

IDENTIFYING DRIVERS FACILITATING PRODUCT DEVELOPMENT WITHIN THE INDUSTRY FOR WOODEN MULTI-FAMILY HOUSES

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Abstract:

Sweden is forecasted to grow its population with 1.1 million people over the next eight-year period, increasing the demand on the construction phase of housing units throughout Sweden. However, at present, 240 of Sweden's 290 municipalities show an existing deficit of available housing units in their regions, resulting in inherent difficulties fulfilling this demand utilizing the current production structure. Therefore, further utilizing wood as a building material could contribute to minimize the gap, as well as fulfilling the EU's goals towards the Europe 2020 strategy and the EU forest strategies, focusing on development towards innovation, bio-economy, sustainable sourcing and use of raw materials. This study is aiming to identify drivers supporting the Swedish industry of wooden multi-family houses to enable market growth through competitive and sustainable strategies. The representatives within the building process identify drivers, how they perceive their effect on the companies' abilities to develop based on long-term and short-term strategic impact. Thus, the goal is to find ways in which wooden multi-family houses could compete as a building solution, compared to established solutions, thereby increasing the market share in Sweden. The methods used in this study is surveys distributed to representatives from municipalities, developers, contractors, architects and real estate companies.

The result identifies three change drivers influencing the industry development for wooden multi-family houses in Sweden: technological-, knowledge- and environmental- drivers. These drivers have an effect on the companies' ability for successful new product development and for development of sustainable strategies towards market growth for wooden multi-family houses.

Key words: industry drivers; wooden multi-family houses; sustainable development; competitive advantage; new product development.

INTRODUCTION

According to forecasts, the population of Sweden is expected to increase by approximately 1.1 million people over the next eight years. During the period 2012 – 2015, approximately 127 700 homes were constructed and the population of Sweden grew with 368 200 people during the same time-period (Eriksson 2016). The task for planning a suitable construction rate in response to the growing population falls partly on the municipalities in Sweden. However, an investigation conducted by Boverket (National Board of Housing, Building and Planning) during 2015 estimated that approximately 240 of Sweden's 290 municipalities show an existing deficit of available housing units in their regions (Boverket 2016).

According to Boverket, forecasted demand for construction in Sweden is approximately 710 000 housing units to be built during 2015 – 2025 (Boverket 2015). By 2020, the industry needs to build 88 000 housing units per year to meet the population growth. Further, additional production volume is required to compensate for the building shortage from previous years, based on insufficient production pace in comparison to market demand. This poses a challenge for the building industry considering its relatively low output during the past decade, with an average annually output from 2007 until 2015 of 14 803 apartments. The production volume has increased throughout this period, during 2015; 23 916 apartments were constructed out of concrete and 2 322 apartments were built using a wood solution (TMF 2017). Development strategies to fulfill the construction requirement until 2025 be to further explore wood as a suitable construction material and to investigate the development drivers for producers of multi-family houses in wood. This poses an additional challenge, since the requirement for building housing units will be at a high level in the foreseeable future. Hence, the additional need for sustainable production technology at all levels of the value chain is required, thereby improving the production output (Eriksson 2016).

Although, the output of housing units has to increase greatly during the upcoming years, the work against climate change will have to continue combined with a demand to develop building techniques in line with a sustainable economy (FORMAS 2012; NRA 2012). This relates to strategic advances influencing

wood-based industries, highlighting the importance for the EU to enhance investments in green building solutions to comply with the climate and environmental targets. Therefore, the EU has recommended the use of wood as a sustainable building material (EU 2012. COM 433).

The development towards a long-term sustainable building industry of wooden multi-family houses requires a massive build-up of the industry to fulfill the expected development. This can not be achieved without the understanding of the existing drivers within the industry and the understanding that these might shift as the industry evolves. According to Björheden (2006), effect and importance of different drivers vary depending on the type of company, the geographic scale and the operational environment within the industry. Thus, drivers may have very different effects within a country, where regional and local conditions may vary, creating specific industry drivers to take into consideration. Furthermore, political decisions are perceived as important drivers for the development, specifically when expressed through legislation, duties, and taxation. In addition, other general drivers are considered to be areas such as social, economical and institutional drivers, identified as influencing the market development and new product development (Björheden 2006; Tudor et al. 2006).

