CHALLENGES AND OPPORTUNITIES FOR THE WOOD PRODUCTS MANUFACTURING INDUSTRY

19 novembre 2019 | 19 November 2019
Funding Partners

- MFFP
- MEI
- RNCan
ABOUT US

Not-for-profit Research & Innovation institute
– 80M$ in R&D and Innovation activities
– 425 employees
– 175 member companies (Canada only)
– Associated with Universities in research
– Laboratories: Pointe-Claire, Québec City, Vancouver

Majors Programs of Innovation
– Forest Operations
– Wood Products
– Pulp & Paper, Packaging and sanitary
– Bioproducts & Bioenergy
NSIMBA KINUANI, B.Sc.A, MA
Analyste de marché – Construction durable

Special Thanks

• François Robichaud
• Alain Boulet and Sven Gustavsson (QWEB)
• Gérald Beaulieu and Cecobois’ team
• Jean-François Guilbert (French Timber)
• Maria Stenberg (Canadian Embassy in Stockholm, Sweden)
• Canadian Trade commissioners in Düsseldorf (Germany)
GOAL AND STUDY FRAMEWORK

Study Goal

• Assess the short and medium-term opportunities for the wood products industry to manufacture new products.

Study Framework

• SM$^2$ which aims among other things a diversification of lumber or value-added products from lumber.
• SM$^2$ basis: use of intelligent and agile technologies
EVOLUTION OF THE REGULATORY FRAMEWORK

Impact
• The evolution of codes and standards has a greater impact than consumer preference, especially for framing products.

Regulatory Environment
• Number of floors
• Energy performance
• Acoustic performance
• Fire performance
EVOLUTION OF THE REGULATORY FRAMEWORK

NUMBER OF FLOORS

The land price increase in cities and the densification policies of city downtowns are leading to a reconfiguration of construction methods.

Trends:
• High-rise building to maximize space;
• Authorization to use wood in buildings of more than 4 storeys.

Source: nordic.ca (Condos Origine, Québec)
EVOLUTION OF THE
REGULATORY
FRAMEWORK

NUMBER OF FLOORS (continued)

• From 4 storeys to 5 and 6 storey buildings in light-frame wood.

• In the U.S., the International Building Code will allow in 2021 the construction of wooden buildings up to 18 floors.

• In Canada, the National Building Code proposes to allow in its 2020 edition the use of solid wood in buildings up to 12 storeys.

Source: sustain.ubc.ca (Brock Commons Tallwood House, Vancouver)
EVOLUTION OF THE REGULATORY FRAMEWORK

ENERGY PERFORMANCE

The energy performance requirements reflected in the codes include:

• The performance and tightness of the envelope;
• The frame of the building;
• Electrical systems, including lighting.

Impacts:

• The use of panels that provide both structural and insulation functions;
• The average wall thickness and continuous rigid insulation outside buildings are growing.

Source: nordic.ca (Condos Origine, Québec)
EVOLUTION OF THE REGULATORY FRAMEWORK

ACOUSTIC PERFORMANCE

• Demand for soundproofing and acoustics solutions (commercial and multi-family buildings).
• Request from codes and standards but also designers and specifiers.

Impacts:
• The National Building Code sets the requirements for noise transmission.
• Performance depends not only on the structure but also on the assemblies of the systems in place.

Source: nordic.ca (Condos Arbora, Montréal)
EVOLUTION OF THE REGULATORY FRAMEWORK

FIRE PERFORMANCE

Single-family Residential Market

• Floors are the main concern of the authorities.

• In the U.S.: since 2012, fire protection of residential floors if exposed to the basement (especially I-beams).

• In Canada, similar requirements would be in effect soon.

Source: thinkwood.com
EVOLUTION OF THE REGULATORY FRAMEWORK

FIRE PERFORMANCE (continued)

Multifamily Buildings Market
• In the U.S., the IBC 2018 allows the use of wood in three types of non-combustible buildings (using fire-retardant wood or timber).

• In Canada and the U.S., the use of massive wood in tall buildings can be done if they are encapsulated.

Source: nordic.ca (Condos Origine, Québec)
EVOLUTION OF MARKET TRENDS

Facts

• Construction is the largest market for wood products in North America: residential, non-residential and R&R.

Market Trends

• Single-family buildings
• Multifamily buildings
• Substitute products
• Prefabrication
EVOLUTION OF MARKET TRENDS

Single-family residential construction in North America is dominated by wood. More than 95% of single-family dwellings have wood framing. But, changes are also observed.

SINGLE-FAMILY RESIDENTIAL BUILDINGS

Source: Home Innovation Research Labs – Annual Consumer Practices Reports
Single-family residential construction in North America is dominated by wood. More than 95% of single-family dwellings have wood framing. But, changes are also observed.

