Quality assurance practices in the Swedish sawmill industry

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Abstract

Sawmills are experiencing a turbulent environment in which customers' expectations and global competition set the landscape for the sawmill industry. Increasing competition and complexity, as well as the general technological development in the business environment, have enhanced the importance of quality with regards to both products and services. Hence it is important for sawmills to be able to offer a high quality of its products and services to its customers. The purpose of this paper is to identify the currently existing quality assurance practices in the Swedish sawmill industry.

This study is conducted as an interview study, in which five sawmill representatives were interviewed with regards to, for instance, their quality assurance process and quality measurements. The study concludes that the individual sawmills work to either an ISO-9000 or strength grading certificate and hence they adhere to certified procedures and routines. This research, however, does not register actions taken in every-day business, and hence additional studies would need to be conducted with an in-depth case study approach in order to identify the actual behavior at each sawmill. The studies identify factors limiting sawmills in their work to meet customers' requirements; however, customers asking for additional requirements are often denied delivery of products. This study aims at laying a foundation regarding sawmills' quality assurance practices and thus covers an unexplored area within sawmill research.

Keywords: Interview study, softwood, structural timber

Introduction

Increasing competition and the general technological development in the business environment have enhanced the importance of quality with regards to both products and services. Technological progress has provided several possibilities for production managers to get "better" control of the performance of a company's production plants (Colledani, M. and Tolio, T. 2011). In industrial markets customers have become more and more powerful and are stating specific requirements with regards to products and services from their suppliers. Hence, assessing customer requirements with regards to quality and service becomes essential for survival for supplying companies. In order to fulfill customers' requirements, implementation of quality assurance practices becomes essential in allowing companies to offer a respectable quality for their products and services. Quality assurance can be defined as a "set of activities and attitudes in the firm that promote collective involvement to work in a process of continuous improvement and product and service quality assurance" (González-Benito and Dale, 2001). In this context quality assurance practices ought to be understood as practices that aim at reducing defects and improving performance of the products and services. Quality assurance can be viewed from an internal perspective, in which certification systems ought to be stressed.

The sawmill industry plays an important role in the Swedish economy; in 2012 about 12 million m^3 of softwood lumber was exported to a net export value of SEK 22B (www.scb.se). In general, there is a surplus of softwood lumber, and competition amongst individual sawmills is immense (Järvinen et al. 2010). Softwood lumber is in many cases referred to as a commodity product which is sold on the

world market (Roos et al. 2002). Commodity products have identical product characteristics, with a focus on competition amongst the suppliers on price and availability (Robinson, Clarke-Hill et al. 2002). Consequently, the price of softwood lumber is set on the world market. For commodity industries, focus is on low production costs and services as a fundamental competitive strategy (Porter 1998). Logistics are in general a cost requirement and hence focus on reducing such costs is essential (Harrison and van Hoek, 2011 and Jonsson, 2008). Sawmills are experiencing a turbulent environment in which customer's expectations and global competition set the landscape for the sawmill industry. Subsequently an individual sawmill has to continuously stress the need for increasing productivity and offer its customers stable quality and logistics service levels. In order to stress this issue a study by Lundahl (2009) concludes that there is a potential for Swedish sawmills to improve productivity by introducing process control tools such as Total Quality Management (TQM).
TQM, being a philosophy aimed at performing the right activity the right way first time and to continue to perform it to the required level, has received much attention since its introduction (Ishikawa, 1985). In order to facilitate the TQM work, a number of quality management tools and techniques have been introduced. The number of quality management tools and techniques are plentiful. In order for the company to utilize the different tools and techniques effectively, it is essential to choose the accurate tool at the right time and to implement it appropriately (Chen, 2013). It is difficult to present a complete list of all quality tools as they are applied in different settings, as well as proposed by different scholars (see for instance Crosby 1979, Imai 1986, Evans and Lindsey 1999, Tarí and Sabater 2004, Chen 2009). However, one common list of tools is the so-called "seven quality tools" (Ishikawa 1985; McConnell 1989). Dale and McQuater (1998) and Tarí and Sabater (2004) extended this list of traditional quality tools with "new management tools" such as the affinity diagram and the matrix diagram, as well as systematic diagrams. Inherent in the concept of these quality tools lies the aim to measure and manage processes in order to obtain and maintain good quality. In order to actively contribute to quality development in all sectors of the Swedish society, the SIQ (National Committee for Swedish Quality) was founded in 1986. SIQ has developed a model for quality management based on three corner stones; systematic, structural and cultural. Systematic refers to the way of posing questions leading to an insight on how a business works; structural implies a public business model constituting the foundation for the questions, and cultural refers to the fundamental values of the business. (SIQ, 2014)

