

Road Map Summary



Value
to
Wood

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Challenges and Opportunities for the Manufactured Building Component Industry

This sector comprises engineered structural components such as roof trusses, floor trusses and wall panels. Much of the information presented can equally apply to manufacturers of prefabricated, modular and mobile buildings that produce or use components in their process. A team of researchers interviewed Canadian producers of manufactured building components for their vision of their industry and the innovation needed to support its continued health. The team then consulted key university and Forintek researchers to review the challenges facing the industry and to brainstorm for additional innovations. The information presented in this report is part of a larger work "Roadmap for the Canadian Value-added Industry" available from FPInnovations – Forintek Division.

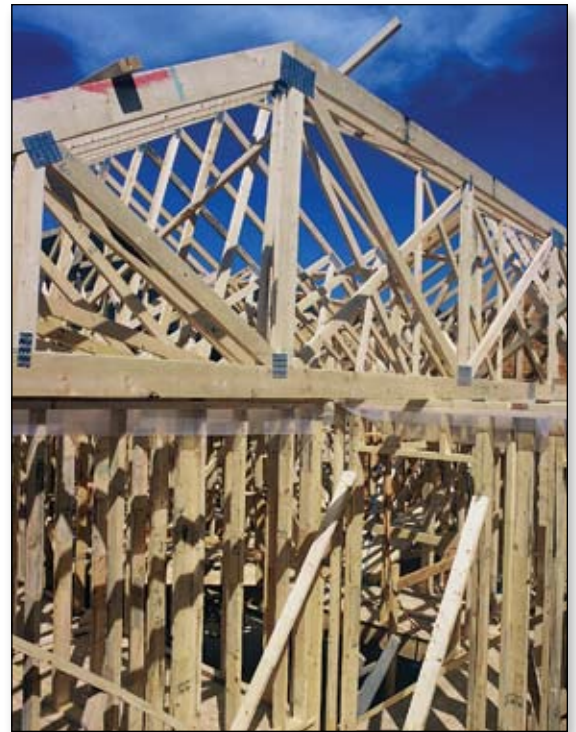


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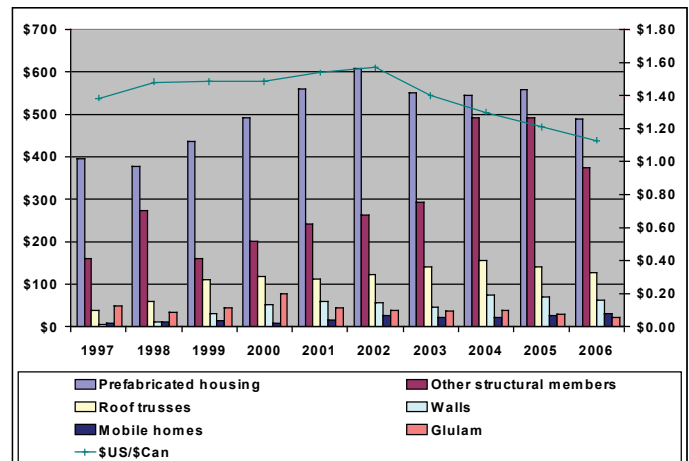
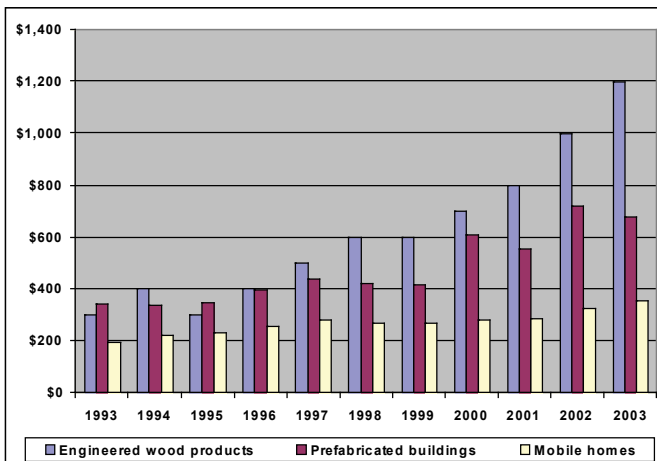


