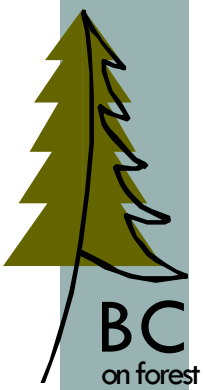

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Technology and the Competitiveness of the Wood Products Sector in BC

By
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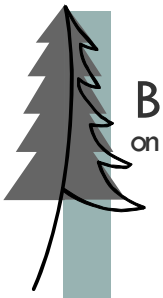

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1.0 Introduction

Canada's competitiveness in the wood products sector has been based historically on the abundance, quality and low cost of its raw material supply. Most of the recent technological innovations have been targeted at lowering costs by improving the volumetric product recovery, and reducing the labour component. For decades, this strategy has worked well to help Canada remain a cost leader in important commodity markets, where product differentiation is less important than price.

The results of this strategy can be seen for the BC sawmilling industry in Figure 1. The lumber recovery factor has steadily increased over the past 15 years due to investment in wood processing technology. This increase has occurred despite the fact that over the same time, average piece size has declined. Similar achievements in output per employee have occurred over the same time, lowering costs even further.

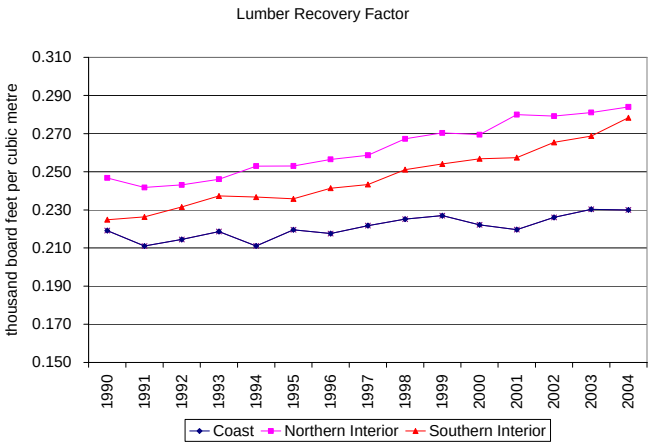

Figure 1. Lumber recovery factor in MBF of lumber per cubic meter of logs consumed for three regions in BC.

During the same time period, technological innovations in product development have not served to improve Canada's competitive position as a producer. For example, new engineered wood products developed in Canada have been embraced by other regions of the world with lower quality timber but faster tree growth rates, making them more cost competitive. Examples of these technologies are oriented strandboard replacing plywood, and stronger papers produced from new chemical processes instead of high quality fibre. Both of these product categories were initially based on Canada's competitive advantage in quality wood fibre.

Canada's cost competitiveness in wood products is threatened from nearly every angle, which brings into question any strategy that relies principally on commodity wood products for several reasons. First, the volume of timber available to the industry is dropping. Quebec has already announced a 20% decrease in annual allowable cut (AAC). BC's cut will likely decrease in the coming decade for a host of reasons – including an unprecedented insect attack in the interior of the province.

At the same time there are major increases in fibre availability in a number of other jurisdictions. Southern hemisphere plantations in Chile will double their output in the next decade. The boreal

forest in Russia is a huge untapped resource that is opening up and will be made available, among others, to state-of-the-art Chinese manufacturing facilities.

A reliance on commodity wood products makes Canada particularly vulnerable to offshore competition. With few barriers to entry, areas of the world with high timber growth rates and low labor costs can quickly become world class competitors using standard technology. Low cost waterborne shipping makes it cost effective for emerging competitors to reach Canada's current customer base in the US, Europe and Asia.

To develop a research strategy for moving forward, the BC Forum on Forest Economics and Policy has conducted a preliminary assessment of the competitiveness of the BC forest products sector in four key areas: demand conditions, factor conditions, technology conditions and firm strategy. This paper summarizes the findings in the technology conditions and makes specific recommendations for future research projects. Results from three other areas are being synthesized and will be published next.

2.0 Methods

The assessment of Canada's competitiveness was conducted in two steps. First a detailed analysis of published data on key financial and operating data was conducted. This information was compiled and sent to a panel of experts for review. Second a set of workshops were held on 28 February 2006 at the University of British Columbia to evaluate BC's global competitiveness based on expert opinions and assessments.

2.1 Purpose of the Workshop

The purpose of the workshop was threefold: 1) to determine a full set of product categories in which to rank BC's competitiveness, 2) to complete a competitiveness grid ranking BC's global competitiveness in a number of conditions related to technology, and 3) to determine the most important research initiatives that could provide better data to for assessing Canada's competitiveness.

