

Road Map Summary



Value
to
Wood

RMS - 07/08
March 2008

Challenges and Opportunities for Window and Door Manufacturers



Photo: www.bcforestinformation.com

A team of researchers interviewed Canadian window and door manufacturers 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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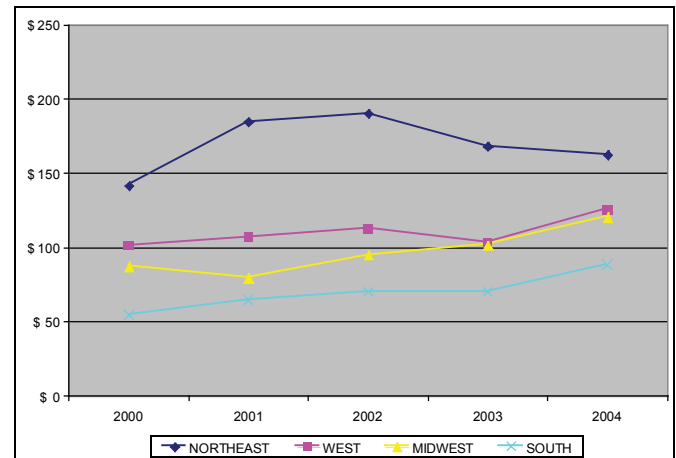
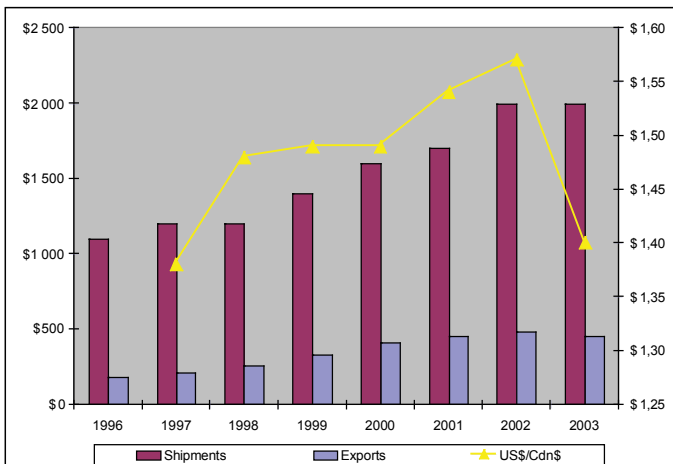
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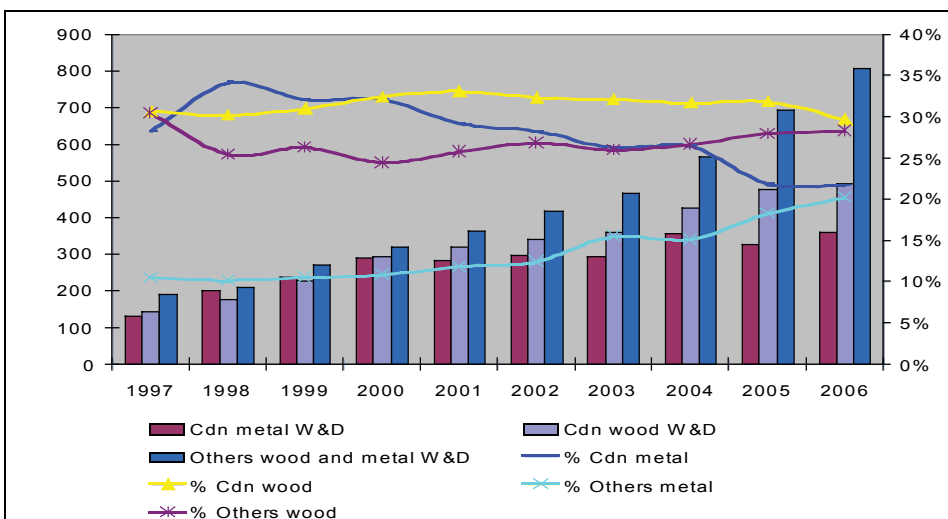
The Window and Door Industry At-a-Glance