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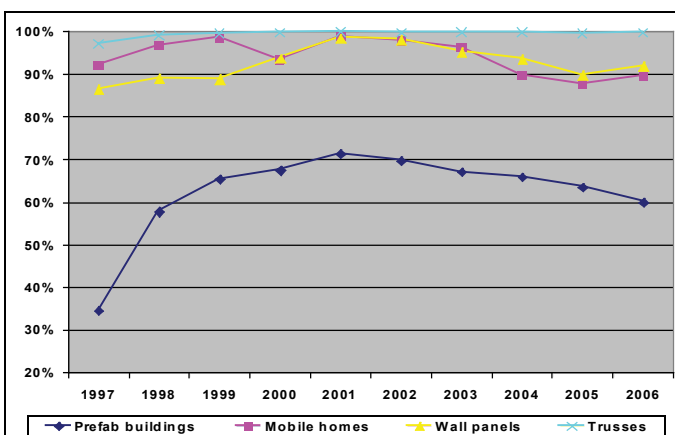
The Manufactured Building Component Industry At-a-Glance

- Shipments of the engineered wood products (including trusses), and prefabricated and mobile home sectors were approximately \$2.2 billion in 2003.
- In 2003, approximately 60% of the engineered wood product (EWP) shipments, and 60% of prefabricated and mobile home shipments were exported.
- Exports of EWP account for about 98% of all Canadian shipments for that sector; and prefabricated buildings, panels and mobile home exports account for about 60% of all Canadian shipments.
- In 2006, Ontario (\$250 million) and British Columbia (\$183 million) led Canada's exports of manufactured components and buildings, followed by Quebec (\$97 million) and Alberta (\$90 million).

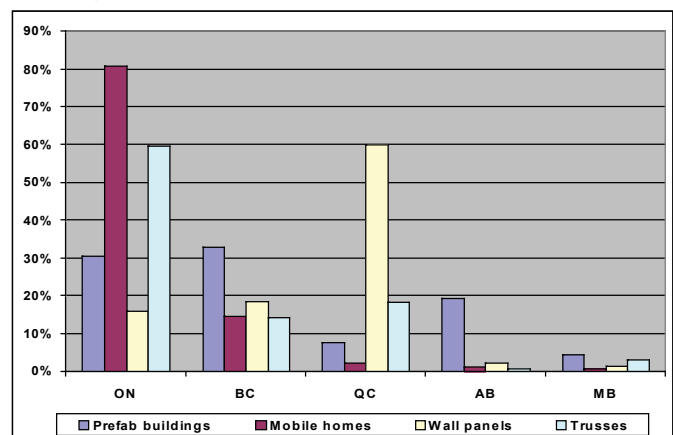


Shipments of manufactured building components and buildings (in \$ millions). Source: Industry Canada, 2007.

Canadian exports of manufactured building components and buildings (in \$ millions). Sources: Industry Canada and Bank of Canada, 2007.



Percentage of Canadian exports for manufactured components and buildings sent to the US. Source: Industry Canada, 2007.



Percentage of 2006 Canadian exports for manufactured components and buildings by province. Source: Industry Canada, 2007.

Industry Vision and Driving Forces

Building Performance-based Innovation

Traditional research on engineered wood products (EWP) and prefabricated components has focused on enhancing physical product properties and improving overall building performance. Research on individual products still needs to be done to impart new properties to structural products (including resins and adhesives), improve product design, design for whole-house using strictly EWP and prefabricated components, and to devise connectors and anchors that improve overall building performance.

According to manufacturers...