2.2 Workshop and participants

The workshop was divided into four panel sessions: technology, demand conditions, factor conditions, technology, and firm structure and rivalry. The participants on the technology panel were:

- Thomas Maness, UBC Forest Resources Management, (Facilitator)
- Darrell Wong, Forintek Canada Corp.
- Alan Potter, Forest Research Opportunity BC

- Dan Price, Tolko Industries Ltd.
- Tim Sargeant, Halco Systems
- Dick Kerekes, UBC Chemical Engineering
- Olaf Schwab, UBC Forest Resources Management

2.3 Description of workshop

The workshop started with a brainstorming session to identify the product categories. The following categories were identified and used as column headings in a technology / competitiveness grid (see Table 1).

- Logs
- Commodity Lumber
- Veneer
- Chips
- Pulp
- Paper
- Structural Panels
- Nonstructural Panels
- Value-Added: Engineered Wood Products
- Value-Added: finished bldg products

Next, a set of technology related factor conditions were identified by working through a series of leading questions (see below). The facilitator posed each question to the group and guided the ensuing discussion. Detailed notes were kept from the discussion. The factor conditions related to each question were placed in the leftmost column of the grid, and BC's relative competitiveness was rated for each of the applicable product categories. The experts also reported how important that condition was to BC's future competitiveness. Once the factor condition was identified, the facilitator worked through each product category and asked the group to rate BC's competitiveness on a global scale between 1 and 10.

Leading questions that were used to guide the discussion:

1) How will new technologies affect BC's competitive advantage in wood supply?
2) In which industries and to what extent are there either economies of scale or scope (these could include cluster benefits)? What are the impacts of economies of scale (e.g. growing size of pulp mills and OSB plants), and substitute products (e.g. plastic decking) on the structure of the Canadian wood sector?
3) Is technology and supply chain management (SCM) impacting the location of manufacturing?
4) Will new technologies make BC more cost competitive?
5) Will new logging technologies permit selection cutting and value-added manufacturing?
6) If technology is available to all (i.e. no advantage for developer or first mover adoption) how does this impact R&D in Canada?
7) How will changing transportation realities impact the wood sector (e.g. are high fuel costs here to stay? Will the shipping capacity shortage turn into a glut?)
8) What is the impact of energy costs, climate change, etc. on key supporting industries (e.g. equipment manufacturing, financing)?

An example of the resulting grid and the rankings (out of 10) by product category and condition is shown in Table 1 below. The full table is shown in the Appendix (posted online at: http://www.bc-forum.org/_media/ **SP0505competitivenesstechnology-Appendix 1.pdf**).

TECHNOLOGY & RELATED CONDITIONS	Logs		Lumber	
	Comp. Rank	Rel. Importance	Comp. Rank	Rel. Importance
Adaptation of technology to enhance BC's fibre base	3	10	5	8
Changing BC's fibre base	0	7	0	5
Sawmilling technology (volume based)			10	10
Sawmilling technology (value based)			4	10
Capability for separating species and quality	4	10	4	10
Supermill			9-10	10
Specialty Mill			0	10
Supply Chain Optimization Technology	0	10	2	10

Porter argues that the way to increase competitive advantage is to use the pressures and challenges that we face to drive innovation through the diamond framework. The BC Forum on Forest Economics and Policy used the Porter Framework to assess the competitiveness of the forest products sector in BC and Canada with a separate panel of experts in each of the competitiveness factors in the diamond framework. These competitiveness factors are described in detail in the next section.

3.0 Competitiveness Factors and Performance

Review of Competitiveness Factors in Canada

The Porter Competitiveness Framework (Porter 1990) argues that internationally competitive firms gain their advantage through innovation and continuous improvement in methods and processes. Home base factor advantages can be important in establishing a competitive presence, but it is the ability to innovate and stay ahead of the competition that provides a consistent advantage.

The framework is based on a national diamond consisting of the following four sources of national advantage. Technology and innovation is woven throughout the diamond, appearing in all four conditions.

- *Factor Conditions*

  The Porter Framework argues that important factor conditions are created rather than endowed. Canada's historic factor advantages have been raw materials (inexpensive, high quality wood) and skilled labor for primary processing. Technology, fast growth plantations in the Southern Hemisphere and the opening of the Russian boreal forest have eroded these as sources of competitive advantage.

  Factors that are highly specialized to an industry or those that offer specialized services to an industry are much more scarce and difficult to imitate. Examples are specialized technical institutes that can provide unique and innovative solutions quickly, and capital markets to help commercialize new technology and approaches

- *Demand Conditions*

  Demanding customers make for a competitive firm. Porter argues that a strong home market with demanding customers will make a firm work harder to gain competitiveness. If the home market is comprised of sophisticated buyers, they will provide an advanced indicator of the needs in the global market. In the case of pulp and wood products, however, it can be argued that the Canadian home market is so small that it does not drive innovation; instead, demand in the US drives innovation. It may therefore be more important to seek out the most demanding customers in the US to guide our drive toward innovation.

