North America Bio-Materials: Summary
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Bio-pathways is a joint project among FPInnovations, FPAC, the CFS, and the provincial governments of BC, Québec and Ontario. The Focus of the project was “How to support the forest sector in choosing the right Transformation Strategies?” It has been a two phase project with this document beginning release under the second phase which had a market focus.
Executive Summary

What needs to happen for the solid wood products’ industry to take the pathways toward a profitable future? No one would argue that innovation will be key, being the propensity to develop/adopt new products, processes or building practices. Innovation must always fill two conditions: serving a customer need and being profitable.

Up to now the solid wood products’ industry has seen most of its innovation in cost reductions and delivery logistics. In other words, successes of the past relied heavily on cost efficiencies through process innovation, especially in equipment. In future the greater need will be for product and business practices’ innovation. This new innovation culture represents a significant shift, calling for product diversification and completely new partnerships in the supply chain.

This report presents current and potential bio-pathways for the solid wood products’ industry. Section 2 summarizes the industry’s starting point on the trip toward business innovation. Section 3 describes the drivers of change affecting the solid wood products’ industry. Section 4 identifies some suggested product opportunities upon which the industry can rely to move forward.

These drivers of change and their implications for action by the industry are summarized into the following vision statement.

“Integration of traditional lumber and panel production with new bioproducts is key for success”.

A key outcome of Bio-pathways I was that the success of emerging products and technologies will need to ride on the continued success of traditional ones. It could be added that a symbiosis is required for the two to succeed. While traditional lumber and panel production outperform emerging bioproducts on the metric of job creation, their profitability needs to be boosted through innovative use and marketing of bioproducts. Meanwhile, most emerging bio opportunities face important challenges on raw materials’ costs unless they are well tied to and integrated with traditional industries.

“There is a strong future profit outlook for lumber through innovations, agility and customer alignment”.

While many value-added products are deployed in the market, sawmills can develop and adapt their products to suit the important needs of these emerging customers. The most classic example is the current challenge for a glulam producer to find square edge and consistently dried lumber at a well-defined moisture content. Typically, the demand for such a product is not seen as important enough in volume to justify a shift in production settings, however these opportunities abound and for these to be relevant, agility is the key.

The mastering of all processes is possible through the implementation of information systems in order to deliver specific products, albeit at lower volumes, to specific clients. The crucial point is the delivery of quality products, where quality is defined by a set of measurable metrics. For this manufacturing engineering to be effective, a seamless integration between sales and operations is required, as well as real-time information on the required measures. In other words, a product is a norm defined by selected characteristics such as dimensions, grade, moisture content, finishing, fabrication delay, packaging, stamping, etc.
The challenge is to define each product and then to monitor the production process in order to properly deliver on each of the product characteristics. To define product characteristics, a deep understanding of the customer is needed. This leads to the development of stronger relationships with customers, as opposed to a focus on sales. In mills that have made the shift, the focus – and success – have been tied to an increase of the average product value, as opposed to cost reductions. Indeed, for those sawmills, cost reduction comes now not as a production objective, but rather as a consequence of reaching the targets set by quality and products’ characteristics. That clearly requires a completely new mindset. In many regards, the diversification of specialty products and the agility to deliver them is also an opportunity for panel producers.

“Prefabrication of building systems is everywhere. Wood products’ manufacturers can be the preferred supplier for prefabricated systems, and even invest in prefabrication”.

The homebuilding process will continue experiencing a shift from the construction site towards factories. This process, called the industrialization of homebuilding, comes with an increased content in engineering and design. The industrialization happens through five channels including: prefabricated homes; structural components; building materials’ dealers; integrated homebuilders; and integrated wood products’ manufacturers.

What does industrialization mean for wood products’ suppliers? It certainly means a greater proportion of sales that are processed within a factory before delivery to the construction site. The more automated the fabrication processes, the more stringent the quality requirements. Automated factories are much more sensitive to wane, twist and the accuracy of moisture content. Increasingly they look for proprietary grades with specific dimensions, moisture content and selected attributes. The industrialization of homebuilding thus means more sales to industrial accounts that are searching for specific properties.

At the mill, the mastering of those properties and the ability to deliver them will become even more important. Some primary producers further invested in structural components’ facilities or at least established fruitful partnerships with structural components’ fabricators. In the past ten years, the components industry has consistently yielded higher returns than the lumber industry. The fact that margins in the distribution trade are low certainly explains why many materials’ dealers, especially in the US keep increasing their share of components’ manufacturing and installed sales.

“The non-residential construction market requires dedicated products. This is one of the few opportunities at the (very large) scale of the wood products’ industry. Fabricators are needed.”

The value of the non-residential market is at least 90% that of new residential construction. While the market share for wood is only 17%, the potential for wood could be anywhere from 50% to 65%. The demand is only increasing due to the good environmental performance of wood. Clearly, non-residential construction is one of the few opportunities that can be at the scale of the lumber and panel industries.