- Prefabricated wall panels are gradually gaining popularity as they represent one more step towards manufacturing complete housing systems. An important barrier to the acceptance of wall panels is that the product's overall value (performance, benefits, etc.) is highly dependent on foundation work over which the manufacturer has little to no influence. Homebuilders using square prefabricated wall panels sometimes have to deal with out-of-square foundations that cannot be changed. Hence, homebuilders are looking to prefabricated wall panel manufacturers for a product that is more flexible and can accommodate inaccurate foundations.
- Flexibility is also sought in trusses as adjustable trusses have made their way on the market. The main advantage of this product is that it helps homebuilders deliver their product rapidly.
- Building certification programs are not aligned with industry needs. Prefabricated products mean that building functions are being broken down into components.
- Businesses are currently competing against small operations producing cheap components that do not meet industry standards.

Resource Issues

(supply and characterization)

Aside from the decision to change species for financial reasons, many appearance structural wood products' manufacturers are being forced to change their materials and grade mixes in response to limited supplies of appropriate raw materials, and for reasons of improving manufacturing efficiencies and developing new products. This situation presents multiple challenges in making a product that is consistent and reliable as well as respecting supply agreements.

According to manufacturers...

- Many companies have stated that they have noticed a significant drop in the quality and consistency of the #2 and Better grade. Wane, straightness and moisture content are some of the problems faced by SPF component users.
- Some component manufacturers use MSR lumber when #2 and Better does not have the properties sought. Yet, MSR lumber is also affected by quality/consistency issues as well as variations in physical properties (i.e., resistance to plate pressing and nailing).
- Component manufacturers use different strategies to deal with quality issues:
 - Buy different grades from different mills to get the quality they need;
 - Use in-house grades;
 - Selectively source lumber from east and west;
 - Deal with individual sawmills to get a consistent product;
 - Avoid doing business with lumber distributors that have too much variation in their products;
 - Maintain higher stocks than normally required.
- Availability of fibre supply is another issue faced by component manufacturers. There have been reports that sourcing 2x3 lumber is difficult because:
 - Most 2x3 manufacturers favour US exports over the domestic market (quotas);
 - A significant number of sawmills producing 2x3 sell it to their own component manufacturing division.

- In response to the shortage of 2x3, some component manufacturers buy 2x6 lumber and rip it to 2x3 lumber. Other manufacturers produce fingerjointed material internally to supply their own needs. There is also some industry concern over supply consolidation in softwood lumber and connector plate industries.

Manufacturing and Cost Efficiencies

Cost reductions and increased efficiency are permanent drivers of innovation in the Canadian value-added wood products industry. Historically, improvements in this area focused on finding low-cost alternative materials as well as designing technology that could perform manufacturing operations faster, more precisely and at a lower cost than using manual labour. Similarly, improvements were continuously sought with regard to the actual operations performed in factories, i.e., scanning (optimization), sawing, gluing, laminating, sanding, finishing, assembly, etc. However, today's search for efficiency gains encompasses the whole spectrum of operations and material inputs used by a company (i.e., packaging).

According to manufacturers...

- Equipment suppliers provide leading edge research on technology and manufacturing operations. Similarly, software quality is a force driving future developments in manufacturing practices. These developments are driven by software supplied by truss plate suppliers, thus, the component industry is 'naturally' geared toward steel truss plates.
- Software and equipment integration is very efficient, yet truss design systems should be updated to take whole-house design into account.
- Much work remains to be done on workflow at the plant level. Handling bulky finished products around the plant and on building sites remains one of the industry's key issues. Roller pressing is not precise enough. Dust collection systems are complicated and expensive. Cutting systems are still crude for precision products.

- Transportation costs are a key element of market access. Component manufacturers are dealing with products that command high shipping costs, affecting their ability to compete in foreign markets (and to a certain extent local markets). Added to this are the difficulties inherent in shipping goods across state and international borders. Other difficulties also associated with product shipments are: wide loads; municipal permits; and safety issues.

- Finding skilled workers is a serious issue for most component manufacturers. The ideal training sought is a mix of architecture, civil engineering, wood science and basic working knowledge of software used in Canada. Component manufacturers also have difficulty finding trained people to do take-offs. Some of them are now outsourcing offshore.
- Adding to the difficulty of finding trained individuals is the fact that the construction industry is seasonal in Canada. Hence, companies have to lay-off some of their staff between December and May and they have difficulty re-hiring trained staff. A potential solution to this problem is to attempt to make jobs as foolproof as possible in order to minimize training requirements.