- *Related and Supporting Industries*

  Firms that can take advantage of internationally competitive supporting industries also have an advantage. Much of the sawmilling technology used in North America is manufactured in Canada. These Canadian manufacturers of technology have been focused on the development of technology and methods aimed at high volume recovery and fast throughput. The same is true with consulting companies and engineering design companies. Canadian companies should seek out the world's best performers in each sector and compete directly with them. Current forest policy that allocates tenures to companies regardless of competitive position may be helping to prop up globally uncompetitive companies. Recent forest policy changes in BC, with regard to consolidation and appurtenance, have alleviated this concern to some degree, yet it must still be considered when reviewing tenure systems.

- *Firm Strategy, Structure and Rivalry*

  To be competitive, a company's strategies should be designed to take advantage of local conditions. For example, according to Porter, nations tend to be competitive in fields that are admired by the citizens. The Canadian forest products sector appears to have lost whatever competitive advantage it once enjoyed in this area – the forest products sector is

no longer admired by Canada's citizens for a host of reasons. Strong rivalry amongst a number of firms and demanding conditions also make for healthy competitive firms, as only the strong survive. On the other hand, sectors that are subsidized are only weakened in their ability to compete on a grander scale. Porter's argument is that we should compare ourselves to our strongest rivals and then determine how to beat them. Our strongest rivals may no longer be in Canada.

4.0 Assessment of Firm Performance and Technology Trends

4.1 The Financial Performance of the Wood Products Sector

The figures below highlight two key profitability indicators for BC and Canada. Return on Capital Employed (ROCE) measures earnings before interest and taxes (EBIT) divided by assets minus current liabilities. It shows how efficiently a company is using its assets to generate profits. It is usually compared to the cost of capital, which is between 10-13% (Roberts *et al* 2005).

For the pulp and paper sector, ROCE rebounded somewhat in 2000 but has declined since. BC operations are performing worse than those in the rest of Canada. In all years the pulp and paper sector trails the wood products sector. While the most successful wood products companies in the world are earning 12-15% ROCE, even the most profitable regions of the world are not, on average, covering the cost of capital. Latin and South American countries are the leaders in the wood products sector, yet even they are earning only 7.0% on average.

In the woods products sector, ROCE has remained in the 6-8% range for Canada. Even in 2004, a banner year for operating profit margins, the ROCE remained below 7.0%. The overall trend the last 5 years has been downward, with some modest upward movement in 2004 due to very high lumber demand in North America.

The Operating Profit Margin measures EBIT as a function of total sales. It can be seen that these are cyclical and highly dependent on markets. It is also weakly correlated with ROCE. The woods products sector in the BC industry has somewhat higher highs than the rest of Canada in good years. The operating profit margin from BC's paper sector is performing much worse than the rest of Canada and the trend is downward on both.