In order to fulfill the quality requirements, implementation of quality assurance practices becomes essential allowing companies to offer a respectable quality for their products and services. Sawmills experience a turbulent environment in which the customers are becoming more demanding, the price of the products is determined by the world market, and economies of scale in production has been focused for a long period of time. In order for an individual sawmill to become and stay competitive, assuring quality of its products and services become a question of survival. Hence the research question; How do Swedish sawmills assure quality of its products and services? The purpose of this paper is to identify the currently existing quality assurance practices in the Swedish sawmill industry as well as to identify potential areas for development of quality assurance practices. By knowing how sawmills assure the quality of their products and services, the foundation for quality assurance practices will be determined; thereafter it will be possible to identify potential areas for continuous work on quality assurance. The Swedish sawmills will benefit from this study by getting the area of quality assurance highlighted.

Method

This study has been carried out as an interview study in which differences rather than similarities between the respondents were sought for. Table 1 presents the companies studied. A convenience sampling approach was used to identify the companies (Bass 1990). As is common in explorative studies, the companies were selected on the basis of diversity with regard to the market in focus. For this study only sawmills delivering softwood lumber for construction participated and the interviews were carried out in the fall of 2013. Each of the respondents was visited personally, and the interviews lasted approximately two hours. The interview guide was influenced and based on the model proposed by SIQ (SIQ 2014) focusing on the issues that are directly related to quality issues. The interviewees'

responses were complemented with other resources such as annual reports, sawmill Web pages and other types of written information regarding each sawmill. The interviews were conducted with one of the authors leading and the other recording responses. Each respondent was contacted after the interview to verify the responses and to provide an opportunity to change and correct misunderstandings, thus improving the validity and reliability (Yin 2003). Further identifying differences amongst the respondents sought to enhance external validity (Bryman and Bell, 2011).

Table 1. Description of the studied sawmills

Saw-mill	*M^3 sold soft-wood lumber*	*Focus market*	*Co-operation Y/N*	*Quality assurance system applied*	*Definition of quality*	*What are the key processes and sub-processes? Which are the key requirements of these?*
1	105 000	England	N	Strength grading	Meeting product quality specifications	- Sorting of logs acc. 80 % - Sawing – acc. 80 % - Drying - Grading – items/hour - Planing – meters and m^3
2	150 000	England, the Netherlands	Y	Strength grading ISO	Meeting product quality specifications	-Procurement -Production -Sell
3	130 000	England	N	Strength grading	Meeting product quality specifications	-Harvesting – m^3 -Sawing – m^3 -Drying – $m^{3,}$ -Grading – m^3 -Planing – m^3
4	120 000	Japan, England	Y	Strength grading	Meeting product quality specifications	- Procurement, m^3 - Sawing, stop time - Drying, $m^{3,}$ efficiency -Planing, stop time
5	115 000	Denmark	Y	Strength grading	Meeting product quality specifications	-Sawing, efficiency, stop time - Grading, efficiency - Planing, efficiency, m^3/ min - Drying, efficiency, m^3/ hour

Empirical findings

Table 2 describes the responses concerning identification of current and future customer demands. Table 3 presents how the interviewees responded to questions related to the assurance of achieving expected results concerning quality outcome of the production processes. In Table 4, results relating to the structuring function at SIQ, 2014 i.e. identification, prioritization, initiation, and implementation of process improvements in studied sawmills, are presented.

