Foresight

Accelerating the Circular Bioeconomy Market in Canada

January, 2021

“The circular bioeconomy is a USD $7.7 trillion global opportunity.”

CEO Guide to the Circular Bioeconomy, World Business Council for Sustainable Development.

A Growing Market Facing Competitive Pressure

The Circular Bioeconomy involves the utilization and conversion of biobased materials from forestry, agriculture and marine ecosystems, as well as related industrial by-product streams and organic waste, to produce bioproducts, biomaterials and biochemicals that are reusable, recyclable and sourced from sustainably managed supply chains. The accelerated adoption of the circular bioeconomy is integral to Canada's net-zero economy future with a projected $240 billion market size in Canada alone by 2030[1].

Why now? There is a shift in large brands' demand for renewable and sustainably sourced materials. Environmental regulation, the promise of a net-zero economy and the rising power of the eco-conscious consumer are moving corporations like IKEA, Ford Motor Company, Lafarge Canada and many others to include renewable based materials in their products.

This is creating demand for a whole new class of higher value bioproducts (biomaterials, biochemicals) across sectoral value chains like packaging, construction, cosmetics, pharmaceuticals and automotive sectors to name a few.

These types of bioproducts can enable numerous advantages. For example, bio-based materials are often sought by transportation manufacturers as these materials are lighter compared to conventional options, and as a result of less weight there is greater fuel efficiency. In the construction sector, bio-based additives with cementitious properties can help to strengthen and reinforce cement and concrete.

Key Findings

High Opportunity Industries

- → Construction
- → Automotive
- → Packaging

Growing Market Demand

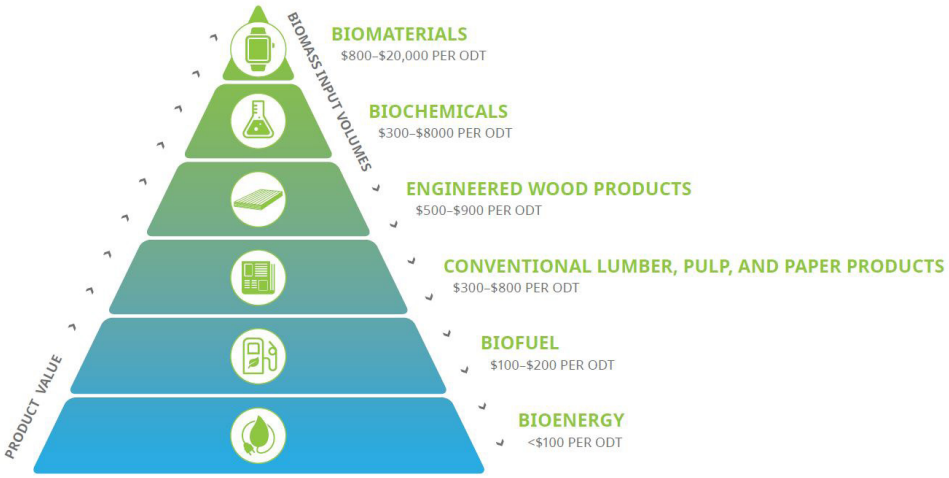
- → Biomaterials
- → Biochemicals

Competitive Pressure

- → Significant Value Chain Gaps
- → Regional & National Communication Gaps
- → Growing International Competition

1. *Analysis provided by Boston Consulting Group for the CEO Guide to the Circular Bioeconomy, World Business Council for Sustainable Development.* | *Images: Flaticon.com*

The Value Chain Pyramid & The Bioeconomy Opportunity



Canada has all the building blocks for a strong bioeconomy, but we are losing out to European and US suppliers. Thankfully it is not too late to turn the tide, as the rapid growth of this industry means there is plenty of opportunity going forward to solidify the presence of Canadian value added products and technologies.

Figure 1: The Bioeconomy Pyramid (excerpt from "The Road to 2050 – Bridging the Gap Between Challenges and Solutions in the Forestry Sector", image and data courtesy Province of British Columbia)

The Observations: Key Sectors & Strengths

At Foresight, our team is working to decipher the complex landscape by mapping out the value chains and applications for bioproduct solutions in order to gain a better understanding of where Canadian innovation and technology can fit in this new economy.

Through our project Closing the Loop on Circular Bioeconomy Innovation, we learned from brand owners, manufacturers, suppliers, innovators, universities and domestic and international accelerators what advanced bioeconomy innovation and solutions exist today and where there is upcoming demand.