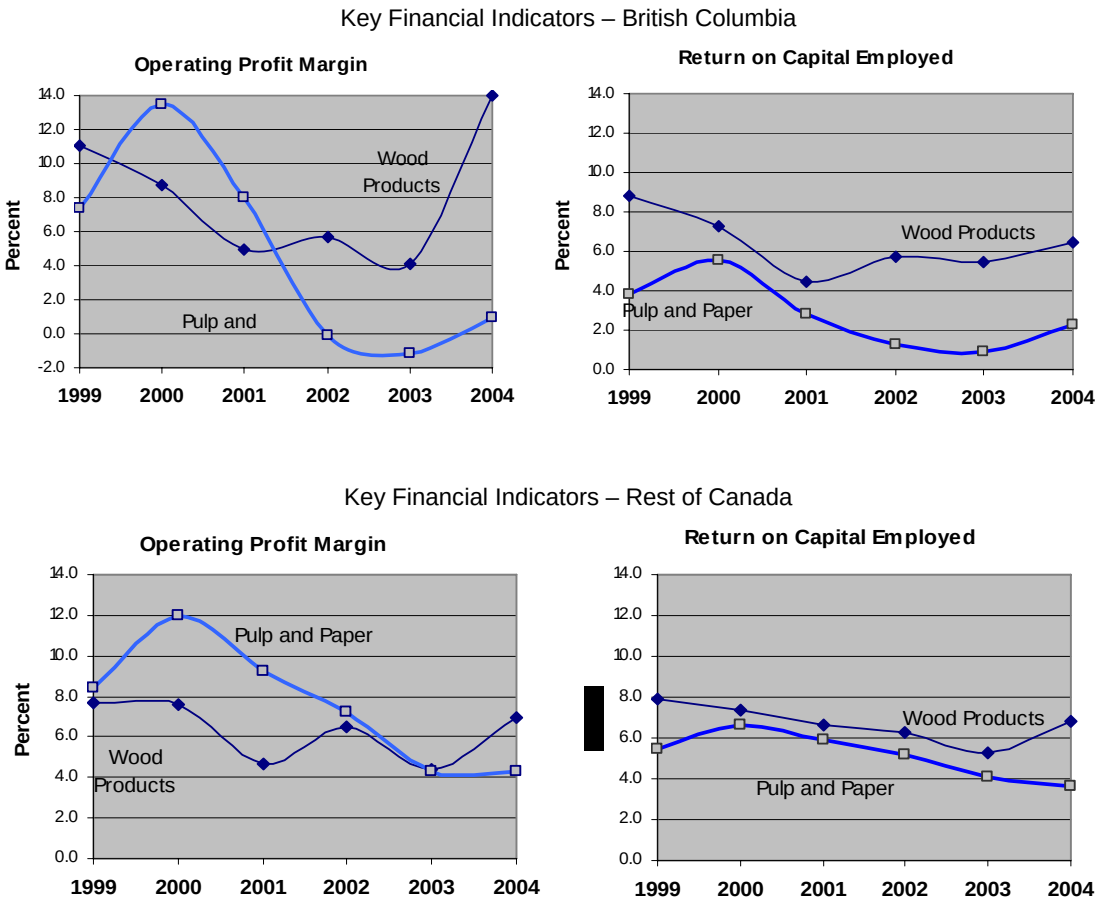

Figure 2. Comparison of BC to the rest of Canada on Operating Profit Margin and Return on Capital Employed for the Solid Wood Products and Pulp and Paper Sectors.

The cause of the poor performance of Canadian companies is to a large extent due to demand factors and manufacturing costs than delivered wood cost. The BC interior has a competitive average delivered pulpwood fibre cost compared to other wood producing countries, much lower than that of Eastern Canada (Roberts *et al.* 2005). Yet the financial performance of BC companies trails Eastern Canadian companies, and is well behind Latin and South American companies.

4.2 Impact of technology on Canada's competitive position

A. Pulp and Paper Sector

It was the strong belief of the industry experts at the workshop that new technologies in the pulp and paper sector have not benefited Canada. In the past, one of Canada's major competitive advantages has been the quality of northern softwood fibre for pulp making destined for paper. While fine paper is comprised primarily of hardwoods for the printing quality, softwoods were blended in to give strength to the wet paper mat in the open draw papermaking process. Newer technologies have replaced the open draw process with faster and wider presses that better support

the mat into the dryers. Therefore, the need for market pulp produced from superior northern softwoods has decreased.

Secondly, with technological advances, newer mills outside of Canada are much larger and more efficient than mills in Canada. The output of the newest pulp mills is in the order of 1.2 million tons per year, compared to 400,000 tons per year in Canadian mills. This is mainly due to faster machines with wider presses. Therefore, the cost of papermaking is much lower in the more efficient mills.

The newest pulp mill in North America is Weyerhaeuser's Kingsport, Tennessee pulp and paper mill that has a 14m wide paper machine running at 1100 m/min producing 1400 tons/day. This paper machine replaced two older machines producing 600 tons per day. Willamette Industries (now Weyerhaeuser) spent $475 million to upgrade the mill in 2001. In comparison, a mill in Dreiden, Ontario that Weyerhaeuser is shutting down has a 6m wide machine running at 800m/min producing 600 tons per day.

Plantation forestry is another reason that Canada is falling behind in competitiveness. For example, a new pulp mill is being completed in Veracel, Brazil that will source its fibre exclusively from sustainably managed eucalyptus plantations within 40km of the mill. This mill will produce 900,000 tons of pulp per year, the largest single-line bleached eucalyptus pulp mill in the world. The Veracel construction is a 50/50 joint venture between Stora Enso Oyj and Aracruz Celulose S.A. The project is financed by company equity (45%) and loans provided by a number of development banks, including the Brazilian Development Bank, European Investment Bank and Nordic Investment Bank. Stora Enso's 50% share of the equity component fits within its existing capital expenditure policy. The European Investment Bank is providing a $30 million loan for Veracel.

Eucalyptus fibres produce the highest quality pulp in the world for fine paper, exhibiting the good strength characteristics of softwood and the printability characteristics of hardwood. At Veracel, their sustainably managed plantations now grow 50m^3/h/yr with rotation ages of 7 years. Genetic improvements in this stock enabled them to increase productivity from 28m^3/h/yr to 45m^3/h/yr between 1989 and 1995 alone, and the improvements in wood quality allowed them to use less wood per ton of air dried pulp, from 4.9 m^3 to 4.1 m^3 per ton. The total annual productivity of land was increased 5.9 tons of paper per hectare to 10.9 tons per hectare (Campinhos 1991).