Specifiers of non-residential buildings need products that are easier to design and install. They further expect the development and spread of wood structures’ fabricators. When it comes to products, the non-residential market needs more information than its residential counterpart; product support is in
much more demand. Products also need better drying consistency; they require precise dimensions and sometimes better appearance. This is not peculiar to non-residential construction: most new products, such as CLT, will urge the lumber industry to redefine their products and deliver specific characteristics, often outside current production settings.

The relationship with non-residential suppliers is a rich one for those committed to developing new products. There is a consensus regarding the lack of supply in turnkey solutions for specifiers. Such solutions are needed to address emerging challenges: knowledge in wood design, lack of qualified labour for installation and strong demand. The approach is to offer complete buildings. The most promising venue to successfully develop this market is to structure an offering for installed building systems. The key is to support the development of structure fabricators, as in done in the steel industry.

“There are several untapped opportunities for developing and marketing innovative wood products. Manufacturers can invest in these productions, or become a preferred supplier”.

One of the greatest opportunities is cross-laminated timber (CLT). It is a cost-competitive wood-based solution that complements the existing light- and heavy-frame options, and is a suitable substitute for some building types which currently use concrete, masonry and steel. It is also fast to erect, environmentally sound, performs well and represents an important outlet for the forest industry, without disrupting the existing value chain.

Another opportunity is veneer strand lumber, or VSL. There is a huge need for low-cost, high strength products, and a growing demand for longer spans. VSL has a high MOE rating at lower cost than similar products.

Profile decking is another great opportunity. Decking is a 3bbf market in North America ($6 billion). In this market, wood plastic decking has taken 30% market share (with considerable price premiums). Profiling minimizes checking and adds design appeal. It is brandable, has attractive pricing, high margins and high return-to-log potential.

Other opportunities include sound abatement panels, ultra-low density insulation and ultra-low density packaging. It is very important to note that all these opportunities present significant potential volumes to the wood industry.
1 Pathways for bio-materials: the starting point

One of the key objectives of Bio-Pathways I was to “quantify key economic, social and environmental metrics associated with the main existing and emerging bio-products”. This was accomplished for 36 products/technologies—some traditional and some emerging.

For solid wood, the products included for ranking were SPF lumber, OSB, fibreboard, particleboard, LVL and OSL. By volume in the overall Canadian production and exports of bio-materials (i.e., solid wood-based products, as opposed to pulp & paper and other bio-refinery or bio-energy products), commodity SPF lumber and wood-based panels dominate.

A key finding of Bio-pathways I was that success of the emerging products/technologies will come from the continued success of the traditional ones. More specifically, it was concluded that:

• higher value solid wood products form the cornerstone of a competitive forest sector;
• they justify the cost of extensive forestry operations due to their ability to pay a higher price/m³ of fibre;
• traditional industries are key to the overall approach; and,
• smart integration is a key component of success.

Again, these “higher value solid wood products” are defined at this point in the Bio-pathways modeling efforts primarily as lumber and wood-based panels.

For Bio-pathways II, for which this report is a part, it is deemed essential that Canada continue to hold its competitive advantage for these commodities, and to continue expanding into further value-adding products and services. This should include innovation in building and living with wood. At the sawmill, the investment in processing equipment is at a point where significant capital may yield limited improvement. This is because the yield on saw logs has been taken close to a physical limit. Successful sawmills now invest in information systems, manufacturing intelligence, product definition and quality. A key to success is flexibility, which allows the most successful sawmills to increase the value of their products.

The 'roadmap' graphic on the following page (Figure 1) illustrates the contribution to exports of Canadian wood products. Taking the pre-recession year of 2004 as a base, out of a total of $25.2 billion of Canadian exports, 70% was in the form of commodity lumber and panels. This number was 85% in 1995. Note that there is a lot of provincial variation around this average; in Ontario, for example, this number is roughly 25%. It should be noted in this illustration that a certain proportion of what Canada exports as commodity products may still find its way into either an engineered product/system or a 'living with wood' value chain.
Figure 1. Canadian Exports by Value, 2004
Focusing on the lumber component in the Figure, the 46% is shown to include softwoods and hardwoods across all grades and sizes. This is predominately softwood (SPF), produced by dimension sawmills and primarily serving the US housing market (new starts and repair and renovation). For a typical pre-beetle BC Interior sawmill as an example, the grade out-turn is roughly as shown in following table.  

**Table 1. Typical BC Interior grade out-turn**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economy</td>
<td>5</td>
</tr>
<tr>
<td>Utility/#3</td>
<td>15</td>
</tr>
<tr>
<td>#2 &amp; better</td>
<td>55</td>
</tr>
<tr>
<td>MSR</td>
<td>5</td>
</tr>
<tr>
<td>Home Centre (includes “highline”)</td>
<td>10</td>
</tr>
<tr>
<td>“J-Grade”</td>
<td>10</td>
</tr>
</tbody>
</table>

The vast majority of the #2 & better lumber exports shown go to new home construction as a commodity product. This is also true for roughly a third of the utility/#3 grade (mostly for housing sill plates). The balance of the utility/#3 grades normally goes to industrial applications such as packaging and pallets, and to manufactured HUD home production. Today, most of these grades in Western Canada go to China.

