Effective Maintenance Management Should be a Component of BC’s Changing Value-added Wood Industry

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ABSTRACT

British Columbia’s value-added wood industry is in a period of development due to the actions of government, research facilities, and industry. This sector is an important component of a diverse forestry industry and in particular is an important way of developing economic stability in rural forestry based communities. The majority of BC’s value-added sector is composed of small to medium sized businesses, which in theory have less specialization of human resources and knowledge gaps because of this. Effective maintenance management is a tool that these manufacturers could be utilizing to develop their industry position and global competitiveness. Groups that are driving the development of the industry should include maintenance management in their goals and discussions of quality improvement, business strategy and marketing development. To approach this topic, research was completed into the background of the value-added wood industry, a literature review of maintenance management strategies was completed and a manufacturer was interviewed.
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“Take care of yourself,
Take care of each other,
Take care of the equipment,
Take care of business.”
1. Introduction

In a manufacturing setting, machinery is relied upon to make a product that finances an entire operation. This reliance upon a company’s machines alters the question of their need for effective maintenance from “if” to “when”, “how” and “how much”. There has recently been an increased effort to try to increase the global competitiveness of BC’s value-added wood products sector. The push is for these manufacturers to be successful, to improve quality, and to create a global brand image for BC value-added wood products. Within this sector, small manufacturers should realize that the implementation of effective maintenance management is worthwhile to improve performance and product quality and is an achievable goal for small firms.
2. The Trend of BC Value-Added Wood Products

Governments, industry and research institutions have been promoting and supporting the development of the value-added wood industry in BC. Their goal is to diversify the BC forestry industry, to innovate for the future, and to increase the value yielded by the province from the forestry resources that are harvested. The value-added wood industry is also a way to develop community jobs in areas that have been adversely affected by changes in the commodity wood markets and sustain long term viability in these communities (Western Economic Diversification Canada, 2003).

2.1 Forestry and Value-Added Wood Products

Forestry is traditionally a very important industry in BC and this continues to be the case. In 2006, the BC resource industry, which includes forestry, mining, agriculture, oil and natural gas, had the largest share (12.6%) of the provincial GDP and logging, wood products and pulp and paper accounted for half of that share directly and accounted for 24.8% of BC’s GDP when including indirect effects (Jock Finlayson, 2008). The wood manufacturing industry in BC in 2006 was the largest in Canada, representing 40% of the national industry GDP, and provincially representing 30% of the manufacturing GDP (BC Ministry of Management Services, 2008). However the BC value-added industry component of wood manufacturing has been lagging behind other provinces and nations.

Value-added wood products are defined by the British Columbian Government as treated lumber, engineered wood products, shakes and shingles, posts, poles, log and timber-frame homes, mouldings, pallets, boxes, cabinets, furniture, art, and other finished or
semi-finished goods (B.C. Government Department of Forests and Range, 2007). In 2002 BC had the second lowest ratio of value-added wood to total wood exports compared to the rest of the provinces, above Newfoundland (BC Ministry of Management Services, 2003). While the share of BC value-added wood products increased in the late nineties as shown in Figure 1, it still only represents a tenth of BC’s overall solid wood exports (BC Ministry of Management Services, 2008).

Figure 1 - The Percentage of Value-added Wood Products of Total Wood Exports.

![Figure 1](image_url)

Another important industry performance indicator is the value we are currently receive for harvested BC timber. As shown in Figure 2, between 1990 and 2002, BC received an average of $123 USD of GDP per cubic meter of fibre. The United States and Japan, BC’s two primary receivers of raw log exports, achieved returns two times and five times this value respectively (Marshall, 2002). These results along with the standing of countries like Germany, Australia and Brazil, illustrates the potential for BC to change its industry focus and thereby add value to its wood products. This opportunity is the motivation behind key

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1 Source: (BC Ministry of Management Services, 2003)
players in the forest industry promoting a shift to the manufacture of more value-added wood products.