This compares to the average growth rate of Canada's natural forests of 1.9m^3/h/yr and a potential growth rate of 30m^3/h/yr with genetically improved cottonwood on the very best sites (Huntley *et al.* 2003). However, the availability of these high quality sites is very limited due to competition with alternative uses such as agriculture.

Newer technology has created the supermill with an order of magnitude increase in productivity and corresponding cost reduction. To be cost competitive in commodity based products, Canada must upgrade its older mills. A new state-of-the-art pulp and paper mill in Canada would cost upwards of $1.2 billion, and upgrades to existing mills are in the range of $500 million. However,

due to labour cost advantages and high yield plantation forests with superior fiber quality, the available capital is being invested elsewhere than Canada.

The sawmilling industry produces a large quantity of wood chips and is dependent on the revenue from those chips for its economic viability. Thus, the viability of the pulp sector (or a credible substitute) is critical for the forest products industry in Canada. Canada must decide whether to replace older existing mills with cost competitive supermills capable of competing in the commodity business, or look toward smaller specialty mills. Experts at the workshop indicated that the latter may be the best case scenario for Canada.

Potential Research Questions for BC:

1. What is the economic feasibility of a supermill replacing a number of smaller pulp mills in BC?
2. What is the economic potential for smaller mills to produce niche products?
3. What types of specialty products could be made using existing pulp mills or with modest upgrades to the mills?
4. What results could we achieve with high yield, sustainably managed plantations and large scale, highly productive mills?

B. Sawmilling

For decades BC's main competitive advantage in the lumber industry was the abundant, low cost, high quality timber supply. While the early industry depended on highly skilled labour to capture value from the logs, this skill was replaced over time by technological improvements that favored production speed and volume recovery over value based decisions along the supply chain.

Up until the mid-1990's, commodity lumber prices were generally higher for wider (2x10) and longer structural boards. Canada, and especially BC, was a preferred supplier of this product because of the lightness and strength of spruce, and BC still had a sufficient number of large-diameter high quality logs to produce these sizes. The invention and rapid market acceptance of the structural I beam and timber strand products rapidly eroded this competitive advantage. Today, only a modest price differential remains between these two products. This example serves to illustrate that while many of these technologies were invented in BC, they served to reduce Canada's competitive edge in favor of areas of the world where low quality wood grows faster, and where labor rates are lower.

The most important technological innovations in the sawmilling industry over the past decade have been 1) the development of 3D laser scanning and optimization techniques that increase volume recovery from the log, 2) curve sawing technology that increases volume recovery from the log, and 3) high speed small log sawing machines that increase throughput of small diameter logs. These technologies have helped to make the Canadian sawmilling sector more efficient, as indicated by

the gains in lumber recovery shown in Figure 1 and the gains in output per employee shown below in Figure 3. However, these same technologies are being adapted in other countries at least as rapidly as, or in some cases more rapidly than, BC. The result is that any competitive advantage that is gained is just as quickly lost because our technology advances are not geared towards our specific factor advantages.

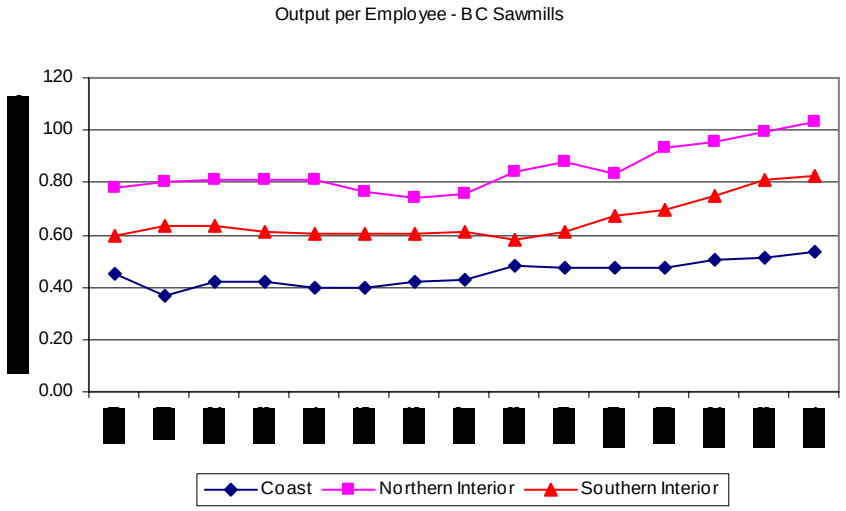

Figure 3. Increases in output per employee as measured by MBF per worker over the past 25 years.
Source: BC Ministry of Forests and Range, 2005.

