

Secondary interior wood products for manufacturing in Swedish hardwood sawmills

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Abstract

The Swedish hardwood sawmill industry is today in a situation where the sawn hardwood exhibit a wide variation in quality characteristics, while the customers places strict demands. To create a profitable return for all their products the hardwood sawmill industry therefore has to find new markets where other quality characteristics are valuable.

In this study the requirements regarding logistic service and product quality characteristics for secondary wood products, used as for instance indoor panelling and mouldings, were identified and described. The industrial setting for the study were the Swedish house building industry. The aim of the study was to identify and rank the important logistics service and product quality requirements with the objective of increasing the use of hardwood in secondary interior wood products.

A total of 15 different requirements regarding logistics service and product quality characteristics were identified; 7 product quality requirements and 8 logistics service requirements. The product quality requirements were related mainly to the aesthetic appearance of the products and to the stability of the product in service, while the important logistics service requirements were related to the location and time of delivery and product customization. The study concluded that when a supplier was to be selected, price was the most important element, followed by product quality, and finally logistics services.

Introduction

Today, the Swedish hardwood sawmill industry is in a situation where the sawn hardwood products are derived from raw materials exhibiting a variety of properties that influence the characteristics and appearance of the wood and eventually the final product. The customers, on the other hand, that are found primarily within the furniture, carpentry (kitchens and floors), and building industries (interior carpentry) place strict demands on the final product. Therefore many hardwood sawmills, given these demands, cannot create a profitable return for all the products in their product line.

Requirements are for instance placed regarding refinement of the sawn timber to components, which implies investing in production capacity (Johansson et al. 2005). The possibilities of refining the products to components though, also open up the opportunity of considering entering new markets, with new products, more refined for instance secondary interior wood products intended for the house-building industry. Secondary interior wood products are, in the study defined as wood used for interior carpentry (flooring excluded).

The normal way of producing houses in Sweden is by prefabricating them more or less complete at the factory. The modules are thereafter transported for final assembly at the delivery site. This production process differs from other countries, for instance North America, where the majority of homes are constructed on-site.

When developing new products Reinertsen et al. (1998) mean that all factors necessary for the production of the product has to be included. Based on customer requirements or market needs. Bush et al. (1991) concludes that competition in the hardwood sawmill industry is based on quality, customer service, and price. The quality aspects are according to Hansen et al. (1999) a function of both product quality and service attributes. Price is a quantified issue, whereas product quality and services are objective and dependent upon the individual customers. In a development process, the most relevant

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service quality aspects are related to transaction elements (defined by La Londe et al. 1976). The transaction elements are in many cases referred to as logistics service requirements*.

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Methodology and data collection

In total there are 60 active wooden-house builders in Sweden (see Gustafsson 2005). In the first part of the study, case studies were conducted at six house-building companies in order to identify relevant requirements of the products. Data were gathered by personal explorative interviews and observations at the different companies. During 2004 the purchasing managers of every company were interviewed. The interviews were followed by mapping the flow of products by studying the use and handling of the products within the company.

The second part of the study aiming at ranking the identified requirements and relate them to price. The study was conducted through a questionnaire, answered by purchasing managers. Telephone calls were made to all purchasing managers each representing a different house-builder and they were asked to mark the importance of the different requirements (identified in interviews) and price using a 1-5 scale (1 not important and 5 very important). The response rate was 33 %.

Identified requirements

The requirements identified are presented in Table 1 and clarified below.

Product requirements

Opinions regarding the *accurate moisture content* of delivered products differ among different companies. According to the companies the moisture content of the products must then be the same as that in the user environment, to avoid shrinkage or swelling.

Appearance colour, texture and finishing are essential aesthetical aspects of these products. It is expressed that the wood surface should be restful and not too lively. The colours of the wood, paint, knots or other structural effects are elements that affect the perception of the surface.

Table 1 – Requirements identified by house builders.

Customer requirements	
<i>Product requirements</i>	<i>Logistics service requirements</i>
Accurate moisture content	Bar-coded products
Appearance, colour and texture	Fixed delivery days
Finishing	On-time delivery
Jointing	Packaged and clean products, protected from moisture and dirt
Knots	Provision of rapid delivery
Optional dimensions and lengths	Provision of customized products
Shape stability	Supply of mixed loads and package sizes
	Traceable products in the process

* Logistics service is defined as "all the activities from order to delivery process and the providing of accurate information and services in accordance with the material flow" (Mattson 2002). The elements of logistics services are; core, control and complementary (Gustafsson 2003).

