases, the sampling procedure began with identification of companies in the Nordic pine sector of the Swedish and Finnish sawmilling industry (SIC code 20101) that have much experience of product development. For this task we benefited from the help of industry experts in both countries who were asked to mention companies that fit this description.

We constructed two categories of size, medium-sized (50-249 employees) and large (> 249 employees) companies, which we covered in the sample of case companies. Considering the differences in integration structure between companies in the Swedish and Finnish pine sawmilling industry, and the possible effects on the topic of the study, we also considered it to be relevant to control for differences in integration structure. Accordingly, two population categories for integration structure were constructed and covered in the sample: 'pure wood industry' and 'fibre conglomerates'. In total 8 Swedish and 6 Finnish case companies were included in the study, making a total of 14 case companies.

The first contact with the case companies was made by phone. We spoke to the CEOs and identified key persons that were responsible for product development activities in the respective companies. Those key persons were targeted as interviewees, and 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 interviewees. An interview guide with the following set of questions was used:

- How is product development work organised in your company?
- Please describe two recent product development projects:
- What was the new product idea?
- Why was it started?
- What activities were carried out during the development process?
- What was the outcome of the process?
- Were you satisfied with the result?
- 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 interviews were conducted at the office of the interviewees, and took anywhere from 45 minutes to 4 hours. The interviews were tape-recorded and field notes were taken. The analysis of the data set started by writing summaries of the interviews (Kvale 1997, p. 175-180). The summaries were sent to the interviewees for feedback (Merriam 1994, p. 179-180; Yin 2003, p. 34). In some cases, this resulted in changes of the interview summaries, but only on a detail level. The next step of the analysis was to categorise the compressed data (Kvale 1997, p. 175-180). Themes that were in accordance with the research questions and directly observable in the data were formulated (Boyatzis 1998, p. 33-37). The aim was to identify different aspects of each theme in an inductive way based on the data from the interviews. In line with the principles of replication logic (Eisenhardt 1989, p. 537; Silverman 2000, p. 178-185; Yin 2003, p. 47-51), a view and/or opinion stated by several respondents was considered to be a key finding of each theme.

5. Results

Product, process and marketing innovation was referred to by the respondents as an important tool to exploit the opportunities inherent in the challenging current market conditions and take advantage of the potential of the Nordic pine wood. Increased competitive advantage and improved financial performance was mentioned as the ultimate objective for undertaking product development. Adaptation of the product portfolio and improvement of customer relations, market orientation, entrepreneurship and knowledge were mentioned as important outcomes of product development. The effects of product development on product portfolio are however more acknowledged than those on resource and capability portfolio. The most frequently mentioned drivers, motives and outcomes of product development are summarised in table 1.

Table 1. Drivers, motives and outcomes of product development.

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Drivers	Motives	Outcomes
Changing customer demands	Differentiation strategy	Changes in product portfolio
Specific actions by competitors	Exploiting strategic opportunities	Investments in machine equipment
Low-cost competition in general	Forward integration	New market and technology related knowledge
Diversifying material flow	Enter into new markets	narkets Improved customer relations
New technology	Take care of consequential products	
A willingness among senior management to innovate		
Market changes, e.g. restructuring in the retail industry, new building regulations		

Many respondents pointed out that there is a difference between product development and continuous improvement. Product development was described as something with more 'innovation height'. Some respondents also pointed out that product development commonly is organised in form of a project, whereas continuous improvement was described as more of an on-going process resulting in minor changes. When describing product development projects, almost all interviewees also described some type of process development. It was described as an integrated part of product development leading to everything from major investments in equipment to minor changes in production processes or logistic flows. Some respondents also described development of new marketing or organisational practices as an integrated part of product development. Overall, product development was described as a dynamic testing and problem-solving process. The activities of the development work was reported to be going on parallel and intertwined with frequent feedback-loops. The most frequently mentioned activities included in the product development process is shown in table 2.

Table 2 Product development activities

Product development activities

Idea generation

Basic analysis: raw-material, production, marketing

Decision on continuation, termination or postponement

Project set-up

Development work: raw-material, production, marketing

Test production and delivery

Customer and employee input

Occasionally loop back to development work

Product launch

Project close

Continuous improvement

Although mainly drawing on internal resources, respondents reported that, if needed, external resources could also be employed during the product development process. The most frequently mentioned external resources are shown in table 3:

Table 3. External resources for product development

External resources for product development

Customers for product feed-back

Universities and research institutes for product testing, development of equipment or market analysis

Consultants for specific design issues, market studies or design of marketing material

Equipment suppliers for development of equipment

Raw material suppliers for adaptation of raw material

Sub-contractors for special processing capacity

Referring to the high work-load of the daily operations, many respondents pointed out the importance of finding sensible ways to put priority on product development activities. Managing the complexity and uncertainty inherent in the product development process and creating a creative climate in the organisation was also described as a major challenge. Some specific factors were frequently pointed out as key factors for successful product development (see table 4).