New product development (NPD) is an area of importance for the development of an industry and individual companies, which is affected by internal and external drivers. NPD is considered as strategically important for companies having the ambition to develop their market share based on product usability and quality (Ciappei and Simoni 2005; Johnes and Snelson 1990). This further enhances the dependence of product innovation and business success on industry drivers and the ability for companies to gain competitive advantage through successful NPD (Hassanien & Dale 2012). However, according to Chiu and Yong (2004) and Roberts (2004), NPD should be supported by several company activities to generate synergies through drivers, such as financial planning, a multi-stakeholder team, governmental activities, the community and expert advisors, thereby maximizing the possible outcome from NPD and a stronger market position.

Despite the importance of NPD for company development, the primary activity for the companies will be towards aligning the company strategy in regard to its context, i.e. the external and internal environment of which the company is involved in, including competences and resources. Actively working within these areas of the company maximize the effect of industry drivers, which have proven to have important implications towards the company's performance (Venkatraman 1989; Venkatraman and Prescott 1990; Anderson and Zeithaml 1984; Bourgeois 1981).

OBJECTIVE

The purpose of this study is to investigate existent development drivers for the industry producing wooden multi-family houses in Sweden. Firstly by generating an understanding of the perception by the main stakeholders within the building process regarding the drivers influencing the industry. Secondly, evaluating the result through the driver's impact on companies from a strategic perspective. This analysis will be useful for the industry or individual companies developing sustainable strategies through NPD, increasing their market share in comparison to traditional building materials.

THEORETICAL FRAMEWORK

Creating possibilities for companies to successfully develop within an industry is based on several factors. Aladwani (2001) discussed the importance of drivers for business development, mentioning competitive position, consumer demands, distribution channels and business image as important drivers for company development. Therefore, companies try to adjust towards drivers, reacting to external and internal challenges influencing their growth, by optimizing the combined effect of resources and drivers.

The resource-based view (RBV) provides an understanding of how strategic activities create a competitive advantage on a company level, by clarifying strengths and capabilities. According to Wernfelt (1984), companies organize their resources, in combination with market conditions, in a way making their products and services hard to imitate and thereby generating sustainable competitive advantage. Kim and Park (2006) suggested that two factors make a company competitive, product quality and brand, which in combination with good design, innovative products, and brand building support companies in achieving a competitive advantage. However, Hax and Wild (2002) discuss that competitive advantage, based on RBV, is factor driven, i.e. dependent on a company's development of resources and its capabilities in comparison to market conditions and drivers.

Having the ability to utilize internal resources and competences within a company, combined with existent market drivers, facilitates innovation and improves competitive advantage (Chesbrough 2003). This has also been discussed by Prahalad and Hamel (1990) and Pavitt (1990), highlighting the importance of efficient usage of internal competences in combination with external drivers facilitating NPD. Defining NPD provides a broad span of activities, from new-to-the-world to minor revisions of existing products, where

many development activities can occur, e.g. Research and Development (R&D) and technological breakthrough (Majava et al. 2013).

The ambition for companies is still to find ways to lower costs throughout the value chain, delivering the required service levels and quality. Optimizing the influence of drivers accomplishing higher profits is still considered as a competitive strategy for companies. Therefore, focus on achieving economies of scale and low-cost production will continue. However flexibility and innovation will continue to be an important aspect for companies striving towards strengthening their competitive position (Ülkü et al. 2005). Based on the scope of this study, three main categories of drivers have been identified; technological-, knowledge-, and environmental drivers. Efficiently combining internal resources with these industry drivers facilitates NPD. These drivers can be unified under a broader concept enabling company growth, discussed by John et al. (2001) as change drivers. Fig. 1 below describes the various change drivers influence on industry structure and company activity.