Figure 2 - Value Received from Wood Fibre in Different Countries

Source

2.2 Key Players

In the past decade there have been many actions by government, industry and research facilities to promote value-added wood manufacturing in BC. Industry analysts advise that to adapt to its future, BC’s forest industry must evolve its traditional products, defend its current markets and look beyond them to the future. That means developing new high-value products and seeking out new markets and matching products to these markets (Natural Resources Canada, 2007). In response, tactics are being used or proposed that would grow BC’s value-added wood industry and increase its long term viability? Many

2 Source: (B.C. Government Department of Forests and Range, 2007)
efforts have been collaborative, but the key players are the federal and provincial
governments, which provide funding through agencies like Forestry Innovation
Investment (FII); industry associations like BCWood that provide networking, marketing
and trade opportunities; and research facilities like FPInnovations – Forintek, CAWP and
UBC Forestry that provide technical advice and research directly to industry and through
programs like Value to Wood.

The success and improvement of the value-added wood industry in Canada is spearheaded
in part by the federal government’s $127.5 million Forest Industry Long-Term
Competitiveness Initiative. They also have programs such as Canada Wood, which focus
on global marketing. In BC, the provincial government is targeting a market based
approach by changing policies, removing barriers and enabling companies. The provincial
government through the FII spent $11.5 million on marketing initiatives in 2007 (Natural
Resources Canada, 2007). Most recently, on March 24, 2009 the provincial government
released their vision and action plan: “Generating More Value from Our Forest,” which is
initiating a Wood Enterprise Centre and Value-for-Wood Secretariat. These two initiatives
support their action plan to tackle key success drivers for expanding BC’s value from
wood (B.C. Government Department of Forests and Range, 2007).

One of these action plans is the promotion of wood in commercial and institutional
building and has been showcased by wood designs in venues for the 2010 Olympic games.
The Canadian Wood Council’s BC WoodWORKS Awards gala also supports value-added
wood products by rewarding wood building and design. The faculty of forestry at UBC
supports the industry through the training of its students and events like that held in 2005
and 2006 by the BC Forum, that brought stakeholders together to discuss sector issues and
present research about global competitiveness of the BC forest sector and opportunities for value focused forestry in BC respectively.

To improve quality, an industry specific quality program designed to best assist small to medium size companies was developed. It was designed to be less document-based then programs similar to ISO and in 2007 was given additional funding by the federal government to aid in branding and promotion of the program (Western Economic Diversification Canada, 2007). The WOODMARK Quality Certification Program was developed by the Wood Products Quality Council around 1997 and was relocated to FPInnovations - Forintek ten years later to be a part of their Solutions to Wood program (Woodworking Magazine, 2007). Its goal is to provide an industry-specific certification program for wood-based products manufacturers, to aid them in adopting total quality principals and practices. The program helps companies to improve value to their customers, overall efficiency and the profitability of their operations (Chiu, 2009).

WoodMARK certification requires the development of an atmosphere of management support, commitment, teamwork, continuous improvement and quality excellence. Statistical Process Control (SPC) and Total Quality Management (TQM) approaches are used to evaluate critical process and operation inefficiencies and to eliminate defects and problems (Wood Products Quality Council).

An industry can increase its competitive advantage through increases in research and development. The Value to Wood program was created in 1998 and renewed by the federal government in 2007, to continue to fund and facilitate the development of
improved products, manufacturing processes, market knowledge and technical advice for manufacturers in the value-added wood industry (Natural Resources Canada, 2007). The program currently funds research at the University of British Columbia and FPInnovations, among others in Canada. It utilizes its connection with research institutions as a network to find Industry Advisors, to bring together leading specialists and to transfer the results of its research throughout the country to manufacturers (The Value to Wood Program, 2008).

Part of the strategy to measure global competitiveness of BC value-added wood products is the creation of a global brand image for BC. This is the goal of associations like BCWood and Canada Wood. BCWood is a government and industry not-for-profit partnership that was created in 1989. It provides marketing and networking assistance to BC value-added wood producers and works to expand North American and international markets. An online inquiry system called the Wood Supply Network has been developed. It matches product requests over the internet to capable manufacturers from the BCWood system. Canada Wood is an association with offices in Europe, Asia, and the UK that works with international partners and governments to explore and expand market opportunities for Canadian wood exports. They seek to brand Canada as a preferred and dependable supplier for quality wood products. (Natural Resources Canada, 2008)
3. Machinery and Maintenance

Manufacturing machinery requires substantial capital investment and is a major asset to a company. The longer the useful life of this asset, the more benefit a company derives from that investment. Maintenance is the upkeep or the process of keeping a machine in good working order, including actions to avoid failures. Direct maintenance costs in the manufacturing industry typically ranges from 5-15% of operating expenditures, although this does not include the penalty costs of revenue from lost production and rework (Campbell, 2006). In industries where there is intense competition for sales based on product price, manufacturers compete to try to reduce costs. In this case, maintenance costs are often marginalized and some firms may decide to reduce budgets for maintenance, not understanding the short and long term impacts this could have on operations and expense. The cost savings may be immediate but the ramifications of the maintenance reductions can take time to filter through (Narayan, 2004, p. 92).