- Shipments from the Canadian wood window and door sector were equivalent to \$2 billion in 2003, with about \$528 million exported annually (97% to the US in 2005).
- Wood window and door manufacturers are competing with aluminium and vinyl products. In the US, the wooden door market share is about 14% for exterior doors and 96% for interior doors (2004). The wood window US market share is slightly under 40% competing with vinyl windows that own 51% of the market. Most wood windows and doors sold on the US market are clad with either aluminium (66%) or vinyl (27%).
- Canadian exports sent to the US are relatively well distributed geographically. About a third of all Canadian exports are sent to the US Northeast.
- Quebec (\$198 million) and Ontario (\$114 million) led Canada's exports of wood windows and doors in 2006, followed by Manitoba (\$106 million) and British Columbia (\$64 million).
- Canadian window and door manufacturers have maintained a stable market share in the US despite the weakening US dollar.



Shipments and exports of the Canadian wood window and door industry (in \$ billions). Source: Industry Canada, 2006; Bank of Canada, 2006.

Canadian exports of wood windows and doors to the US by region (in \$ millions). Source Industry Canada, 2006.



Relative importance of Canadian windows and doors exports in US trade balance (in \$US millions). Source: USITC, 2006.

Industry Vision and Driving Forces

Newly Emerging Economies

Foreign manufacturers of commodity products (e.g., lumber, particleboard, MDF, etc.) are increasingly exporting their products into markets traditionally supplied by Canadian industries. The emergence of these economies, coupled with a weak US dollar, forces Canadian manufacturers to target different market segments or offer additional service attributes to differentiate their products from those coming from countries with low manufacturing costs.

According to manufacturers...

- The window and door market is highly dependent on the construction industry and general economic conditions (e.g., interest rates). Houses built 30 to 40 years ago are due for remodelling and it is foreseen that many old wood windows will be replaced by vinyl or metal windows.
- Chile is the Canadian exporters' main rival as their exports quintupled between 1997 and 2004. Nevertheless, Chilean exports only represent 10% of all Canadian wood windows exported to the US.
- The low-end and much of the middle range market for windows has already been claimed by vinyl products. The weak US dollar and offshore competition have marginally impacted high-end wood windows and doors occupying niche markets in custom projects (residential, architectural or historical).

Resource Issues

(supply and characterization)

Aside from the decision to change species for financial reasons, many appearance wood products' manufacturers are being forced to modify their materials and grades mixes because their historical raw material supply has changed in quality and/or price, thus influencing their ability to deliver the same products. This situation presents multiple challenges and opportunities.

According to manufacturers...

- Unique characteristics present in wood force manufacturers to devote a large proportion of inventory space to wood supply.
- Window and door manufacturers have been dealing with a declining quality in their wood supply (solid clear grade), narrower boards, etc. Moreover, there are significant variations in grades among suppliers (in shop grades).
- Window and door manufacturers are looking to cut material costs using various strategies, including using materials other than wood, optimizing their actual wood supply and continuously searching for replacement species for high-priced pine and exotic wood species (i.e., mahogany).
- Alternative species frequently used include radiata pine, spanish cedar, hemlock, Douglas-fir and alder. Engineered wood products such as MDF and veneer are also being considered in window and door applications (i.e., casings).

Customer Focus (consumers, homebuyers, designers, etc.)

Consumers are becoming more and more educated about the products they buy. Widespread access to the Internet makes it easy to obtain third-party information about various products and compare them quickly. Simultaneously, the current North American demographic profile is contributing to the emergence of a market segment that is looking for high-end customized products, and, more importantly, that has the ability to afford them.

According to manufacturers...