Regarding finishing, the products may be procured untreated, painted, varnished or glazed. The house-building industry applies the finishing at different stages in the production process. To some of the house-builders the products are delivered finished while others apply it after fitting the products in order to avoid visible nails. The normal procedure is then to treat knots and other defects with filler before priming, and then top-coating the products.

The finishing often raises complaints from the customers. The customers demand an even finishing without pimples or blisters. It is especially common that after a while knots become visible in painted products. To achieve an even finishing, the supplier must have a reliable production process, and package the products securely in order to avoid damage during transport. The result of painting different species of wood is also different. Especially regarding the pre-finishing stages, the workload and the result are very dependent on the evenness of the surface, especially regarding knots.

When mounting the products, *joints* should be avoided if possible, because of esthetical aspects and because of the additional work. To avoid joints, products should have the necessary lengths. This may be achieved by more specified orders. If it is difficult for the supplier to produce products that are sufficiently long, finger-jointing is proposed as an alternative.

The normal procedure when producing hardwood in Sweden is to use timber with length 3.0 meters. This indicates that receiving sufficient lengths of the products will be a problem if the products are to be produced from hardwood. Therefore some sort of jointing is necessary. However, another aesthetic problem will then occur regarding the acceptance of visible joint.

A functional and an aesthetic problem are the *knots*. Often extractives will percolate through the knots and as a consequence they will often become visible, particularly in painted products. Knots and dry knots are difficult to avoid since they are a part of the natural part of wood. The problem may be avoided with a flexible production process where knots may be cut off. In order to obtain sufficiently long boards, then again using finger-jointing is necessary. The requirements regarding secondary interior wood products may also be different from those for furniture and carpentry wood, where normally no knots are accepted. The companies in this study mean that occasional knots are accepted in secondary interior wood products.

Today the products are delivered in *optional lengths and dimensions*. The products are delivered with different lengths within each package. This is advantageous since it is possible to combine different lengths to fit different places in the construction. The house-building companies also suggest pre-sawing of the products into lengths to match constructional drawings as an additional service the suppliers might add. Requirements regarding package sizes illustrate the need for the house-builders to be able to order only the products needed for a specific house according to constructional drawings. The sawmills normally deliver wood products in pallet sizes with one type of product on each pallet. Sometimes companies also wish to order specified lengths in accordance with constructional drawings or from what the customers require. This is particularly important for panelling wood, window cases and doorframes. Wood panelling, window cases and doorframes should be delivered in specified lengths in accordance with the customers' constructional drawings.

Shape stability of the products is regarded as very important for some of the companies. The products should be straight and should not change shape. No twists, bows, crooks or cups are allowed. The products therefore have to be sawn, dried, and stored carefully.

Logistics service requirement

Fixed delivery days imply that a supplier delivers its products on the same day of the week every time. In order to be able to plan and co-ordinate the incoming material, the house-building industry would like to have the individual products delivered according to a pre-determined schedule. A fixed delivery day implies a strictly developed and planned distribution process including more or less pre-determined

routes. This requirement goes hand-in-hand with a short delivery time. If the respondents are willing to wait for the delivery of products, the hardwood sawmills ought to be able to hold the deliveries and deliver on a pre-determined delivery day.

Traceable products in the process are valuable when a problem occurs in the order-to-delivery process, due to the possibility of tracing problems back to their source. A pre-requisite, which is particularly important for house builders who make use of computer systems, is to deliver *bar-coded products*. In some cases business processes rely on computerized systems and it is therefore necessary for them to be able to identify and store information in their systems regarding, for instance, inventory. These requirements imply that there is a need for a well-developed computerized system (a pre-requisite is to have structure and control of the production and distribution systems) and skilful users, as well as an organized structure and handling of the products.

The companies require that their suppliers deliver their products *on-time*. In the house-building industry, the products are mainly used as incoming raw material, and the planning and usage is therefore dependent on the deliveries of the other products in order to finalize construction of the house. In the sawmill control of the production, distribution processes and incoming raw material is necessary. These issues ought to be included in a computerized system with pre-determined set of queries.

In some cases, the products are delivered to the construction site where the storage place varies with regard to both space and quality. In order to protect the products during transport and storage, *packaged products* are necessary. The products are packed in one of the final stages in the production process. The packaging procedure is usually performed largely manually. Due to its heavy reliance on manual work, the requirement of different package sizes and different assortments within each package should be fairly easy to meet.