3.1 Maintenance Management Strategy in Literature

There are many strategies for maintenance management and there is a large body of academic literature on the subjects of operation research, reliability, replacement, maintenance engineering, and statistical process control. There are many theories and strategies for tackling maintenance, but three main categories of maintenance tasks are:

- Continuous improvement maintenance
- Preventative maintenance
- Corrective maintenance
These are discussed in more detail below, but in general are system improvements, planned maintenance and emergency maintenance respectively. These three are not mutually exclusive and in a well structured maintenance program are used in different proportions to achieve optimal maintenance at a facility. The core idea of separating these three categories is to change a mainly chaotic, reactive task and to a controlled and predictable one by adding structure and planning to it. Another maintenance theory is Total Productive Maintenance, which is an important concept because of changing quality and business strategies.

### 3.1.1 Continuous Improvement

Continuous Improvement encompasses activities planned to reduce the total need for maintenance. They are activities with the goal of eliminating future maintenance tasks and problems by improving the current system. Similar to the principal of ‘Kaizen’ in lean manufacturing and Japanese management philosophies, continuous improvements should be an ongoing, active part of management (Huntzinger). It might involve purchasing longer lasting saw blades for difficult to change locations or including ease of maintenance in machine purchasing decision. Newer computerized machines can have many features to improve ease of operation and maintenance. Some include maintenance information and notifications built into their software, notifying the operator that the equipment needs servicing. Continuous improvement is the most valuable part of a maintenance program (Joseph D. Patton, 1983), and is inline with quality programs or mentalities like Lean, Six Sigma and 5S that stress continuity as a key step.
3.1.2 Corrective or Run-to-Failure Maintenance

Reactive maintenance is unscheduled or emergency maintenance; the act of fixing a failure after it has happened. It will always be a part of a total maintenance program because there will always be some unexpected failures. It is a reactive mentality towards maintenance but on the surface appears to avoid excessive spending on maintenance. However it usually is the most expensive type of maintenance with an average cost three times higher than the same preventative repair (Mobley, 2004). The realized costs of it are: increased spare parts inventory, increased expedited parts delivery, higher machine downtime, lower production availability and increased overtime labour hours (Joseph D. Patton, 1983). Using this maintenance mentality does not allow you to schedule your repairs and take advantage of the savings from planning the repair time, parts, and labour.

3.1.3 Preventive Maintenance

There are three sub-sections to preventive maintenance that all aim to find the optimal timing for a maintenance task and in this way to prevent corrective maintenance. The first is “on-condition” maintenance, which utilizes inspections and peoples’ observations to identify the need for maintenance. An example of this is an inspection of a drive belt for cracking and wear. The second type is predictive maintenance using condition monitoring, statistics and probability to predict the actual lifespan of a part and to schedule maintenance accordingly. This type of maintenance generally suites sophisticated machinery that, for example, could utilize non-destructive testing such as oil analysis or vibration monitoring to monitor wear. The third type is periodic maintenance, which is based on a fixed interval (days, runtime hours, etc.) and may be guided by manufacturer’s recommendation or operating experience; it relies on a schedule to indicate when
maintenance should be done. This type of maintenance is best utilized on parts that do not show wear, or where a failure may cause catastrophic damage. This type of system can also be used to initiate condition-based maintenance. An example of this is an oil inspection on a compressor, which is triggered by a certain number of operating hours, after which an employee would check the condition of the oil, but not necessarily change it.