Source: Home Innovation Research Labs – Annual Consumer Practices Reports
Multifamily residential construction share is growing in the United States and Canada:

- É-U: 30%,
- Canada: 50%
- Québec: 70%
EVOLUTION OF MARKET TRENDS

Throughout North America, light-frame wood construction is now accredited in 5 and 6 storey buildings.
EVOLUTION OF MARKET TRENDS

Competition from substitute products is felt in structural products, but also in appearance products.
EVOLUTION OF MARKET TRENDS

Wooden appearance products must not only compete on the basis of cost, but also and above all on strength, maintenance and ease of installation.
EVOLUTION OF MARKET TRENDS

The market share of prefabricated construction is rising worldwide for several reasons.

PREFABRICATION

Factors influencing the manufacture of buildings and components in the factory:

- Shortage of manpower
- Increase in productivity
- Delivery delay
EVOLUTION OF MARKET TRENDS

Industrialized construction involves the **automation** and **robotization** of processes, which has an impact on the materials used.

PREFABRICATION (cont.)
Impacts of automation:

- Increase in quality requirements (straightness, low proportion of wane, etc.);
- Produce in small batches at the speed of commodities.
Europe is an important player on the world wood market, both in terms of consumption and production.

The continent is self-sufficient in wood but a serious competitor and an interesting model.
EVOLUTION OF MARKET TRENDS

The big differences with sawmills in Quebec and Canada:
- Logs => good factory => good application (geometrical defects, 2D internal defects);
- Large variety of processed products in sawmills;
- Great synergy between sawmills and 2nd and 3rd process factories.
TECHNOLOGICAL CHALLENGES

Facts

• Improving agility and product diversity opens up opportunities for sawmills.

Technological Challenges

• Quality
• Automation ($2^{nd}/3^{rd}$ process and industrialization of construction)
• Non-standard dimensions
• Non-standard moisture content
• Technical flexibility and operational agility
TECHNOLOGICAL CHALLENGES

EWP and specialty products (2\textsuperscript{nd} and 3\textsuperscript{rd} process) and industrialized construction products require specific qualities of lumber:

QUALITY CHALLENGES

- Non-standard dimensions
- Precision Kiln-drying
- Precised planing
- Wane limitation

The lack of supply of these products caused by a lack of suitable technological solutions is a limitation to the development of the 2\textsuperscript{nd} and 3\textsuperscript{rd} transformation industry, even a barrier to entry and opens the way to substitute products.
TECHNOLOGICAL CHALLENGES

The shortage of labor combined with the quest for efficiency supports a wave of investment in the automation of the 2nd and 3rd transformation industry and industrialized construction.

2ND AND 3RD PROCESS AUTOMATION CHALLENGES

• **Roof/Floor Trusses**: Low wane tolerance due to metal plates.

• **Glulam**: precise planing, almost-sharp edges, little or no wanes.

• **Walls**: twist (critical), low wane.

One piece that does not meet the standards can affect the productivity of the production line.
Some wood products of 2nd and 3rd transformation would be made of lumber of non-standard dimensions. A wide variety of wood dimensions is possible and desired.

**TECHNOLOGICAL CHALLENGES**

**NON-STANDARD DIMENSIONS CHALLENGES**

- **Glulam**: thicker wood acceptable (1 5/8 vs 1 ½)
- **CLT**: various acceptable widths.
- **Roof / floor trusses**: custom dimensions acceptable.
TECHNOLOGICAL CHALLENGES

For manufacturers of engineered wood products, the moisture content is systematically more restrictive than the generally accepted standard of 19%.

Drying quality is so critical that most manufacturers re-dry the wood they buy.

NON-STANDARD MOISTURE CONTENT CHALLENGES

- **Moisture targets**: lower (9% -12% -15%)
- **Moisture gradient**: lower for better stability of the product.
- **Variance**: lower
TECHNOLOGICAL CHALLENGES

FLEXIBLE SYSTEM
A system that adapts to the production of goods of different quantities and types according to the needs of the market.

AGILE SYSTEM
A system that adapts to the production of goods of different quantities and types according to the needs of the market, quickly, while controlling the costs and quality of products.
OPPORTUNITIES FOR THE WOOD INDUSTRY

Facts
• There are different opportunities for the wood industry that require more than just technical flexibility but also operational agility of production systems.

Products and Markets Opportunities
• Products census
• Multicriteria analysis
• Selection results
OPPORTUNITIES FOR THE WOOD INDUSTRY

Recent innovations in engineered wood products could be used in all segments of the construction markets.

PRODUCTS CENSUS

• More than 50 innovative products and systems have been identified.

• They were then grouped into 12 categories.
OPPORTUNITIES FOR THE WOOD INDUSTRY

Several criteria (technical, regulatory and market) were used to select promising products.