Table 4. Key factors for successful product development

Key factors for successful product development

Product advantage

Relatedness between current and required resource base

Human resources specifically designated for product development work

Organisation of strategic business units according to market segments

Strong customer relations

Mix of experience-based and academic market and technology competence

Knowledge about market launch tactics (for consumer products)

Support from senior management for product development work

Previous experience of product development

Versatile production equipment

Informal project organisation

Speedy, trial-and error approach

Clearly defined project goals

Dedicated project manager

According to the respondents, product development is often seen as complicated and strenuous. It is considered to be difficult and yield insecure results. The most frequently mentioned obstacles for product development are listed in table 5:

Table 5. Obstacles for product development.

Obstacles for product development

Relatively high heterogeneity of the Nordic pine wood material results in uncertainty regarding the determination of product yield and in the control of the diverging material flow.

The processing and marketing of consequential products complicates and hinders the development of new products.

Weaknesses of the wood material hinder further development of some product segments. Issues such as deformation, splitting, and poor fire resistance is still not fully solved. More knowledge about these issues is needed, something that was considered too big tasks for individual companies.

Short-term financial performance restrain investment in product development. The shortage of resources was generally blamed on the low margins of the Nordic wood industry.

Structural short-comings of the supply chains to some market segments, e.g. the construction industry, delimit product development since exchange of knowledge and goods with further processors and end-users is blocked and knowledge is missing.

6. Discussion and conclusions

In general, the respondent's description of product development and its key success factors produced results in line with findings from previous research. However, some interesting differences were found:

Many managers of the industry seem to primarily acknowledge effects of product development on product portfolio rather than on renewal of firm competences. Hamel and Prahalad (1994) referred to this as product-market myopia, something that can impede both competence exploitation and exploration.

The respondents integrated view of product and process innovation contrasts to that of a previous study of innovation in the forest industry that sees product, process, marketing, and organisational innovation as separate processes (Hovgaard & Hansen 2004). The integration of innovation types in the sawmilling industry has however been acknowledged by Crespell et al. (forthcoming, p. 23).

The role of trial runs and customer- and employee feedback as core activities of the product development process and the analysis of availability and suitability of raw-material and occasionally development of customised raw material supply illustrates interesting differences compared to other industries.

As a contrast to the benefits of structure and completeness of the development process advocated by previous research (e.g. Crespell et al. forthcoming), the respondents in our study stressed informality, flexibility, trial-and-error and speed as key factors for maintaining energy and creativity in the project which contributed positively to the result of product development efforts. This contradiction suggests a careful balancing of structure and flexibility in management of product development projects in this industrial context.

The importance of knowledge about market launch is also acknowledged in cross-industry research on the product development process (e.g. Cooper 1996). It has however not been highlighted in much of previous research in the wood industry context. The importance of market launch was specifically pointed out 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.

7. Limitations of the study

The focus in this study was on internal validity, rather than on external validity, which often is the main concern in research using quantitative methods. Nevertheless, when describing a complex organisational process like product development, one must admit that the description only can be approximate. Both occurrence and sequence of activities are subject to context, project and company specificity. Despite this, and in order to promote understanding, findings comprise both occurrence and sequential order, derived through replication logic. It is important here to point out that the aim of using replication logic was to establish the occurrence of events and the meanings given to those events by key actors, rather than identifying the frequency of events.

From the comments made by the experts during the nomination exercise, we have reason to believe that there is a bias towards successful innovators among the companies that were chosen. A sample including both successful and unsuccessful innovators would probably have given a better understanding about the topics of the study.

8. Further research

Regarding key factors for successful product development, the statements by the respondents only revealed the occurrence of the respective factors, and not the amount or strength of them. The lack of quantification complicates the understanding of the factors and their respective influence. Operationalisation and validation of key factors for successful product development as well as antecendents of organisational innovativeness should be a hot topic, especially for practitioners. A positive relationship between innovativeness and performance (commonly manifested in profitability or growth) has been established by previous research. Nevertheless, a validation of that relationship in the context of the wood products industry would also be of interest. Finally, research on the properties and functionality of wood, on processing technology and control of production flow are encouraged to overcome some of the factors perceived by managers to hamper product development initiatives.

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