MSR grade is at a price premium to #2 due to its defined and less variable strength characteristic (applications that require this include roof trusses). Home Centre grade is also at a price premium, mostly going to the big box stores (with the majority going to repair and renovation construction). Finally, J-Grade is at the top of the price scale; while rarely sorted out by BC Interior mills these days, this category of lumber includes shop and clear grades.

While not shown explicitly in Figure 1, some lumber from primary sawmill breakdown also finds its way into the remanufacturing sector. This is represented by the dashed line.
When looking at these lumber grades on an international level (Figure 2), it is interesting to note that the trade of utility/#3 and #2 grades have been primarily limited to North America. Other major softwood users such as Japan and Western Europe have historically used higher value lumber for housing construction such as that represented by J-Grade. This is well illustrated in Figure 3, showing global trade flows categorized by price (actual and predicted from a global trade model first developed by Forintek in 1999\(^2\)). These bars are Canadian softwood lumber exports at prices less than or greater than CDN$250/m\(^3\) FOB for a 2002 base year, respectively. These price ranges roughly categorize J-Grade versus MSR and lower, with Home Centre grade somewhere in between.

Note that with the exception of minor exports of the lower price category to “other importers” (which would be more significant today for China in particular), the only real market for Canadian exports of this represented lumber grade was to the US. Both Japan and Western Europe are demanding a higher level of softwood lumber attributes and are willing to pay higher prices.

\[\text{Figure 3. Global trade flows}\]
The evolution that is taking place in this balance between commodity inputs and engineered products and solutions, as well as the value-adding manufacturing associated with ‘living with wood’ products is encouraging and needs to continue into the future. In fact, this evolution is consistent with what is being seen in many industries globally, where the value in manufacture is shifting from the producer toward the end consumer.

In order to better understand the value chain of lumber entering the residential home building market, an analysis of the operating margin from public companies was completed. This analysis looked at five points along the value chain including: timber, building materials, distributors, components and home builders, illustrated in Figure 4.

The timber industry consistently had the highest operating margin (defined as net sales less operating costs). This matches historical results and is line with reports on TIMO’s performances. The next strongest segment is the components segment. This segment is characterized by producers who focus on providing components such as roof trusses, wall panels or specialty materials like siding. Building materials’ producers, which include the lumber and panel industries, follow next and then home builders. The weakest segment is the distribution segment.

This analysis lends support to the need for producers to understand the value chain and where there are opportunities to either add margin or avoid volatile markets. Several interesting observations were noted during the analysis. The first observation is that many firms especially in the distributor segment have moved out of a publicly traded structure and are either private or controlled by private equity firms. The second observation (and caution) is that in some of the value-added firms there were not enough publically traded companies to support a data point on the chart. Specifically we looked at the door & window segments and the pre-fab producers. The fact that margins in the distribution trade are low certainly explains why many materials’ dealers, especially in the US keep increasing their share of components’ manufacturing and installed sales.

![Operating Margin Analysis (%)](image)

**Figure 4.** Home Building Value Chain (Source: FPInnovations)
The incidence of higher financial performance in wood materials was shown in Bio-pathways I for LVL in particular. While limited in opportunity because of overall market size, LVL performed well over SPF lumber manufacture both in terms of the calculated ROCE and earnings before interest, depreciation and amortization.

Figure 5 further illustrates that one of the products recommended in this report as a strong opportunity is cross-laminated timber (CLT). The strong profitability potential (shown in the Figure with the highest normalized ROCE estimate among the products investigated) is supplemented by a number of other components in its value proposition, including the ability to compete with steel reinforced concrete in buildings of more than 4 storeys (thus growing the pie for wood demand), and the resulting environmental benefits (LCA of wood as compared to steel and concrete, and high carbon storage).

While not shown in here, the return on capital employed is also expected to be quite high for "living with wood" product options.

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**Figure 5. Bio-pathways: Return on Capital Employed (ROCE)**

As a final word on the evolution toward marketing less pure commodity products to more differentiating and adding more value, it should be noted that the former are subject to much higher price volatility.
3 Drivers of the supply and demand for bio-materials

3.1 Structural changes in supply

British Columbia has witnessed an unprecedented mountain pine beetle attack on its lodgepole pine resource this decade. By the time the infestation runs its course, it is estimated that a staggering one billion cubic metres of standing timber will have been affected.

This has tremendous implications on total Canadian wood product supply, with BC accounting for over 40% of Canada’s annual allowable cut (shown in Figure 6 for pre-beetle 2004). First, this contributes to North America’s growing inability to be self-sufficient post beetle kill in a number of wood products. Second, this changes the nature of the available fibre at present, particularly on those killed trees that are not suitable for lumber production.