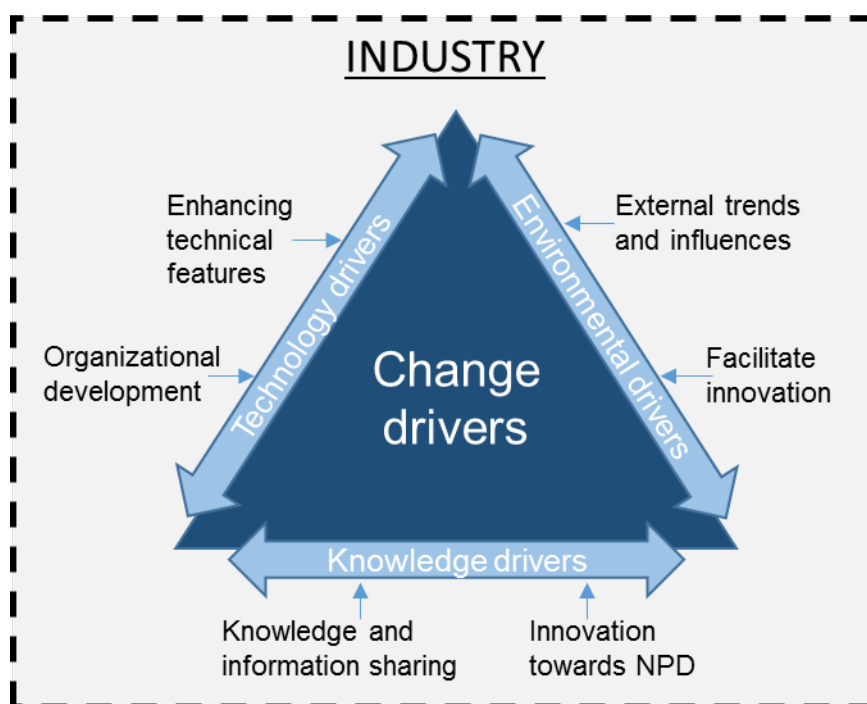


Fig. 1.
Industry change drivers influence on company activities.

The first category, technological drivers, consists of activities associated with enhancing technical features, enabling organizations to develop products and processes to create a competitive advantage. Technological capabilities are for many companies considered as the main driver towards successful product development (Gann and Salter 2000; Mitropoulos and Tatum 2000; Verona 1999). Furthermore, it is important to coordinate the technological development by using official programs or institutions as platforms, thereby facilitating development based on industry requirements and capabilities. Miozzo and Dewick (2002) discussed the importance of long-term relations between companies and external knowledge centers providing access to new technologies in the construction industry, which further enhance the possibility for the industry to develop, based on the efficient use of existent drivers.

The second identified category is knowledge drivers. This includes various activities required for companies to enable knowledge and information sharing between organizations and institutes that are associated with innovation towards NPD (Goverse et al. 2001). A study conducted by Toole (1998) identified that a company's ability to accumulate and process information about new advances in technology contributed to the company's possibility towards successful innovation and NPD. Further, Toole (1998) and Veshosky (1998) discussed the positive effect of information gathering and knowledge sharing as an enabler towards successful innovation and development.

The third category, environmental drivers, has a relatively broad scope including general trends and influences from market, society, and competition that encourage organizations to innovate (Toole 1998; Gann and Salter 2000). A study conducted by Arditi et al. (1997) found that the innovation rate increased, based on general market forces pushing for product development. In this context, public policy instruments

have the possibility to drive development in a specific direction and studies by Seaden and Manseau (2001) highlight the positive effect of innovation and change when governmental organizations were in the position of clients in construction projects.

Furthermore, a study of the Dutch construction industry concluded that development of regulations was required to stimulate the use of wood within the construction industry in order to stimulate innovation and NPD. This, according to Goverse et al. (2001), could be various regulatory measures by the government. However, Björheden (2006) displayed in his study of the Swedish market that policy is not enough. The political system must publically support and contribute to the development of a stable market situation. This was further discussed by Markström et al. (2016), mentioning that local strategies by municipalities for construction of wood buildings act as an incentive for the industry. Thereby providing necessary drivers for companies to invest towards innovation and NPD, possibly strengthening their competitive advantage.

METHOD & DATA

The research conducted in this study is based on a specific wooden multi-family house building project in Sweden. Data collection was predominantly focused on companies that are actively involved in the process of that project. It is a method consistent with the convenience sample strategy of data collection, finding suitable respondents to be included in a study. This method was used to find respondents within the identified building process (Zikmund 1997).

To start with, drivers for market development were identified from existing literature. By means of senior-level managers from the industry, these drivers were validated and selected, with respect to the context of the study. The resulting questionnaire was sent to 157 respondents via an online survey. To gain a broad understanding of the perception of drivers, respondents from municipalities, developers, contractors, architects and real estate companies were approached.