Customer Focus (key specifiers)

The structural products sector's ability to innovate is still highly dependent on the products the sawmilling industry produces. In many cases, value-added structural products are perceived by the primary industry as a means to sell more primary products. One of the weaknesses of the structural products sector resides in its limited ability to reach specifiers who are the key to increased product use, especially for non-residential markets.

According to manufacturers...

- The non-residential market should be targeted in the US and Canada as there is significant room for development. A key to fulfilling this objective resides in changing perceptions of wood's flammability in structural applications.
- Marketing is required to reach homebuilders and homebuyers who are becoming increasingly educated about homebuilding. The advantages of prefabricated components need to be identified and promoted.

- Distribution networks and customers differ for each product. Different distribution channels offer various conditions, for instance, retailers and large pro-dealers offer builders financing options on components. This has impacts on business requirements that component manufacturers have to meet. Outside of Quebec, it is rare for components to be sold directly to the clients.
- Homebuilding industry trends that have been well documented include: labour scarcity, material substitution, builder consolidation, insurance and litigation issues, attributes demanded by homebuilders, spread of automated techniques, waste disposal, cost, conservative attitudes, etc. It is believed that componentization can solve many of the previously mentioned issues.
- Most companies producing components export a proportion of their products to offset the seasonality of Canadian construction work. US demand for prefabricated components drives the Canadian prefab industry to a certain extent. Canadian businesses have had success on the US market in the past, but it seems that recent currency exchange rates have hurt what many deemed to be a price and not customer driven industry.



Environmental, Health, Social and Governance Issues

Canadian manufacturers of value-added structural products must comply with continually evolving codes and standards to ensure that there is negligible risk to consumer health and safety in the final product. Designers and other key specifiers (corporate and municipal) are increasingly demanding that the products they buy be made from wood that is harvested according to environmentally and socially acceptable procedures. The gradual implementation of environmental and social standards will eventually affect the way both residential and non-residential buildings are built.

According to manufacturers...

- The demand for green building and certified wood products is growing rapidly in North America. This could become problematic as some companies use non-certified products in their components and there is confusion regarding green building requirements.

- The roof and floor truss industry is regulated by standards (noise, mechanical properties, fire, etc.). These standards can have important impacts on manufacturing costs and product development. Accreditations and standards can vary significantly from region to region. Canadian manufacturers often need help to understand export requirements.
- Products accepted in other countries are difficult to use in Canada mostly due to standards that are too limiting. 'turb-o-web' is a good example of a product that is frequently used in the US, but is not making its way into Canada.

Top Four Innovation Needs and Priorities of the Structural Product Industry

- Increasing the industry's design and product development capacities
- Optimizing lumber and raw material use
- Controlling quality in material inputs, manufacturing processes and products
- Improving the use of supply chain management in the industry

Innovations for the Manufactured Building Component Industry

Incremental innovations are refinements or improvements to existing technologies, products and processes. **Breakthrough innovations** are totally new ways of thinking and doing. They represent significant departures from current processes, technologies, equipment and products used in the industry.

The lists below represent only some of the innovations identified in this project. Please consult the *Roadmap* for a more extensive listing of possible innovations.

Codes, Standards, and Social Responsibility

Incremental Innovations

- Develop standards for prefabricated wall panels.
- Remove obstacles for non-residential construction in building codes and design standards.
- Facilitate the use of foreign technologies/products in Canada.
- Study the impact of housing lifecycle on home design (i.e., design for disassembly, reuse and recycling as houses are often destroyed before condemned).
- Critical analysis and development of a scientific basis for the green building standard.

Breakthrough Innovation

- Assist the Canadian forest products industry in the transition towards green building certification and the development of green building compliant building materials.

Market Access / Intelligence / Competitors

Incremental Innovations

- Assess the North American market potential for high walls (12' to 20' in height).
- Demographic and geographical analysis of highest potential niche markets for design specific products (e.g., green building products for Lifestyles of Health and Sustainability in the US).
- Comparative study of how other housing components and materials service homebuilders.
- Study values of developers and identify ways to minimize their risk.
- Assess product sensitivity to transportation costs and identify optimization solutions for small and medium sized companies.