Therefore, focused research is needed on how to capture the value from BC's remaining high quality timber as this could be a true source of competitive advantage that cannot be duplicated elsewhere in the world. Due to the overwhelming presence of the commodity sawmill sector, technology development has focused on high speed/low cost innovations. The specialized custom-cut sawmills that do exist in BC are generally lower technology headrig mills with a high reliance on manual labor with sawing and grading skill. These skills are not as abundant as they once were.

Some of the most efficient small log manufacturing systems in the world have been developed in Quebec where decreasing log sizes have forced them to innovate. This technology is being implemented in BC to deal with our smaller log profiles. The trouble is that this technology can be, and is, rapidly implemented anywhere in the world.

Potential Research Questions for BC:

Research is needed throughout the supply chain in managing for value:

1. What can be done with sawmilling residues currently produced for the pulp sector? Are there new products that can be made? What is the feasibility of bio-energy?

2. What silvicultural systems could be employed to grow high value timber destined for a high value product? Can these systems better coexist with other (social) uses of public forests?

3. Are there selective harvesting systems that can economically get the right products out of the woods? This is especially important on the BC coast where the utilization of hemlock and true fir is a significant problem. What are the costs and benefits of such a system?

4. What sorting and merchandising methods can help to get the right log to the right mill? What are the economic benefits of better sorting? Can this help spawn a high value sawmilling sector?

5. Are there intelligent manufacturing systems to saw high quality products just in time? These high value recovery businesses could potentially augment the presence of a smaller but more competitive commodity sawmilling industry, and produce the types of lumber products that would help to spawn a more successful secondary manufacturing sector.

C. Engineered Wood Panels

Much of the current technology used to manufacture engineered wood panels was invented in Canada. However the technology has more recently been adapted for southern pine, and is growing in the Southeastern US. Nonetheless, the level of technological sophistication is still judged to be higher in Canada, and oriented strand board (OSB) made from aspen is more consistent and lighter than that manufactured from southern pine. Therefore, OSB may still present an economic opportunity for Canada for some time to come.

For example, Peace Valley OSB is a Canfor/Louisiana Pacific joint venture that recently opened in Fort St. John, BC. One of the largest OSB mills in the world, the mill will consume about 1.1 million m^3 timber annually (90% aspen) and produce 820MMSF annually. The competitive advantage of the mill is its proximity to the aspen timber resource, some of the highest quality aspen in North America. Analysts are watching this investment closely to see if it pays off.

While Canada currently produces about 40% of the OSB produced in North America, OSB capacity is moving away from Canada. Despite its competitive advantage in wood supply, technology, and superiority of product, OSB capacity is moving to the Southeastern US, to Europe, and more recently to South America. Chief among the reasons is the proximity to markets.

Norbord Inc. for example, is a Canadian company based in Toronto. They are the second largest producer of OSB with 11 mills, but only 2 of those mills are actually located in Canada. They are currently targeting the Southeastern US for new mill locations for two reasons: 1) almost half of the US housing starts are there, and 2) there are pockets of wood available due to the closure of large uncompetitive pulp mills in the region.

Plywood is another product for which BC has a clear competitive advantage. Western plywood is recognized in the market as a superior product, and it draws a 10% price premium over southern pine plywood. However, plywood production is shrinking for a number of reasons, but chiefly because OSB continues to gain market share in structural residential and non-residential applications. Plywood's main strength is in the industrial market.

Plywood requires a superior grade of logs to be produced, so BC has a natural competitive advantage. The plywood industry has been successful at developing smaller market niche products with higher margins and there continues to be a good opportunity for plywood production in BC.

D. Value-Added

BC's traditional strength in secondary wood products has been in further processing of lumber products that were originally produced for the dimension lumber market. The vast majority of employment in secondary manufacturing is in lumber remanufacturing. Lumber remanufacturing contributed 6000 jobs to the BC economy in 1999. This is a significant contribution that should not be underestimated. The lumber remanufacturing business is also an important driver for other secondary manufacturing, as many of the products are destined for further processing. However, this business has the lowest jobs/m^3 coefficient at 0.41, compared to 2.75 for millwork and 1.03 for engineered wood products (Wilson *et al.* 2001). The provincial average for the forest products sector in BC in 2004 was 0.92. If BC is to significantly increase employment per m^3 it will be necessary to move further up the value chain.

The value-added industry is growing in Canada and it is becoming an important employer. Value-added employment in BC during the 1990's was up 24% and sales increased by 75%. BC's shipments of value-added products increased from $300 million to nearly $1 billion over the period 1990 – 2001 (BC Stats 2003). This accounted for an increase from 6.2% of forest products exports to 10.5%.