The suppliers have to *provide rapid delivery*, as the house builders use wood products as an incoming material and missing products might cause problems in the production process. Since end-users demand very specific products from the house builders, the manufacturers must be able to *provide customized products* (e.g. special profiles or products for special applications). This requires a flexible production process while at the same time asking for the possibility of standardising and transforming the products into modules in order to re-work them according to their customers' demands.

House builders order products according to a constructional drawing and therefore wood products need to be ordered and delivered in separate packages for each house. To *supply mixed loads and package sizes* is therefore necessary for the suppliers.

Ranking of requirements

The ranking of the individual requirements is presented in **Table 2**. On-time delivery is the most important requirement, followed by shape stability and packaged products. These requirements represent the product quality as well as the logistics service issues.

The individual logistics service requirements and product quality requirements have been grouped and related to price, see **Table 2**. Price appears to be more important than both product quality and logistics service. However, on-time delivery (logistics service requirement), shape stability (product quality requirement), and packaged products (logistics service requirement) are ranked ahead of price, implying that the house-builders are willing to pay for these services. The ranking order between the studied concepts and price gives an indication as to where the suppliers ought to focus.

Comparable studies regarding softwood products state that product quality and price are ranked ahead of logistics services (see e.g. Gustafsson et al. 2002). Perreault et al. (1976) rank product quality and distribution service (forerunner concept to logistics service) ahead of price. However, this study concludes that price is the most important issue with reference to the total concept of product quality and logistics service. Therefore suppliers need to leverage economies of scale and be ready for competition based on price.

Table 2 – Ranking order of the individual, and grouped requirements.

Element	Average	Grouped requirements	Average
On time delivery	4.7	Price	4.3
Shape stability	4.5	Product quality	3.6
Packaged products	4.4	Logistics service requirements	3.5
Provision of rapid delivery	4.3		
Moisture content	4.3		
Dimensions	4.0		
Special assortment	3.7		
Mixed loads	3.6		
Appearance	3.5		
Knots	3.4		
Joints	3.3		
Finishing	2.5		
Traceable products	2.4		
Bar-coding	1.5		

Conclusions

This study shows that the customers' requirements span over a wide range of issues that will affect the entire organization of the suppliers; from basic requirements such as short delivery times and protecting the products from moisture and dirt, to advanced requirements such as the ability to trace products in the process and the control of colour and texture.

When ranking the requirements price is ranked ahead of both product quality and logistics services, implying that the house-building industry is not willing to pay a higher price for these requirements (when the requirements are viewed in their total concept). However, the house-building industry values some requirements more than price, and hence indicates that it is willing to pay additionally for them.

Important aspects to study further in the future are how the supplier organization should be designed to achieve the necessary flexibility and control. It is also important to find out how wood may best be jointed to achieve necessary lengths, and how the customers react to this. Finding new ways of fitting the products without leaving nail-heads visible is also a challenge that could probably also be interesting for other products.

References

1. Bush, R.J., S.A. Sinclair, P.A. Araman 1991. *A qualitative investigation of competition in the U.S. hardwood lumber industry*. Forest Prod. J. 41(11/12):43–49
2. Gustafsson, Å., D. Igeklint 2002. *Retailers' requirements on logistic services, price, and product quality regarding softwood products*. In: Proc. on the Biennial Mtg. of the Scandinavian Society of Forest Economics, May 2002.
3. Gustafsson, Å. 2005. *Importance of Logistics Service in the House-Building Industry*. Submitted to Silva Fennica
4. Hansen, E., R.J. Bush 1999. *Understanding Customer Quality Requirements - Model and Application*. Industrial Marketing Management 28:119–130
5. Johansson, J., D. Sandberg 2005. *Volume yield from manufacturing of knot-free components and solid wood panels with vertical annual rings*. Växjö University School of Technology and Design, Report no. 8.
6. La Londe, B.J., P.H. Zinszer 1976. *Customer Service: Meaning and Measurement*. National Council of Physical Distribution Management.
7. Perreault, W. and Russ. 1976. *Physical distribution Service in Industrial Purchase Decisions*, Journal of Marketing 40:3–10.
8. Reinertsen, D., S. Thomke 1998. *Agile Product Development: Managing Development Flexibility in Uncertain Environment*. California Management Review 41(1):8–30.