![Figure 6. 2004 Canadian Softwood Annual Allowable Cut](image)

3.2 Demographics

Demographic factors are the single most important drivers of housing demand\(^3\), which is derived from the number and type of households. The US demographics show an increase in household formation throughout 2012. However, housing starts remain low due to excess inventories (over 8 million units\(^4\)). While the single most important indicator to watch, for any reduction in inventories is job creation, current demographic and social trends support a lack of labour among the building trades\(^5\). Recent research confirms that the housing recession may exacerbate this trend.


\(^4\)CIBC Economics: Consumer Watch US, February 2, 2010

Implications for change:

These observations need to be considered in setting out marketing and product mix plans to fill building material demand in the coming years. For example, as infill projects become more common, the economies of scale in building large new subdivisions are lost. Can building products and systems be designed to build efficiencies in small infill projects? Which wood products are most appropriate for the growing pool of rental units? Will renters take care of wood floors or will owners pursue other materials to retain their investments? As the market is moving towards smaller homes and a greater proportion of multi-family units, the usage rate of softwood lumber per housing start will decrease. Other segments within the housing market may be considered in order to reverse this trend. For instance, wood use could be increased in outdoor living and in high-rise multi-family housing starts. (The multi-family segment is the most reliant on industrialized construction techniques.)

3.3 Consolidation of the supply chain

For wood products’ suppliers, larger homebuilders should be significant customers. Larger builders have been found to be more innovative and to be the earliest adopters of substitute materials. For instance, larger builders are more likely than smaller ones to replace solid wood with finger-jointed studs, on-site construction with prefabricated walls, and structural sheathing with non-structural sheathing. Larger builders also leverage their strong purchasing power and actively look for a shorter supply chain.

A recent study of substitution trends in the 20 most important US markets found that in floor systems, large builders are much more likely than small builders to use monolithic concrete slabs. In other words, larger builders are more likely to substitute concrete for wood. Wood-based sheathings have a market share of 80% among large builders, and 91% among smaller ones. Foam and kraft-board, alone or in combination, have a market share of 5% among small builders, and 17% among large ones. No doubt, substitution for non-wood products is more likely to happen as builder size increases.

As a response to homebuilders’ consolidation, the consolidation among building materials’ dealers is more recent but has gained momentum over the past decade. An important shift within the dealers channel is the increasing importance of co-ops and buying groups as a source of supply. As prodealers and Home Centres consolidate, they develop more direct relationships with lumber suppliers, who in turn dedicate more resources to servicing these accounts. These customers have a great influence on the product mix (requirement of specialty grades) and on the logistics and services.

3.4 Industrialization of homebuilding

The homebuilding process will continue experiencing a shift from the construction site towards factories. This process, called the industrialization of homebuilding, comes along with an increased content in engineering and design. To quote Al Schuler, research economist at the USDA Forest Service, “the industrialization of homebuilding is the process of building homes like we build cars. The industrialization happens through five channels including: prefabricated homes; structural components; building materials dealers; integrated homebuilders; and integrated wood products’ manufacturers.”

Implications for change:

What does industrialization mean for wood products’ suppliers? It certainly means a greater proportion of sales that are processed within a factory before getting to the construction site. Here quality is the word, especially with the spread of automated processes. Automated factories are much more sensitive to wane, twist and the accuracy of moisture content. The industrialization of homebuilding may also mean more sales to industrial accounts that are searching for specific properties. It is possible that “proprietary grades”, where customers specify various properties such as dimensions, moisture content, finishing, etc., keep increasing. At the mill, the mastering of those properties and the ability to deliver them will become even more important.

3.5 Increasing importance of Repair & Renovation

In 2009, spending in repair and renovation (R&R) has been higher than in new residential construction for the first time in years.

Although spending in R&R has been much impacted by the economic downturn from 2008 through 2010, there is some evidence that this segment will continue capturing a greater share of wood use in the near future. According to FEA (Forest Economic Advisors)\(^7\), homeowners will continue to fix-up rather than trade-up their homes. Accordingly, improvement markets are set to continue to expand through 2011, albeit at lower rates, mostly because 2010 proved to be a sharp rebound from previous years.

According to HIRI, the main improvement projects involving building materials were decks, kitchens and living rooms in 2007/2008. Not surprisingly, green concerns also make their way through the improvement market. Indeed, energy efficiency and environmental sustainability are important goals for a growing number of contractors, who are increasingly likely to use green products in remodeling projects\(^8\).

Implications for change:

A stronger remodeling market involves strong demand for decking products. Homeowners are looking for decking materials that will last and require low maintenance. And while composite materials have made important inroads in that market, the appearance of wood products is coming back as a high demand attribute. Remodeling markets also require a lot of appearance products, e.g., wood flooring is bound to take even more advantage of the improvement markets. The remodeling market pulls wood products’ manufacturers closer to end-users. This means that a strong focus should be placed on communications. In addition, product quality and appearance are very important in remodeling markets, even for structural products.