Despite this growth, BC lags the rest of Canada in the growth of the value-added sector. The provincial average for the value-added sector in Canada is 30% of exports. BC's percentage of Canadian value added exports dropped from 33% in 1990 to 14% in 2002 (BC Stats 2002). The biggest hurdles to growth of the value added sector in BC is the lack of skilled employees (DeLong and Cohen 2006). This is also inhibiting the adoption of technology on a broader scale in the BC wood products sector.

Over time it has been increasingly difficult to survive in the lumber remanufacturing business because the technology designed for the sawmilling industry in BC has been designed to produce products that just meet the grade standards. In addition, as log size and quality for many regions in the province have dropped, there has been a corresponding decrease in lumber quality. Another significant challenge for value-added businesses in BC is to readily find lumber that is the

appropriate grade (Kozak *et al*. 2003). The main reason is that the majority of the lumber processed in the province is intended for the dimension lumber market.

There have been significant technological improvements in machinery designed for the secondary wood products industry. Most of these new technologies have been designed in Europe to reduce the labour component and increase throughput. This technology is well utilized in the Eastern Canadian provinces and Alberta, but is not yet established in BC. However, when this technology is used to commoditize a product line, it plays into the strengths of Chinese manufacturers. At the same time, this technology has the potential to be used for mass customization of just–in-time products like windows, doors and cabinets. BC has been a traditional leader in the production of these products, and BC's wood species are ideally suited for them. The challenge for BC is to successfully adapt these technologies into their businesses. A second challenge is to produce, in quantity, the lumber products that are ideally manufactured and graded for these businesses. This again requires development or modification of sawmilling technology designed for efficiently producing customized lumber products.

A recent study by Jaacko Pöyry Consulting (Jaacko Pöyry 2001) that compared BC to four countries and other Canadian provinces, ranked BC lowest by far in seven all qualitative performance categories that they studied: categories in management capability, worker skill, clustering, policy, industry and market structure, technology, and raw material.

Perhaps the type of innovation most needed in secondary manufacturing is organizational innovation. The Jaacko Pöyry report noted that regions with high capabilities in value-added manufacturing have a high interdependency between value-added manufacturers and suppliers of all types. These suppliers are willing to adapt products, demonstrate flexibility and support product development.

Large scale commodity oriented companies cannot compete globally with Chinese imports. What is needed are flexible firms that understand the market, their customer's needs, and can quickly adapt technology to provide the product required at a reasonable price point.

Potential Research Questions for BC:

1. Could customized lumber products substantially increase the economic potential of the secondary wood sector?
2. What types of skills and knowledge are needed by the secondary wood sector? How could they best be delivered?
3. What lumber grades / sizes are required?
4. How can we increase the utilization of hardwoods?

5. How could we catalyze a secondary wood processing equipment manufacturing industry as part of the wood cluster?
6. What are the potential benefits to innovation is (?) design? How can this skill be developed in BC?

E. New technologies that improved the competitive position of Canadian fibre

There have been few, if any, technological advances that were recognized by the technology panel that improved Canada's competitive position. It was strongly felt by the panel that most of the technological advances have only helped to decrease our natural competitive advantage – which is still seen as the abundance of high quality wood fibre. To significantly move ahead, it was felt that we must become adept at rapid innovation, using or adapting technology to meet customers' customized needs quickly and at low cost.

BC does have a clear advantage in that it has an abundance of low cost hydro power. Mechanical pulp mills are very efficient in terms of yield, but they are big consumers of energy. The pulp industry currently uses 11% of BC's total hydro power. As energy costs rise this is something that could give us a significant advantage.

F. Investment in Technology

Successful firms innovate to remain successful and to improve their competitive position. Developing new technologies is one way to innovate; developing new methods and processes are others. At the present time, the pulp and paper sector in Canada is carrying a very high debt to equity ratio[1], making it difficult to invest in new technology (Statistics Canada 2006). Having missed out on a recent investment cycle, this puts the Canadian industry at a disadvantage relative to other regions of the world in terms of employing cost saving technology.

The solid wood sector on the other hand has a comparatively low debt to equity ratio and is therefore well positioned to invest in technology, or to grow through investments outside of Canada. It appears that both are happening – technology upgrading investments are occurring in areas where there have been AAC uplifts due to the pine beetle salvage in BC, and acquisitions are occurring outside of BC. However, there is concern that the investments are occurring precisely in those businesses and communities where there will be a seriously declining resource base in the near future.

[1] This information on D/E was obtained from Statistics Canada. The information concerning the interpretation and comparison of the D/E ratio amongst sectors is from a personal discussion with Don Roberts, Managing Director CIBC World Markets on 4 April 2006.