The survey took place during autumn 2016. The response rate on the survey was approximately 40%. In the survey, the respondents were asked to evaluate the importance of the questions, offering a comprehensive picture from procuring or commissioning a building, through construction and finally the operational use of the building. This provides an end-to-end perspective. Focus was on three main segments: company information, market information and market drivers. Each segment had several subsections to emphasize the context of the questions.

Considering focus was on companies producing multi-family solutions, data was analyzed in relation to those companies only producing wooden multi-family houses. This provided a 31% response rate. These companies are not only involved in the construction of multi-family buildings but also other building solutions i.e. single-family houses, public buildings and in other types of construction projects. In addition, 91% of the companies build higher than 3 floors and 54% build higher than 5 floors out of wood. Further, some companies are also active in several different roles within the building process i.e. procurer, developer, architects, contractor, sub-contractor and real estate company, providing a comprehensive value chain perspective.

The survey consisted of 18 main questions and 14 sub-questions designed to use a 10-graded Likert scale. However, some question were open-ended, which allowed the respondents to elaborate on specific industry information. Further, some questions had a *yes* and *no* option, intended to be a filter for some of the following questions.

Researchers analyzed the responses and established possible trends. Further, data was analyzed quantitatively for those questions with an open-end response option. Based on an analytical approach, focus was to identify drivers enabling the development of the market for wooden multi-family houses in Sweden.

The data from the survey was structured combining the responses from the participants with the appropriate change drivers, displayed in Table 1 below. The table is based on 18 main questions and 14 sub-questions, where the average result from the question in the survey has been classified into three levels based on importance, thereby providing the ability to classify the different drivers. The evaluation of question 7 and 9 was incorporated into the three-graded scale in Table 1, based on the percentage, i.e. if > 67.3% answers *Yes*; equals major importance. Question 3 is based on the same structure i.e. if > 67.3% spend less than 5% is perceived as being of minor importance.

Technology is the first driver, consisting of six questions including topics such as R&D, economies of scale and product differentiation. Question number one was of most importance for the respondents providing an average score of 7.19, positioning it as being of major importance for the development of the industry. On the other hand, question number three, relating to the extent the companies reinvest in R & D based on their production cost, was perceived as being of less importance from the respondents. The response showed that 78.7% of the respondents only allocated less than 5% of the production cost towards R & D. Yet, of the respondents, 45.8% considered the R & D cost as a limitation towards technological development for the industry.

Table 1

Review of industry change drivers

Change Drivers		Importance		
		0 - 3,3 Minor	3,4 - 6,6 Medium	6,7 - 10 Major
Technological drivers				
1. Are economies of scale a necessity, and will this influence the development of wood buildings	Score 7,19			X
2. What significance do you put on research and development within your company	6,25		X	
3. What proportion of the production cost is connected to R & D	< 5% = 78,7% 6-10% = 21,3%	X		
4. Is cost for R & D considered a limitation towards technological development	Yes = 45,8% No = 54,2%		X	
5. To what degree is product differentiation important for the development of the wood building industry	6,12		X	
6. What is the importance of product differentiation for the development of your company	6,11		X	
Knowledge drivers				
7. Do you continually work to create competitive advantage for your company	Yes = 89,1% No = 10,9%			X
8. What kind of business intelligence activities do you conduct prior to an investment	Based on 6 sub-questions			
Complie information	23,6%			
Conduct a market analysis	21,4%			
Identify sales channels	12,1%			
Analysis of production capacity	20,7%			
Review alternative solutions	20,7%			
Misc	1,4%			
9. Have you got financial possibilities to invest towards strengthening your competitive position within your industry	Yes = 81,2% No = 18,8%			X
10. What kind of advantages exist regarding investment possibilities	Based on 8 sub-questions			
Stable political situation	12,3%			
Market size	16,4%			
Growth opportunities	25,3%			
Good infrastructure	14,4%			
Possibilities finding partners in the Value Chain	9,6%			
Access to personnel	8,9%			
Stable financial situation	12,3%			
Misc	0,7%			
11. Are you required to make investments to optimize your competitive position	Yes = 48,9% No = 51,1%		X	
12. Is an improved collaboration between the participants in your value chain a necessity for improved competitiveness of wood buildings	7,02			X
13. Are you able to identify possibilities to achieve economies of scale and how significant is this for your company	5,92		X	
Environmental drivers				
14. Market strength of concrete	8,17			X
15. Insufficient understanding of wood as a building material	6,67			X
16. Are there any rules or regulation that limits competition	Yes = 62,5% No = 37,5%		X	
17. Essential for legislation to change	6,23		X	
18. To what degree can you change rules or legislation	6,23		X	