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\(^7\)Paul Jannke, FEA: Monthly Lumber Advisor, August 2010.
3.6 Increasing substitution for building materials

In North America, wood has been and remains the most used framing material in residential construction. However, there are continuous shifts in materials’ use and construction techniques. In some regions, the use of concrete in structural floor and wall applications has spread to the detriment of wood. In decking applications, composite materials have also gained important shares in several markets. In sheathing products, both OSB and plywood are facing substitution from foam products, at least in some regional markets.

The use of construction materials largely depends on business constraints faced and attributes demanded by homebuilders. Labour availability is an equal, if not greater, factor than product availability in the competition among building products and systems. Builders increasingly look for easy to install, straight and dimensionally stable products. Speed of assembly is also a paramount requirement.

In structural floors and walls, there is a perception on the part of builders that concrete significantly outperforms wood on durability, strength/structural integrity, and acoustic performance. According to homebuilders, the first two of these attributes are among the three most important in floor and wall systems. For wood to remain competitive in walls and floors, these attributes should guide future product development. The increased reliance on concrete is also thought to result from the perception, on the part of homebuilders and homebuyers, that the use of concrete provides better fire resistance, termite resistance and insurance premiums than the use of wood.

Plywood and OSB are thought superior to be foam sheathing for strength, structural integrity, resistance to jobsite damage, environmental friendliness, and code acceptance. Foam is said to perform better than OSB or plywood for both acoustic and energy performance. Accordingly, acoustics and energy performance in sheathing applications are valuable paths for product development. In decking applications, composite materials better suit the attributes in most demand, including durability, appearance and longevity.

Builder/specifiers are increasingly looking for innovative products and solutions.

Implications for change:

Materials’ substitution is driven by builders’ quest for building solutions. Builders look for specific attributes such as structural performance, durability, low cost, minimal call-backs, ease of installation, etc. Although wood is the preferred structural building material in North America, builders experience various business constraints and are more open to new construction alternatives. In other words, builders that were once thought to be conservative in their practices are increasingly willing to consider the adoption of new products. Right now, the ideal product for homebuilders would be one that combines structural and energy performance, with ease of installation.

3.7 Green Building

In North America the idea of green building is growing in popularity despite lower housing demand. There is now a myriad of green building programs for residential construction and most builders attempt to respond to shift towards the demand for green homes. Green building programs constitute the main target for builders in their development.
One of the most important aspects of green building for homebuilders and homebuyers is energy performance. While energy savings are quantifiable and energy costs are likely to increase, building code requirements increasingly stress energy performance. In practice, the quest for energy performance translates into deeper wall cavities for higher R-values, the use of low-E glass and gas-filled panes, the minimization of thermal bridging, and the use of mass in walls and floors to absorb heat.

It seems that the claim of being green is just not enough. Successful green products ought to provide builders and homebuyers with some other attributes that differentiate them. But because codes and standards will reflect greener requirements in the future, wood products’ suppliers need to adapt to the green market demands. Indeed, wood suppliers no longer solely manufacture wood products, they also produce knowledge and information, such as carbon balance, energy performance, environmental footprint, and so on. There is now an intimate bond between product and information, especially in green markets. Such knowledge is needed to assess the compliance of wood products with the various certification schemes and to provide specifiers with objective data to evaluate building alternatives.

### Implications for change:

Due to the greater demand for green materials, wood products’ manufacturers have to produce and disseminate knowledge in addition to fabricating products. In the case of green buildings, such knowledge includes life cycle analysis – or part of it – such as carbon balance or energy and water content. While the production of such knowledge relies on rigorous standards, the communication of environmental information is also bound to be addressed through norms such as Environmental Products Declarations. Clearly, the product alone doesn’t suffice, and suppliers need to invest time, resources and effort to document the environmental merits of their products.

### 3.8 Developing markets and market diversification: Europe and Asia

Western Europe has historically been an important market for diversifying Canadian wood supply. Before the early 1990s, this included significant shipments of green dimension lumber for wood-frame construction, particularly to the UK. Thanks to a phytosanitary scare with Pinewood Nematode this demand virtually disappeared within a year. Wood-frame housing quickly gave way to concrete. Interestingly enough, wood-frame housing has returned to favour in the UK in recent years, particularly in Scotland. While this has led to some demand for Canadian softwood lumber, it is largely supplied by domestic and northern European sources. Note that outside of the UK, wood-frame housing is a small market—concrete is the favoured material. Wood use in construction is common in roofs, less so in floors, and in certain regions for siding.

In more recent years, European imports of Canadian solid wood products have been primarily hardwoods and higher value softwoods for remanufacture. For the latter, imports have been dominated by BC Coast species.

Demand in the EU 27 region can best be described as highly competitive. In softwoods, Scandinavia and Austria lead the way in a dynamic lumber industry, both in metric sizes for Europe and exports such as
Japan, and in CLS sizing for North America and Japan. In hardwoods, while Canada is a noted supplier, markets are very price competitive with other temperate and tropical sources.