- Vinyl (and metal) windows and metal doors represent 80% of North American window and door sales as homeowners/homebuilders are looking for low maintenance products.
- Wood windows are high-end products that appeal mostly to older homeowners who are willing to maintain their windows. Some of these customers may be looking for windows made from high-end species (e.g., maple). Service and product warranties are important components of these products. It is foreseeable that manufacturers could eventually offer maintenance services to look after their products.
- Companies are continuously looking for new products that can help distinguish themselves from competitors (local or foreign). Design and product-based innovation can come in many shapes such as custom products, service attributes, specialized products and branding.
- There is interest in the industry for the development of windows and doors that are suited to the specific markets (i.e., hurricane and termite regions) and style preferences (i.e., California). Finishing products are a key component of 'product suitability'.

Environmental, Health, Social and Governance Issues

Partly in reaction to the challenges posed by newly emerging economies, but also from legislative measures put in place in Western countries, the Canadian value-added industry is reconsidering its raw materials, components and practices to ensure that they are less harmful to the environment and that they pose a negligible risk to consumer health. Similarly, consumers are increasingly demanding that products imported from other countries respect human rights (outsourcing) and come from wood that is legally harvested.

According to manufacturers...

- Budding consumer concerns over toxic emanations in PVC windows may increase the demand/need for green windows and doors. There may be an increased demand for wood in window interiors as it is perceived as an environmentally friendly material.
- Less stringent energy efficiency policies may also have an impact on product development in the window and door industry. As of late, government bodies are becoming less involved with energy efficiency programs. Similarly, the lack of enforcement of the building code in certain regions/provinces can severely affect product performance and service life.

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).



Photo: www.bcforestinformation.com

According to manufacturers...

- One of the main challenges related to using new wood and wood-based materials consists of finding ways to machine these products without replacing the equipment, machine heads and knife materials currently used in the industry.
- There are issues related to the gluing and machining of fingerjointed materials. The various materials and components used in windows contribute to gluing and design issues. Poor drying and differential shrinkage of wood and EWP are other significant wood-related concerns.
- Windows using various material combinations are being developed and marketed. Wood veneering and wrapping of windows and doors could contribute to maintaining the appearance of wood while avoiding its current perceived shortcomings/disadvantages.
- Wood processing is relatively low-tech when compared with the way vinyl and metal are processed (i.e., extruders). CNC machines, which are commonly used in large scale operations, are often seen as a trade-off between high waste and low labour costs. There is room to improve wood processing for the needs of the window and door industry.
- Assembly is a labour-intensive operation that is very time consuming. There is interest to increase the degree of automation with which this operation is accomplished.
- Limited demand for wood windows contributes to a low industry profile and lack of training in the industry makes it difficult to recruit qualified labour. Lean manufacturing and leadership training would answer the needs of Canadian manufacturers.

Top Six Innovation Needs and Priorities of the Appearance Product Industry

- Increasing the industry's design and product development capacities
- Developing enhanced finishing products and methods
- Improving the industry's understanding of business models
- Providing the industry with relevant and up-to-date market intelligence
- Developing improved methods for sanding and surface preparation
- Resolving and capitalizing on environmental and social responsibility issues

Innovations for the Wood Window and Door 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.

Market Access / Intelligence / Competitors

Incremental Innovations

- Improve consumer knowledge (acceptance of alternative species and designs) via direct relationships with end-users.
- Identify performance requirements in different markets/geographic areas.
- Investigate and assess the performance of foreign windows and doors (e.g., Europe).
- Develop marketing approaches that are targeted to key demographic segments (e.g., women as decision-makers).
- Study the effectiveness of various communication channels targeting key specifiers.

Breakthrough Innovation

- Assess the market benefits and feasibility of environmental certification in wood flooring—products targeted to homebuilders, architects and designers.