3.1.4 Total Productive Maintenance

Total Productive Maintenance (TPM) is a philosophy that had its beginnings in the development of Total Quality Management in Japan (Roberts, 1997). The goal of total productive maintenance is to achieve predictability of machine operation and zero machine failures. A team based approach is used and continuous improvements are made to solve chronic machine problems and thereby improve equipment reliability. It involves a combination of all three of the above mentioned maintenance categories but in addition stresses diligent record keeping and operator involvement in all areas (Hay, 1988). It calls for management support and a change in approach to team based problem solving between skilled maintenance personnel, operators, and supervisors. TPM requires the training of operators until they understand the function and structure of the machine, are able to solve slight machine problems, are able to do day-to-day machine maintenance and are able to identify early indicators of machine problems. Responsibility of machine upkeep is transferred to the operator so that they will use their close relationship with the functioning machine as a sensor to prevent machine breakdowns at their source (Suzaki, 1987).
3.2 The Benefits of a Proactive Maintenance Strategy

The economic return from maintenance investment generally occurs over a long term and the benefit of maintenance investments may go unnoticed in informal maintenance programs that have poor or no feedback measures. However, the main benefits from instituting an effective and comprehensive maintenance program are increased productivity, increased reliability and control and reduced costs. The monetary benefits associated with these and other factors could aid a value-added wood company to be more successful, increase quality and become more competitive.

Company profitability and growth are affected by many factors but can be affected by maintenance costs, productivity, and safety. Diligent care for machines rewards a company with increased machine uptime and therefore increased productivity (Joseph D. Patton, 1983). It allows a company to schedule maintenance to best suit their production demands and ultimately prevent inefficient utilization of their assets and the wasting of resources (Narayan, 2004). All of which increase the control owners have of their organization and make them better able to balance work flows, schedule production, and meet lead times for their customers (Hay, 1988). Improvements in machine reliability and strategies that focus on product flow allow companies to reduce buffer inventory sizes, thereby requiring less working capital and improving their cash flow.

Poor maintenance of equipment is one area likely to be highlighted during an inquiry into a disaster at a facility. Maintenance of pollution control devices and machine safety devices are a very important part of general maintenance and effect worker and public
health and safety. Proper maintenance can help limit the escalation of incidents from minor failures to serious situations and should be maintained with all due diligence considering the risks associated with failures (Narayan, 2004). A structured maintenance system that utilizes inspections can detect safety and environmental problems and allow a company to uphold its social and environmental values (Joseph D. Patton, 1983). A safe work environment and progressive environmental policies are one way to keep a company competitive and successful.

Quality and global competitiveness are linked goals for the value-added wood industry because typically global markets that BC manufacturers aim to compete in, like Japan and Europe, are challenging because customers have high quality expectations and tight tolerances. Good maintenance alone is not likely to make a company a highly competitive player, because a company is made up of people and processes, not just machines, but implementing a program like total productive maintenance does enhances a company’s ability to produce high quality goods and services quickly and to satisfy customers consistently (Campbell, 2006). As companies move away from mass production mentalities and towards strategies pioneered by the Japanese, like Lean and Just-In-Time manufacturing and Total Quality Management, maintenance programs become a necessity (Hay, 1988). Machine breakdowns and their effects on neighboring machines are the prime reasons that traditional manufacturing has larger buffers between machine centres, but these large buffers force the inclusion of many steps in an operation that do not add value to a product and time and money are spent for example simply stacking and un-stacking parts (Suzaki, 1987). The new process management philosophies, including ones
like the theory of constraints, aim to reduce buffer sizes, make machines more closely
linked and improve flow through a facility. These goals put a high demand on the
availability of machines and the reliability of the system.

The benefits to BC manufacturers of value-added wood products of implementing
maintenance philosophies similar to total productive maintenance could be substantial.
Choosing to excel in maintenance will result in lower costs, more reliable and predictable
operation, and improved safety performance and environmental compliance (Campbell,
2006).
4. Interview with Industry

Island Precision Manufacturing Ltd. (IPM) was contacted to include a real-life representation of a maintenance program and to get an industry specific perspective from a small wood products manufacturing. IPM is an architectural millwork manufacturer in Victoria, BC. Their clients are primarily general contractors and developers of large corporate facilities, hospitals and schools. They manage their production on just-in-time principals and therefore their production is very tightly scheduled and they keep very little inventory. They are a progressive small value-added manufacturer with about 30 employees and are a competitive icon in their field, having worked on such highly publicized projects as the Vancouver Convention Centre Expansion Project. Some key machines that they utilize are a medium size panel saw, a hot press, an edgebander, and a CNC router. The interview was conducted with Brett MacDonald, their Production Manager.