While eroded in recent years, Japan remains the most important off-shore market for solid wood products, dominated by softwood lumber (this has recently been taken over by China by volume, but not by value). The reason is not surprising—Japan is just about the only large population base outside of North America that builds predominantly wood-based single-family homes. Historically these homes have been in post-and-beam architecture, with a growing percentage of platform-frame over the past two decades.

This has led to two distinct export opportunities. First is large dimension products associated with post-and-beam construction. This has been an important opportunity for the BC Coast in particular. Lamstock has also offered an opportunity as Japan gradually evolved from using timbers to the incorporation of glulam. This opportunity has primarily been exploited by the Europeans. Second, softwood lumber, panels, and other products such as doors and windows that are consistent with the size and style of North American platform-frame construction grew in demand. This has been particularly important to western Canadian lumber producers, with strong price premiums of J-Grade over #2&better lumber.

China is a market that has generated a lot of interest in recent years. Since joining the WTO in 2002 China’s economic growth has remained in double digits year after year. The past year saw dramatic growth in the import of softwood lumber from Western Canada, and came at a very welcome time. The question is whether the demand is sustainable and whether there is opportunity for sales of higher value products.

China imports raw materials and exports value-added finished products. In spite of aggressive establishment of plantation forests in China, the country is far from self-sufficient given growing domestic demand and growing exports (most notably furniture). Unlike North America and Japan, China uses very little wood as a construction material. The main uses are decorative and industrial, the latter including concrete form and packaging.

Implications for change:

Europe. One of the major challenges for further expansion of wood-frame homes particularly in France and the UK is an insufficient domestic capacity to supply wooden home framing. The reduced skilled trades are observed not only in the wood business, but in construction in general. Over the medium-term, this means that Canadian suppliers can actively seek partnerships with local homebuilders and developers, because labour deficits do favour off-site construction. Despite the economic downturn, the demand for engineered wood products is set to increase significantly throughout Europe. Although small by North American standards, this market is evolving quickly. There is a sense that the demand for products such as LVL is not completely fulfilled by current suppliers, as it appears there have been recurrent shortages of supply of OSB panels over the past three years in France and Europe. The growing scarcity and increasing price of raw materials suggest that the European panel market may become attractive again in future. The development of the European market should be based on longer term relationships that should outlast the next housing boom in North America.
Japan. In the medium-term, there is no question that Japan will remain the most important Canadian value-added opportunity for off-shore exports from Western Canada. This includes J-Grade lumber, KD timbers, lamstock and more finished products like millwork. The challenges for recapturing market share include aggressive competition from Europe, the US and others; and due to growing protectionism, Japanese domestic supply. Exchange rates will continue to contribute to this challenge.

China. Overall, is China a market opportunity or a competitive threat? At the present time, Chinese imports of softwood lumber from Western Canada have been a blessing to mills that may otherwise be shut down because of the US recession. Is this sustainable? Will this remain a market for lower grades of lumber? If so, will this be the most profitable pathway for that fibre?

3.9 Developing and diversifying markets: non-residential construction
The total value of new non-residential construction in the US ranges around US$300 billion per year, which is larger than residential construction. Although wood is by far the dominant structural material in houses (around 85%), it is considerably lower for the non-residential market. For 2003, just 1.5 billion board feet of lumber and 2.3 billion square feet (3/8") of structural panels were used in the non-residential building sector. This was only 10% of the total wood usage in the new residential construction sector, and has declined since. Building codes are considered one of the largest hurdles to greater use of wood in non-residential construction. Codes serve primarily to protect public health and safety. Because fire is one of the biggest safety risks in buildings, codes apply major restrictions on combustible structural systems. In general, structural wood is only permitted in small, low-rise buildings. While code-related issues are estimated to limit wood’s potential non-residential market share to approximately 50% of the value of construction, this still leaves tremendous room for growth. In addition, the 50% estimate is based on model codes prior to the transition in the US to the unified International Building Code, which may open up more market to structural wood applications.

Why is wood used so infrequently as a structural material in non-residential buildings? It certainly is not for lack of knowledge about the material—most American and Canadian building designers are probably familiar with wood. But it is not a customary structural material outside of the housing sector; steel and concrete are dominant in the non-residential environment. Change is difficult (the barriers to wood are complex and the building industry is both averse to risk and slowed by inertia)—but with the right focus, the wood industry can make a difference.

Non-residential material specifiers (primarily architects and engineers, and to a lesser degree owners/developers and builders) represent perhaps the best standard for success in further wood market penetration. Non-residential structures tend to require higher standards, with a higher willingness to pay. They also are the group that most appreciate innovation, both in products and in application.
Implications for change:

Specifiers of non-residential buildings need products that are easier to design and to install. They further expect the development and the spread of wood structures’ fabricators. When it comes to products, the non-residential market needs more information than its residential counterpart. Product support is also in much more demand. These products need better drying consistency, precise dimensions and sometimes better appearance. Wood products’ suppliers need to be in control of the moisture content and they also need to accommodate various dimensions that may be outside common lumber grades. The relationship with non-residential suppliers can be excellent for those committed to developing new products.