MULTICRITERIA ANALYSIS

• Each criterion has a weight of 1 to 5, depending on its importance.
• Each criterion is given a score of 1 to 10 (from easy to easy).
OPPORTUNITIES FOR THE WOOD INDUSTRY

PRELIMINARY RESULTS

- Traitements ignifuges: 69.6%
- Traitements chimiques: 61.3%
- Poutrelles de coffrage: 46.0%
- Plateaux (pièce par pièce): 46.4%
- Systèmes de planchers multifonctionnels: 55.1%
- Panneaux plafonds suspendus: 48.0%
- Panneaux sandwich multifonctionnels: 40.7%
- Panneaux 3 plis: 58.9%
- Panneaux de bois massifs (CLT, DLT, NLT): 62.9%
- Modifications chimiques: 57.1%
- Colombages d'ingénierie: 46.2%
- Caissons d'ingénierie: 49.1%

FINAL RESULTS

- Panneaux 3 plis: 77.3%
- Traitements ignifuges: 75.6%
- Panneaux de bois massifs (CLT, DLT, NLT): 74.7%
- Traitements chimiques: 61.3%
- Modifications chimiques: 57.1%
- Systèmes de planchers multifonctionnels: 55.1%
- Caissons d'ingénierie: 49.1%
- Panneaux plafonds suspendus: 48.0%
- Plateaux (pièce par pièce): 46.4%
- Colombages d'ingénierie: 46.2%
- Poutrelles de coffrage: 46.0%
- Panneaux sandwich multifonctionnels: 40.7%
OPPORTUNITIES FOR THE WOOD INDUSTRY

Several SM² projects can already meet or are under study to meet these new market needs.

<table>
<thead>
<tr>
<th>Produits novateurs</th>
<th>Projets SM²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panneaux 3 plis</td>
<td>Scies circulaires ultra performantes</td>
</tr>
<tr>
<td></td>
<td>Tranchage de bois</td>
</tr>
<tr>
<td></td>
<td>Séchage Ultra-Rapide (SAF)</td>
</tr>
<tr>
<td></td>
<td>Reséchage Haute-Fréquence</td>
</tr>
<tr>
<td></td>
<td>Plateforme d’analyse agile et flexible (Modélisation)</td>
</tr>
<tr>
<td>Traitements ignifuges</td>
<td>Amélioration de l’imprégnabilité de bois résineux</td>
</tr>
<tr>
<td>Panneaux de bois massif (CLT, DLT, NLT)</td>
<td>Séchage Ultra-Rapide (SAF)</td>
</tr>
<tr>
<td></td>
<td>Reséchage Haute-Fréquence</td>
</tr>
<tr>
<td></td>
<td>Raboteuse intelligente</td>
</tr>
<tr>
<td></td>
<td>Plateforme d’analyse agile et flexible (Modélisation)</td>
</tr>
<tr>
<td>Modifications chimico-physiques</td>
<td>Amélioration de l’imprégnabilité de bois résineux</td>
</tr>
<tr>
<td>Systèmes de planchers multifonctionnels</td>
<td>Séchage Ultra-Rapide (SAF)</td>
</tr>
<tr>
<td></td>
<td>Reséchage Haute-Fréquence</td>
</tr>
<tr>
<td></td>
<td>Plateforme d’analyse agile et flexible (Modélisation)</td>
</tr>
<tr>
<td>Caissons d’ingénierie</td>
<td>Séchage Ultra-Rapide (SAF)</td>
</tr>
<tr>
<td></td>
<td>Reséchage Haute-Fréquence</td>
</tr>
<tr>
<td></td>
<td>Plateforme d’analyse agile et flexible (Modélisation)</td>
</tr>
</tbody>
</table>
OPPORTUNITIES FOR THE WOOD INDUSTRY

Several possible project tracks.

<table>
<thead>
<tr>
<th>Produits prometteurs</th>
<th>Études recommandées</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panneaux massifs 3 plis</td>
<td>Analyse technico-économique incluant : caractérisation des approvisionnements requis, procédés de fabrication, technologies requises, estimation des coûts de procédés, définition des applications/marchés potentiels.</td>
</tr>
<tr>
<td>Traitements ignifuges</td>
<td>Étude de marché pour préciser la demande potentielle, les utilisations, l’offre, les prix et la distribution des produits.</td>
</tr>
<tr>
<td>Panneaux de bois massif (CLT, DLT, NLT)</td>
<td>DLT : caractérisation des procédés et propriétés du produit et des technologies. CLT de nouvelle génération : explorer d’autres types de panneaux (avec isolants), etc.</td>
</tr>
<tr>
<td>Systèmes de planchers multifonctionnels</td>
<td>Caractérisation des options de conception</td>
</tr>
<tr>
<td></td>
<td>Étude de marché : demande, applications potentielles et prix</td>
</tr>
<tr>
<td>Caissons d’ingénierie</td>
<td>Caractérisation des options de conception</td>
</tr>
<tr>
<td></td>
<td>Étude de marché : demande, utilisations et prix</td>
</tr>
</tbody>
</table>
IDENTIFICATION OF NORMATIVE BARRIERS

Regulations on:

• Formaldehyde emissions
• Acoustic
• Fire (indoor and outdoor)
• Intellectual property
• Structural calculation
• Treatment products
SOME PRODUCTS
Merci

Nsimba Kinuani
Analyste de marché
FPInnovations
Nsimba.Kinuani@fpinnovations.ca
(418) 781-6725