4.1 Discussion of Interview

4.1.1 The Company’s Current State

Island Precision Manufacturing Ltd. has an informal maintenance program based on their machine supplier’s schedules. They use Microsoft Excel to record completed infrequent maintenance tasks and Microsoft Word to create maintenance task checklists. They have scheduled startup and cleanup periods every day and a longer time period at the end of the week. During this scheduled time, operators clean, lubricate and inspect their work stations. The production manager oversees these tasks and relies on his operators to
communicate problems or irregularities with the machines to him. IPM does not fully employ a maintenance worker, and instead they contract out what they are not able to do in-house. If they require other expertise they contact their suppliers for advice and service;

In December 2007, they suffered from a serious fire, and had to invest in new machinery and renovate much of their production shop. Their new large machinery, the CNC router, the belt sander, and the panel saw are computer driven and indicate when they require certain maintenance operations. Their CNC router has online capabilities and the supplier can remotely access the machine and diagnose any problems that they encounter, however their warranty period is soon ending. Maintenance improvements are not a part of their planning, although reliability is very important to them because of their clients’ demands for consistent on-time delivery.

4.1.1 IPM’s Maintenance Knowledge

IPM has no in-house maintenance expertise other than personal experience in their facility and they rely on advice from their suppliers and contracted help to complete repairs and schedule maintenance. They base their maintenance decisions primarily on expert advice and cost, but do not compromise because of expense. They insist on fixing a problem properly the first time.

4.1.2 Preferred State

The areas of improvement that IPM wishes to make in their future are and increase in commitment and a re-establishment of some procedures that have not been reinstated after the fire. They do not maintain their equipment with the diligence that they wish to and do
find they have a strong commitment to maintenance. They often encounter problems which have been overlooked by their operators and find that maintenance is constantly pushed back due to demanding production deadlines. Maintenance management is one of a range of duties for the production manager, and he finds that if maintenance is not consistently brought to his attention, it is overlooked because of other tasks that occupy his attention. This is exemplified in their annual and long term maintenance tasks, which are irregular.

The production manager’s ideal situation would be if a person with skills in maintenance management was employed to manage it as part of their duties. This would also improve the scheduling and diligence with which their maintenance is accomplished. There are many small improvements that could be completed if they had more resources to devote to it; the production manager’s schedule simply does not allow the time for him to complete them. Another area in which this could help is in the training of their employs regarding maintenance.

IPM is a forward company and they have had great success using Just-In-Time principals. The production manager worries very little about breakdown now that they have their new machinery, and he would like that to continue. If maintenance management and continuous improvement can maintain this for them then that is the direction they will head.
5. Maintenance Implementation in Industry

To implement a maintenance program, a company must: evaluate the strengths and weaknesses of their current situation, determine a strategy that suites their company, develop comprehensive actions to realize the program goals, implement these actions, sustain them and improve the program continuously (Campbell, 2006). And a maintenance program is multi-faceted and simplified down includes: maintenance tasks, inspections, scheduling, maintenance personnel and their training, procedural documents and checklists, records and logs, and economic analysis for review among other elements (Joseph D. Patton, 1983). A company therefore must utilize a wide range of skills throughout this process. Discussed briefly here are some tools and skills that are useful in maintenance program, factors that affect implementation of a program and the crux strategy components for a small value-added company implementing a program similar to Total Productive Maintenance.

The likely choices for a managing and coordinating a maintenance program, are to use generic software, like Microsoft Office to create basic company specific documents and controls, to use a generic Computerized Maintenance Management Software (CMMS) or to have a custom CMMS developed for the company. Calling these options one, two and three respectively below is a chart of their basic advantages and disadvantages.
Figure 3 - Evaluation of Common Maintenance Control Tools.

<table>
<thead>
<tr>
<th>Options</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Office Software | ● Specific to a company  
                   ● Tailored to their goals  
                   ● Most affordable | ● Lack of integration in the different aspects of the maintenance program |
| Generic CMMS | ● Thorough control system  
                   ● Developed by maintenance specialists  
                   ● More affordable than a custom CMMS | ● Cumbersome and generic  
                   ● Require constant updating  
                   ● Use lots of paper |
| Custom CMMS  | ● Tailor suited to a company  
                   ● Integration with system | ● Most expensive |

Source³

Skills used in effective maintenance management involve problem solving, analytical skills and economic skills. Functional block diagrams (FBD) are a problem solving method used in maintenance management, which isolates inputs, outputs and process restrictions to identify process functions. Failure Modes and Effect Analysis (FMEA) in a mechanical sense is the process of taking function failures and identifying all of the mechanical failures that would cause them. FBD and FMEA used in conjunction allows one to identify a what has caused a problem and helps to identify significant failures so that resources can be assigned accordingly (Narayan, 2004). A more in depth area of maintenance is the usage of Reliability Engineering. It is an area of specialty more common to larger scale facilities, and is not necessarily appropriate for the small value-added facilities under discussion. It raises the topic of approach though and the size and demands of a facility and why a discussion of maintenance targeted at small scale firms in particular is pertinent to the value-added wood industry.