3.10 Living with wood

Implications for change:

There is ample room to introduce higher end interior wood products that focus on quality and design such as the use of solid wood products, and use of higher value material like specialty veneers, combined with market strategies to elevate the interior wood products to a design priority. As floor space decreases, ceiling height is increasing to compensate. There is a niche opportunity for products that can better be used in vertical space.

A price premium for wood products such as doors and windows is generally unattractive for developers and builders in multi-family construction. Maintenance requirements of wood are also an added risk for developers and strata councils who prefer to minimize maintenance. Therefore manufacturers should develop products and design systems that minimize the manufacturing cost and product maintenance required. On the other hand there are a limited number of potential renovation opportunities for multi-family owners. A focus on the available projects for this group may capture their renovation dollars. The products to target include cabinets, interior doors, wall treatments and furniture.

As outdoor space becomes more of an extension to indoor space, outdoor products need to be more finished and visually pleasing. This can be achieved by introducing products that have features such as:

- radius edges
- sanded parts that come in contact with people
- designs that add to durability, ease of installation and user-friendliness.

It is important to note that consumers may choose higher cost plastics for decks, fencing and furniture as their dollar stretches further in a smaller yard.
The application of wood visual surfaces indoors is one way to reduce stress and promote health for building occupants. In architecture, "evidence-based design" is a growing field that seeks to promote health and optimize outcomes based on scientifically credible evidence. This study establishes wood as a tool in the pursuit of evidence-based design and healthy building occupants.

Healthcare environments have been the top priority with respect to evidence-based design to date. However, school and office environments are now being considered as the amount of time spent in these environments is great and can influence one’s overall health. The use of interior wood in hospitals, schools and offices should be a priority as occupant health is considered.
4 Product Opportunities: Structural Markets

4.1 Engineered Wood Products

4.1.1 Veneer Strand Lumber Need

• Total engineered wood use in the North American residential sector in 2006 was 3.9 billion board feet
• Low-cost high-strength products
• Growing demand for long spans (including for non-res)

Approach

• Develop prototype
• Full & waste veneer
• Novel stranding and forming technology
• Estimated time to commercialization 3 to 5 years

Benefits

• Combined benefits of veneer and strand products
• High MOE rating at lower cost than similar products
• Improved recovery

Competition

• Concrete/steel
• LVL
• LSL/OSL
• PSL

![Graph showing price FOB mill vs. MOE x 10^6 psi for various wood products.](image-url)
4.2 Engineered Wood Systems

4.2.1 Pre-fabricated Construction

Need
• Complete solutions/industrialized homes due to:
  - persistent labour shortages in the construction trades
  - high capital costs in land development/long cycle times increasing quality and liability requirements
• Market share for prefabricated wall panels ranges from 5 to 30%, leaving a lot of room for growth

Approach
• Promote automated technologies to implement mass customization of wall and floor systems
  (volume and design flexibility)
• Increase support to engineering and design community (res and non-res)

Benefits
• 40% faster install
• 60% less construction waste
• 5 to 15% lower production costs
• Reverse non-wood market share losses
• As compared to steel/concrete systems, benefits per costs are superior for energy savings, better environmental footprint

Competition
• Stick frame
• Steel/concrete

4.2.2 Non-Residential Construction

Wood products’ manufacturers produce engineered wood products (LVL, glulam, I-Joists, etc.) that may be specified by architects and engineers in non-residential construction. This market is substantial and remains significantly untapped. The most promising venue to successfully develop this market is to structure an offer for installed building systems. The key is to support the development of structure fabricators such as those seen in the steel industry.

Need
• Non-residential construction: a preferred segment for structural wood products (Kozak and Cohen, 1999; Gaston et al., 2001)
• Value of the non-residential market (2007): 87% of new residential construction
• Market share for wood is only 17% (Goetzl and McKeever, 1999)
• Potential for wood: 50% to 65% (O’Connor, 2003; Kinuani, 2008)
• Demand increasing due to environmental performance of wood

Approach
Specifiers of non-residential buildings include owners, developers and contractors, architects, and engineers. There is a consensus regarding the lack of supply in turnkey solutions for specifiers. Such solutions are needed to address urgent challenges: knowledge in wood design, lack of qualified labour for installation and strong demand. The approach is to offer complete buildings. To do so, it is important to describe the organizational resources and competencies needed to fully structure an offer of building systems by wood products’ manufacturers.

Benefits
The selling price for engineered wood products included in a building system is at least 25% higher than the market price for those products. But benefits are not only measured by costs. For equal cost, wood structures have superior environmental and energy performance. Cost benefits are expected when using wood as a substitute for concrete slabs in steel structures and in substitution of steel studs in concrete structures.

Competition
Competition is coming from concrete and steel buildings, very familiar to specifiers. The benefits per costs of wood are superior due to increased occupant comfort and improved environmental footprint.