Table 2. Identification of current and future customer demands

Saw-mill	*Collection of info.*	*Translation of customer requirements into the sawmill's processes*	*Ranking of customer requirements*	*How does the company use comments and complaints to improve its processes?*	*Id. of customer future demand*
1	Telephone, mail, personal meetings	We saw the softwood timber that suits us.	Price Product quality	It depends on the size of the customer	When the customer calls
2	Telephone, mail, personal	We saw the softwood timber	Price	Failure report –	When the customer calls and if we like

	meetings	that suits us.	Product quality	problem is corrected	the idea, then we try to sell it to other customers
3	The customer calls and tells us	We saw the softwood timber that suits us.	Price Product quality Delivery precision	It depends on the size of the customer	When the customer calls
4	Through the sales organization	We saw the softwood timber that suits us.	Price Product quality	It depends on the size of the customer	We do not bother
5	Through the sales organization	We saw the softwood timber that suits us.	Price Product quality	Having a complaint is preferable, as you do not offer a product that is not too good for its price.	We do not bother

Table 3. Assurance of achieving expected result

Saw-mill	*How are deviations and risks in the process prevented?*	*How do you investigate the root causes of the possible problems?*	*How do you ascertain if the problem is solved?*	*How and when do you measure?*
1	Continuous maintenance and service 2-3 times per year	Cause and effect Managed by the operating staff	Control requirements for each run in relation to metrics	We measure continuously
2	Daily controls, deviation reports according to ISO Maintenance	Cause and effect	Controls until the problem is solved	We measure continuously
3	Daily controls Maintenance	One employee is in charge per machine and the task is to ensure the best result	Tests until the problem does not persist	We measure continuously
4	We follow the processes in real-time systems and will be alerted if the values are outside those limits Maintenance	There is one employee in charge per machine and the task is to ensure the best result	Tests until the problem does not persist	We measure continuously
5	We follow the processes in real-time systems and will be alerted if the values are outside the limits Maintenance	There is one employee in charge per machine and the task is to ensure the best result	Tests until the problem does not persist	We measure continuously

Table 4. Identification, prioritization, initiation, and implementation of process improvements

	How do you identify, prioritize and initiate process improvements? How do you use the results regarding measurements and other follow-ups to support the decision?	*How do you implement the improved process? What are the different methods and tools applied?*	*How do you assure the improved processes' result?*	*How do you secure that all employees have suitable knowledge for their tasks?*
1	Investments for meeting legal requirements are always done. Use of quality tools (for instance flow charts and cause-and-effect diagrams) identifies bottle necks. We utilize the pay-off method	Purchase what is needed and then install	We install - then we measure	At least one employee per shift and work station have personal licenses for strength grading
2	Investments for meeting legal requirements are always done. At monthly meetings, we decide on what should be done to improve overall efficiency	We just do it!	We install - then we measure	We have descriptions of all work stations and in personal meetings (regularly once a year) with the employee we decide what each employee needs to learn
3	Investments for meeting legal requirements are always done. We make improvements that affect the quality of the products	Purchase the necessities, install and educate internally.	We install - then we measure	We make sure that each operator enrolls in the internal courses needed for them in order to conduct their work.
4	We divide investments into three categories 1) Necessary 2) Quality Improvements 3) Bottlenecks. Regarding necessary investments - we prioritize, and regarding the other two - pay-off time. We compare us with our competitors and see what we would need to invest in.	- Make a time plan - Define a group - Do the installation - Test - Train the employee	We install - then we measure	We make sure that each operator enrolls in internal courses needed for them in order to conduct their work.
5	We identify bottlenecks and identify how the bottleneck would move following a particular investment in two categories; legal requirements and efficiency improvements. Investments regarding the category of legal requirements are always conducted, whereas investments regarding category efficiency improvements are based on pay-off calculations.	Purchase by the central purchasing department, installation, training test	We install - then we measure	Each employee starts his/her position by joining other employees in order to learn, internal courses, external courses