Material Supply and Properties

Incremental Innovations

- Acquire design value knowledge of all wood species (commonly used and alternative species such as tamarack and southern yellow pine) as well as regional variations in design values.
- Standardize MSR colour sprays. Length of the board should be sprayed to identify grade of cut MSR lumber.
- Identify value-added materials that could potentially be used in prefabricated components (i.e., sheathing with pre-installed vapour barrier).

Breakthrough Innovations

- Need composite wood products that can be used to produce trusses. Product should ideally incorporate wood residues.
- Develop 12-foot long structural sheets that could be cut by laser.
- Develop telescopic wood (material) for width and height adjustable trusses.

Technology and Manufacturing

Incremental Innovations

- Improve the integration of Canadian and US software.
- Consolidate design, materials, etc. into a database to be used by software manufacturers.
- Reduce the amount of materials used in manufacturing.
- Develop an assembly system eliminating the manual positioning of truss plates and wood members.
- Organize transportation according to installation (improve coordination and logistics according to just-in-time principles).

Breakthrough Innovations

- Develop design software allowing the optimization of an entire home (fibre use and performance).
- Develop software to de-layer AutoCAD plans in order to design wood structures that fit original architect plans. Benefits include improved communication (logistics), faster delivery and more precise quotes. Software should allow the determination of material requirements on given projects.
- Develop software that combines plates and engineering (e.g., MITEK) with Optiframe to get a complete tool to visualize wood-frame structures.
- Develop kerfless sawing (metals are cut with lasers and water jets).

Skills and Training

Incremental Innovations

- Develop training for technical staff to do quick quotes.
- Vocational/professional schools should teach AutoCAD with focus on wooden structures.
- Study the impact of wood engineering and architecture programs on the use of wood in structural applications and evaluate the impact of loss of university programs in this area.

Breakthrough Innovations

- Support architectural training on wood buildings. This encompasses both the need to have professors specialized in wood engineering and having courses being taught at the university level (i.e., having the specialization offered).
- Pressure US legislators to allow Canadian installation labour to work in the US.

Design and Product Development

Incremental Innovations

- Develop a protocol for the use of 'turb-o-web', foreign connectors and other innovations in Canadian products.
- Assess product performance of floor cassettes and walls in transportation (as well as handling on the building site) and identify ideal product dimensions.
- Develop a pre-engineered building system for non-residential construction.
- Develop tools to design connectors.
- Study the interactions between building construction materials in combined systems (e.g., compatibility of connections).

Breakthrough Innovations

- Develop connectors (nails or plates) that are not made from steel or can be cut to achieve an adjustable truss that does not require any glue (web is glued).
- Design a roof truss with a bottom cord made from LVL to eliminate the need for truss web and allow a living space in the attic. This would necessitate the development of an anchor system for PSL or LVL component members.
- Evaluate the possibility of using custom made walls and trusses that are designed like an accordion and would include all walls/trusses for a specific home. Potential advantages are the elimination of bracing and ensuring adequate spacing of structural elements.



- Develop an anchoring system that does not necessitate opening walls or nailing through them (twist handle, Velcro, glue, etc.).
- Evaluate the feasibility of designing a module that could be used as a container to ship bulk products (i.e., mineral wool) to domestic and foreign markets.

Reference

Lavoie, P.J.P., D. Fell and F. Laytner. 2006. Roadmap for the Canadian Value-added Industry. Prepared by Forintek Canada Corp. for Natural Resources Canada - Canadian Forest Service. 179 pp.

Value to Wood Research Program Partners



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As part of the *Value to Wood* program, funded by Natural Resources Canada, Forintek's Industry Advisors are providing technical services to value-added wood product manufacturers in all regions of Canada. Find out about upcoming workshops or seminars in your area by visiting us at www.valuetowood.ca or make a request for information on any technical issue related to wood product manufacturing via valuetowood.ca (Help Desk).

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