4.2.3 Cross-laminated Timber
CLT is a cost-competitive wood-based solution that complements the existing light- and heavy-frame options, and is a good substitute for some building types which currently use concrete, masonry and steel. It is also fast to erect, environmentally sound, performs well and represents an important outlet for the forest industry, without disrupting the existing value chain.

Need
• Large demand in the mid-rise construction industry (70 to 200 million square feet of floor area/year)
• Forest industry needs further penetration in non-residential markets (1 to 3 BBF/year opportunity)
• New outlets are needed for small dimension lumber and low-quality lumber (e.g., MPB-cracked)
• Occupants demand a livable space, that is energy efficient and cost-competitive
• Developers demand a fast building system, allowing for faster capital turnover that is cost-competitive against other systems
Approach

• Define short-, mid- and long-term goals, e.g.,
  - Short: Floor slabs, focus: res and non-res
  - Mid1: Floors and walls, focus: industrial
  - Mid2: Entire buildings from limited portfolio, based on competitiveness
  - Long: Custom projects

• Build partnerships and alliances to better access the market, e.g., sawmills, distributors, developers

• Approach immediate projects via one-offs

• Support advocacy groups to increase awareness

• Support developing a generic product standard

• Draw from wood’s environmental credentials to seek subsidies/credits from government building programs

• Build expandable plants as demand increases

Benefits

• 10 to 50% less expensive shell costs

• Good environmental credentials (e.g., high carbon storage and less greenhouse gas emissions)

• Prefabricated system (fast, safe, precise)

• Good seismic, fire and acoustic performance

Competition

CLT competes – in cost and socially – favorably with concrete/steel buildings, especially in the non-residential and multi-family mid-rise market niche. Another competitive type is industrial buildings, typically built with tilt-up concrete, which are simple, profitable and represent a large demand. Low-rise educational is also attractive.
5 Product Opportunities: Non-structural markets

5.1 Living with Wood Products

5.1.1 Profile Decking

Need
- Decking is a 3+ BBF market in North American ($6 billion)
- Wood plastic decking has taken 30%+ market share (with considerable price premiums)

Approach
- Produce profiled decking, including fall-down utilization
- Presented at Home Shows
- Establish demonstration sites
- Develop value chain, including product positioning, branding and distribution

Benefits
- Pacific silver fir treatable and dimensionally stable
- Profiling minimizes checking, adds design appeal
- Brandable
- Attractive pricing, high margin/return-to-log potential

Competition
- Plastic wood composites, non-wood
5.2 Industrial Wood Products

5.2.1 Sound Abatement Panels

Need

• Improved margin on Japan-destined 105 square fall-down, representing 10% of production
• Local market for low-value products to improve return to mill through reduced transport

Cost

• Lower cost (<$100/lf) solid fencing in residential sector
• Wood option for contractors bidding on provincial contracts as part of the Wood First Initiative

Approach

• Install test sound abatement panels at FPInnovations site
• Acoustic testing at accredited facility (U of Alberta)
• Install residential and highway demo sites
• Identify manufacturing partners

Benefits

• Potential increase in price of $100/mbf on Japan 105 square fall-down
• 30% shop/clear grade material available for upgrade remanufacturing
• Residential: 1% market penetration into the 42.8 million lf concrete/brick/stone fence market would consume 10 million board feet
• Highway: North American annual sound abatement market is approximately 2,300 km; 10% market penetration would consume 53 million board feet
• Significantly cheaper than concrete
• Environmental benefits
Competition
- Concrete sound abatement
- Sound absorption systems

5.2.2 Ultra-low Density Insulation

Need
- 8 billion pounds market in 2007 ($10.4 billion)
- Growing demand for 'healthy house'
- Cost efficient delivery of R-value

Approach
- Developed initial prototype; improvement in process; patents pending
- R-value tested is similar to the current product in the market and further research and development continue for fire and moisture resistance
- Identified two markets – North America and China
- Identifying industry partners for manufacture, initially in China
- Estimated time to commercialization is 2 to 5 years

Benefits
- "Healthy house" – no harmful airborne particles
- "Green" low environmental impact, renewable resource as compared to fibreglass, foamed plastic, agri-fibre insulation
- Provides similar or better insulation properties
- Cost-competitive
- Uses excess mechanical pulp

Competition
- Fibreglass insulation
- Foamed plastic insulation
- Agri-fibre insulation
5.2.3 Ultra-low Density Packaging

Need
• Protective packaging demand in the US was $3.8 billion in 2009
• Moulded foam accounts for 61% of the $825 million foamed plastic industry
• Growing demand for green products

Approach
• Developed initial prototype, patents pending
• Identified two markets – North America and China
• Identifying industry partners for manufacture, initially in China
• Estimated time to commercialization is 2 to 5 years

Benefits
• Renewable, recyclable
• Non-toxic
• No blowing agent needed
• Naturally anti-static, no need for anti-static treatment
• Cost-competitive

Competition
• Expanded polystyrene
• Polyofin
• Polyurethane
• Ridged paperboard
• Corrugated
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