5.0 Future Trends

5.1 Future trends of technology change

As explained above, there have been significant changes in technology that have increased the operational efficiency of BC sawmills over the past decade. The technology to process small logs with less labor and overhead component will continue to evolve. The commodity sawmilling industry in BC is highly cost efficient and globally competitive. The major questions that will potentially curtail further growth in the sector are: 1) the decrease in available wood fibre due to the mountain pine beetle, 2) increased social use/needs from the forest, and 3) increased cost competition from offshore. This will likely cause a contraction in the commodity sector forcing higher cost producers in the province out of business. Rather than keeping these high cost producers in business, policy initiatives should focus on developing new businesses in more competitive business areas.

The commodity sawmilling industry in BC does have a skilled workforce and is an early adapter of new cost saving technology (once it is proven elsewhere). It is likely that commodity lumber production will be a strong wealth generator in certain parts of the province for some time to come, and it should not be overlooked in the current discussion. However, a proactive strategy should be adopted now to develop new businesses for the future of resource dependent communities. Ideally, this investment should be undertaken with rents derived from the commodity sector while there is still time to do so.

Innovations in wood drying would be of particular benefit to BC. Hemlock is a particularly difficult species to dry, and part of the challenge in marketing hemlock products is the lack of quality drying. Innovation in drying technology in the past has favored very fast drying times with low quality specifically for commodity products. There have been new technologies invented, such as radio frequency drying that could have positive implications for the BC industry, particularly on the coast.

Developments in x-ray scanning have been proceeding but are as yet disappointing in delivering a product that can assist with grade sawing or sorting logs for quality. Research work in this area would support the utilization of BC's higher quality species.

Innovations in modular housing and timber construction also hold promise for BC. BC has a competitive advantage for large beams and timbers used in high value homes. New automated CAD/CAM software and manufacturing technology could create substantial benefits for BC. This equipment was developed in Europe but could be rapidly employed in Canada to build homes for markets in Canada, the US and Asia. We currently lack the skills, management and innovative mindset to adopt and adapt this technology in a large way. This would be an industry that would fit in with Canada's natural advantage in quality wood fibre.

5.2 Product Innovation

In engineered wood panels, advances in resin, forming, and pressing technology will permit manufacturing OSB to 2 inches thick in the near future. Panels of this thickness can be sawn into a dimension lumber substitute. This product will likely require strong process and quality control programs, which is a competitive strength in Canada. Also, the lightness and strength of Canadian aspen and cottonwood could bring a price premium for Canadian produced board. Since this will be a substitute product for dimension lumber, this will no doubt have a negative impact on lumber demand and prices as well.

Other new products on the horizon include plastic wood composites for outdoor non-structural applications. This is one of the prime uses for recycled plastic trash bags and waste wood fibers. This product is used to produce decking, door and window frames, and exterior moldings. Products produced with recycled wood/plastic lumber can be more durable than conventional preservative-treated lumber, and are less toxic than conventional treated lumber. The wood/plastic composites are stronger than 100% plastic because the wood fibres reinforce the material.

It is relatively easy for manufacturers of plastic injection moldings to modify their equipment to produce plastic/wood fibre composites. The winners for manufacturing this product will likely be those close to markets and close to the supply of recycled plastics and waste wood. The southeastern US would again be a logical location for these types of plants. The losers will be producers of cedar and treated lumber products, in which Canada currently enjoys some competitive advantage.

In value-added manufacturing innovation in wood joinery for timber frame houses could have significant implications for western Canadian home builders. Automated computer controlled machinery permits accurate shaping of timber frame elements for high end houses that can be put together from factory assembled modules. BC is an important source of the high quality wood necessary for this type of construction. This could also have positive implications for glue laminated lumber beam manufacturers in western Canada. These homes can be built using just-in-time manufacturing principles to lower the cost of producing custom high end homes.

5.3 What is required to benefit from the potential technology changes?

It was mentioned repeatedly in the workshop that the Canadian forest products industry has been good at implementing proven technology, but is not necessarily good at being first innovators. It is the successful first innovators that will reap the largest rewards as there are few barriers to entry in these markets. The Canadian industry needs to respond more rapidly. We need to be more innovative in adapting technology to meet specific customer's needs and be a technology leader rather than a trailer.

6.0 Conclusions

Canada needs to put a strong effort into moving from a resource industry based on extraction and commodities into one based on innovation and adding value to customers. Studying the Swedish experience, Blomström and Kokko (2002) report that Sweden successfully transitioned from a natural resource based economy to a high-tech economy by supporting the sustainable use of natural resources while promoting learning and internationalization. They report that Swedish companies were able to offset the disadvantages of high raw material and labour costs by investing in technology and value-added manufacturing. A strong knowledge base is necessary to ensure that companies are able to adapt to changing conditions. The knowledge and technology gained through development in the forest products sector can then be translated into other high-tech businesses as well.

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