Design and Product Development

Incremental Innovations

- Improve the industry's knowledge of product interactions (e.g., wood and caulking, wood and glues, etc.).
- Develop the use of stereolithography¹ to improve the speed and accuracy of hardware and joinery prototyping.
- Assess the benefits of end-grain sealants to improve window performance.
- Develop finishes that reduce colour variations in wood.
- Investigate design platforms/systems that integrate the entire product development process. The system should reduce the product development cycle.

¹Stereolithography: Process which promises to accelerate the model-building process. It involves building three-dimensional plastic prototypes from computer-aided designs (CAD's) in a matter of minutes or hours.

Breakthrough Innovations

- Develop effective and cheap exterior finishing products.
- Develop new water-based finishing products (impregnation of exterior products) that do not result in raised grain after application.
- Develop a non-toxic water repellent product made from solvents (resolve current shortcomings of water-based finishing products).
- Develop wood treatment (e.g., wood densification, thermal modification) for improved durability (20 years without maintenance).
- Develop an EWP that does not warp and can be laminated/welded.

Environment and Social Responsibility

Incremental Innovations

- Offer incentives to encourage the use of Canadian natural resources and environmentally friendly products in windows and doors.
- Develop a guidance document to facilitate the use of green components.
- Develop standards to present green building data for individual products.
- Improve knowledge of trends in corporate social responsibility as well as environmental, social and governance issues.

Breakthrough Innovations

- Assist the Canadian forest products industry in the transition towards green building certification and the development of green building compliant building materials.
- Develop environmentally friendly packaging solutions that are returnable and/or reusable.

Material Supply and Properties

Incremental Innovations

- Develop hardwood plywood (with no void core) that could be CNC machined for window grills.
- Develop artificial vision to scan for defects, colour and heartwood/sapwood.
- Assess regional suitability of alternative wood species in windows and doors (e.g., hemlock in Eastern Canada).
- Improve colour matching of fibre supply using near infrared spectroscopy and ion mobility spectroscopy.

Breakthrough Innovations

- Develop an engineered wood product (EWP) that is suited for wood window and door applications.
- Develop a versatile wood product that has properties similar to vinyl, i.e., no warping, can be welded, can be laminated, etc., and sold for a price at least equivalent to solid wood and can easily be optimized (e.g., wood plastic composite).
- Develop wood treatments that offer resistance to mold, rot and decay (e.g., thermally modified wood, plastic encapsulated wood, etc.). Work is needed to increase the permeability of refractory species suitable for window and door applications.
- Develop procedure to sort more permeable wood from refractory wood that meets CSA penetration and retention requirements. Species of interest include amabilis fir/western hemlock as well as pine, alpine fir and balsam fir/spruce (SPF specific). Possible suitable methods include near infrared spectroscopy and ion mobility spectroscopy.

Skills and Training

Incremental Innovations

- PC-based distance education/training is needed for workers. Potential topics include (but are not restricted to): wood as a material, equipment currently available, typical manufacturing processes, markets, management, etc.
- Implement a training program and extension strategy for finishing and basic woodworking.
- Design a method to retain 'lessons learned' in the company as labour turns over. The process should be evolving and form a manufacturing manual.

Breakthrough Innovation

- Develop web-based training to increase the R&D capacity in the wood window and door industry.



Technology and Manufacturing

Incremental Innovations

- Develop adhesives that improve stability in curved window components.
- Assess the use of end-grain sealants to improve the performance of windows.
- Identify an alternative to radio-frequency (RF) pressing due to fire and safety concerns as well as service issues associated with this technology.
- Study the impact of finishing window components prior to assembly on product performance and recommend manufacturing practices that improve the durability of wood windows.
- Provide unbiased 3rd party information on the performance and properties of cutting tools and other machines used in manufacturing (e.g., machine speeds and materials). Current sources of information come from equipment manufacturers.

Breakthrough Innovations

- Develop kerfless sawing (e.g., laser saw).
- Automate the assembly of wood windows and doors.
- Research ways to reduce set-up delays by automating equipment set-ups (e.g., moulder heads).

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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