Discussion

For the individual sawmill, there appears to be two ways of collecting information from the customers; either through direct customer communication (such as e-mails and calls) or through the sales organization. The use of a sales organization depends on the internal organizational structure of the sawmill and the management of the co-operation. Further it appears as if the sawmills do not actually consider the customers' requirements, as all interviewees state that their sawmill saws the softwood timber that suits them. The product more or less completely follows a standardized commodity product with standardized grading rules. Additionally the interviewees are unified in their opinion that the customers rank a low price as the most important criterion, low price being closely

followed by good product quality (i.e. meeting the standard assured through quality assurance system). Regarding the sawmills' view on complaints, there is slightly different view amongst the interviewees; a majority state that it depends on the size of the customer, one states that it handles all types of complaints, and one states that having complaints is preferable, as the sawmill's offer is then not too good in relation to the price of the products. As a consequence this specific sawmill will lower its product quality until the customers start to complain, just to identify the borderline. Concerning future demands, most sawmills listen to their customers once they have contacted them and take action on inquiries if the business proposals include volumes large enough making it worth changing the existing production. However, two of the interviewers state that, generally, they do not bother trying to fulfill customers' special requirements since they disturb and complicate their normal production processes.

The prevention of deviations and risks in the processes differs between the individual sawmills. Interviewed sawmills with a large production volume have real-time alerting systems, whereas interviewed sawmills with smaller production volumes control the outcome of the production process daily. All sawmills conduct maintenance on their machines; some of the interviewed sawmills conducting planned service on the machines throughout the production time. A majority of the studied sawmills utilize the concept of work stations with the responsibility assigned to one specific employee. The assigned employee is responsible for identifying root causes, correcting and controlling. No sawmill, however, describes how they structure this process. All sawmills measure the outcome of their production processes continuously concerning effectiveness, and most companies have procedures to use this data to identify improvement needs. All of the studied sawmills appear to assure the outcome of their processes similarly.

All sawmills make investments that are necessary for meeting legal requirements. Differences could be viewed regarding other investments; some appear to make investments that improve the product quality, and some make investments in order to reduce bottlenecks (thereby enabling increased production volume). It appears as if all the interviewed sawmills conduct the implementation of investments in a similar manner i.e. they purchase a product, put it in place, educate their employees, and measure the outcome. All of the studied sawmills appear to educate their (newly) employed personnel within the organization, and in alignment with the requirements stated by certification system.

Conclusion, delimitations, and future research

This explorative research concludes that the studied sawmills assure the quality of the products and services by following the certification system and reaching an acceptable level of product quality according to the grading standards. The product in focus (softwood lumber for construction) is a commodity product, and the willingness for the individual sawmill to shift its focus appears to be low, most likely due to economies of scale in production. The study indicates that sawmills, in reality, do not directly reflect on customer requirements; instead they focus on production volume and economies of scale in production. On the other hand, legal requirements on the product (softwood lumber for construction) are well specified, and certification is necessary according to specified standard building specifications. These building specifications differ between markets. Further, the customers' possibility to state additional requirements is concluded to be limited. This combination of set standardized requirements and economies of scale in production within the sawmills limits their willingness and ability to change. Interesting to note is that all interviewees state that they only ensure product quality and do not consider any other quality aspects such as logistics.

This research is delimited to sawmills producing construction timber and in the light of this, forthcoming steps in studying quality assurance in the sawmill industry ought to focus on another product and thereby include other actors; for instance sawmills producing softwood for the manufacturing industry such as windows and/or furniture ought to be stressed.

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