Knowledge drivers are the second category, including 7 main questions and 14 sub-questions. This category includes topics such as competitive advantage, business intelligence, investment decisions and the possibility or importance to achieve economies of scale. Question seven received the highest attention with 89.1% of the respondents continually working to strengthen their market position by e.g. participation in research projects, project development and internal project teams focusing on development issues. However, only 48.9% consider it a requirement to invest optimizing their competitive position, which indicates that current resources suffice. Both question 8 and 10 have been answered by 100% of the respondents showing the value of information prior to investments decisions and the importance of a healthy business climate supporting investment activities. Out of the sub-questions are the most important to collate information, market analysis, production capacity and general growth opportunities those questions that receive most responses. Further, linked to question 10, requirements for municipalities to promote wood-buildings for new construction projects were of importance, rather than utilizing traditional building materials such as concrete.

The final category, environmental drivers is based on five questions related to external environmental factors influencing the development of wood as a suitable building material for wooden multi-family houses. The main identified issue influencing the industry development is the strength of traditional building materials, predominantly concrete, which received an average score of 8.17. It makes this question the most significant, by the respondents, out of all questions asked in the survey. Furthermore, the perception that rules and regulations limit the possibilities to compete is shared by 62.5% of the respondents making this an important focus area. Hence, the respondents feel a requirement to change the legislation to improve their abilities to compete. However, they don't consider themselves having the possibility to do so, which provides an average score of 6.23, positioning these questions close to being of major importance for the industry. In addition, several of the respondents had supplementary comments regarding the environmental driver e.g. requirement to introduce taxation on CO₂ emissions, demand on a life cycle analysis, stopping the spiraling cost increase within the industry and a faster phase changing regulation to support sustainable building solutions.

DISCUSSION

Meeting the main objective of this study, to investigate existent development drivers for the industry producing wooden multi-family houses in Sweden, was fulfilled. This was conducted by mapping the industry perception regarding main drivers influencing the development of the industry, which generated a structure consistent with three categories of drivers: technological-, knowledge-, and environmental- drivers. Thereafter, the second objective was to provide a structure demonstrating the impact of the identified drivers, which was conducted by grading the responses. This generated an overview of what drivers that were perceived to be of greatest importance for NPD and industry development. The result is summarized in Table 2.

Table 2

Classification of industry change drivers

	<i>Minor</i>	<i>Medium</i>	<i>Major</i>
Technological drivers	17%	67%	17%
Knowledge drivers	0%	29%	71%
Environmental drivers	0%	60%	40%

Table 2 indicates that knowledge drivers are of greatest importance for the industry trying to develop their competitive advantage, with 71% of the answered classified as being of major importance. Thereafter, environmental drivers with 40% of the answers perceived to be of major importance and the equivalent percentage for technological drivers was only 17%.

Hence, it is an interesting finding that the industry considers technological drivers as being of least importance, yet the knowledge drivers are considered as much more important for the development of the industry. These drivers are connected, displaying two different sides of the same basic requirement, to develop the industry by either improving capabilities and production by advances in R & D or optimizing the output by improved market understanding. Thus, it could be indicative that Swedish companies producing wooden single-family houses have taken a low-cost development approach with a relatively conservative strategy enhancing their competitive advantage. This is emphasized by the importance put on the environmental drivers, which reflects both the strength of concrete and the lack of understanding of wood as a suitable building material, combined with their view that the industry imbalance requires change in regulation to further facilitate required development. One could argue that this is a relatively passive approach combined with how the industry value technological drivers compared to the other identified drivers.

More multi-family houses are planned to be built in wood, yet companies who can do that are limited in comparison to the demand. Further research should therefore focus on how the industry can increase their competitive position by enhancing the identified drivers. Thereby creating further understanding of how these drivers interact with the market requirement found in the procurement process. Studying this process would identify discrepancies between market expectations and industry capabilities by increased end-to-end transparency throughout the building process, which can facilitate an increased rate of NPD based on the general market demand of an increased availability of housing units in Sweden.

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