³ Source: (Pershin, 2009)
5.1 Differences between Small Facilities and Large Factories

The maintenance strategies discussed in section 3.1 must be instituted differently depending on the size of the facility. There are differences in processes, resources and human resources that constrain the two situations differently. Large corporations in general will have more human resources, more machinery, and larger budgets. Smaller companies have less specialization of employees, less machinery as a whole, and in general a smaller or maybe even unallocated budget for machine maintenance. However, the machinery in small companies is no less vital to production and it could be argued that it is more vital, as they may be less buffered against losses than a large company. British Columbia’s value-added industry is mainly composed of small and medium size firms. As shown in Figure 4, 88% of the companies in the value-added wood industry in British Columbia of the employed fewer than 50 people and 45% employed fewer than ten.

Figure 4 - British Columbia's Value Added Sector

<table>
<thead>
<tr>
<th>2006 Revenue</th>
<th>2006 Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% of total</td>
</tr>
<tr>
<td>Less than $1 M</td>
<td>30%</td>
</tr>
<tr>
<td>$1.1M – $3M</td>
<td>29%</td>
</tr>
<tr>
<td>$12.1M - $24M</td>
<td>24%</td>
</tr>
<tr>
<td>More than $24M</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>$Billion</td>
<td>$ 4.0</td>
</tr>
</tbody>
</table>

Source\textsuperscript{4}

\textsuperscript{4} Source: (B.C. Government Department of Forests and Range, 2007)
5.2 Key Area for Implementation of Maintenance a Programs

The main factors mentioned by Hay, 1988, Campbell, 2006 and Suzaki, 1987 that will affect a manufacturer trying to implement maintenance philosophies similar to TPM are operator involvement, management support and diligence. It is humans themselves that cause the deterioration of machines if they allow it to happen. If operators and management and maintenance personnel understand their role in affecting the machines they can support each other and can affect change. The elimination of potential causes for failure, such as dust, wear, loose bolts, or bad operating conditions etc addresses the issue before there is a problem. Operator involvement, management support and diligence, are not skills or tools, they are strategies that have been proven to be effective. If a company doesn’t have to purchase anything and must simply change its attitude to enact the kind of change that has been written about, it could either be the most expensive or affordable change they make.

“The role of people is more important the more complicated [a] machine becomes” is a strong statement at a time when more and more machinery is incorporating technology (Suzaki, 1987).

5.3 The Main Barriers to Industry Implementation

Two barriers to industry implementation are the general attitude of the industry towards maintenance and the maintenance knowledge level of small facilities without maintenance expertise. The pervasive attitude that maintenance is an unavoidable burden and an interruption to normal operations is a mindset that many share (Mobley, 2004) and that
will limit the effectiveness of any program that relies on worker buy-in to sustain its activities. Maintenance knowledge is a key barrier as it was identified as a skill in short supply in the industry (Wood Manufacturing Council, 2006). As demographics change and many individuals that were part of the baby boom generation retire there is concern about who will capture that knowledge as many individuals of subsequent generations learn far more about computers and technology than trade skills (Campbell, 2006).
6. Conclusions

BC’s value-added wood sector is changing in response to actions taken by government, research facilities and industry to improve its global competitiveness. Many of those actions involve process, quality and market based improvement initiatives, however none of them focus on adapting maintenance strategies to BC’s industry specific circumstances. The BC value-added industry is primarily composed of small to medium sized companies which lack the scale and specialization allowed in larger facilities. Within this sector, small manufacturers should realize that the implementation of effective maintenance management is a necessary part of their development especially considering the importance of machinery to these companies and the changes in management philosophies from the traditional mass production to those of lean, just-in-time and total Quality Management. Governmental programs and research institutes should include maintenance management in their recommendations to industry because at the centre of an effective maintenance program is the commitment to long term viability and success. Small facilities should utilize the gains they can make in maintenance because rising production costs are going to threaten the existence of small shops in the future (Wood Manufacturing Council, 2006).
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