Innovation and market strengths include:

- There has been strong bioproducts uptake in Construction, Automotive and Packaging sectors
- Canada's innovation and research ecosystem is strong and supportive of the bioeconomy
- Commercial bioproducts and solutions are available and some are starting to compete in global markets
- There is a strong market demand along with high public awareness about the value of the bioproducts, such as bioplastics or engineered wood
- Bioproduct solutions are also being developed for home and personal care, textiles and pharmaceuticals sectors (at an earlier stage in development than the key markets noted above).

Image: Vancouver Fraser Port Authority

The Discovery: Value Chain Gaps

As a result of interviews with brand-owners and value chain intermediaries, we found there is high demand for **Made in Canada** bioproducts ranging from bio-resin to flax based polymers, to bio-based material for construction materials like cements and bricks. In some cases, end-users are seeking bioproducts and technologies that don't exist yet, in others the bioproduct exists but needs to be scaled up.

It was clear that there is not a single entity that can help connect the dots between actors across these emergent value chains. Even though the market is nascent, there are existing gaps that can be opportunities for Canadian companies, particularly given the growing innovation ecosystem of university research and development, clean technology and biotechnology SMEs, investor activity, and traditional industry who are looking to diversify their markets, and government interest to create a value added circular bioeconomy.

Market Opportunities

Outlined next are the market opportunities observed during the course of the project, categorized by sector. Each opportunity represents an investment case and ability to create meaningful jobs to advance innovation and technology.

Construction

From both cement and wood construction, there is interest in increasing the amount of Canadian made bio-based material into construction components to reduce reliance on expensive imports, and support embodied carbon goals.

Value Chain Gaps & Opportunities

- The use of waste and by-product streams (e.g. sludge, ash, waste wood) for the cement industry
- A lack of local, bio-resin options for engineered wood
- A lack of local suppliers of finishing products, such as paints
- The use of hemp as building materials, such as hemp concrete and hemp wool for insulation

Benefits

- Use of bio-materials in construction support embodied carbon as required by certifications such as LEED, and material reuse priorities in a circular economy

Automotive

The supply and quality of processed feedstock and cellulose required by both Canadian manufacturers and international end-users is not in abundance.

Value Chain Gaps & Opportunities

- A lack of diversity of processed non-timber feedstock that is native to Canada (e.g. flax, hemp and jute)
- A low volume of quality cellulose fibre supply within Canada
- A limited capacity of Canadian manufacturers to transform native lignin; they need to partner with raw source suppliers

Benefits

- Use of biomaterials supports lightweighting of vehicle components and other industrial manufactured parts

Image: The Ford Motor Company

Packaging

There is availability of lignin and quality cellulose fibres for packaging across Canada, but the intermediary market is very competitive and less likely to collaborate.

Value Chain Gaps & Opportunities

- A lack of end-user manufacturing of packaging in Canada
- A growing number of SMEs working on sustainable bio packaging for the food sector
- A number of existing companies in the value chain who produce pre-cursors to packaging could convert to sustainable materials

Benefits

- Growing demand for biodegradable and recyclable packaging materials for durable and food goods

The Solution: A Circular Bioeconomy Market Cluster

"Innovation clusters and ecosystems are important venues in which to develop the bioeconomy and facilitate relationships between actors along the full value chain."

- Canada's Bioeconomy Strategy, May 2019 [2]

What's clear is that the brand owners and intermediaries need to lead the conversation on the bioproduct solutions that are required to meet their needs.

This will guide the innovations, SMEs, and industry on bioproduct development and will ultimately support the transition to a circular bioeconomy. Without projects such as **Closing the Loop on Circular Bioeconomy Innovation**, these value chain opportunities outlined above would remain undiscovered, delayed or lost to other countries as the conversation remains in the hands of a few individuals. We can't afford to lose opportunities and jobs in sectors or areas where Canada has a competitive advantage.

Collaboration will unlock the potential and aid communication between key Helix-5™ stakeholders - Industry, SMEs, Academia, Investors and Government - to uncover market opportunities and bridge connections leading to shorter innovation cycles and commercialized circular bioeconomy solutions.

A cluster model focused on closing market gaps will help identify end-user demand, socialize market research, target investments in projects and companies, support exports, and commercialize Made in Canada solutions.

The Bioeconomy Market Cluster: Helix-5™ Stakeholder Model

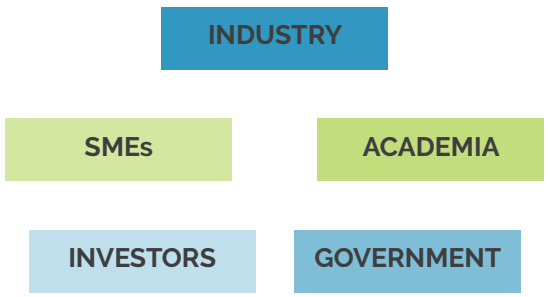


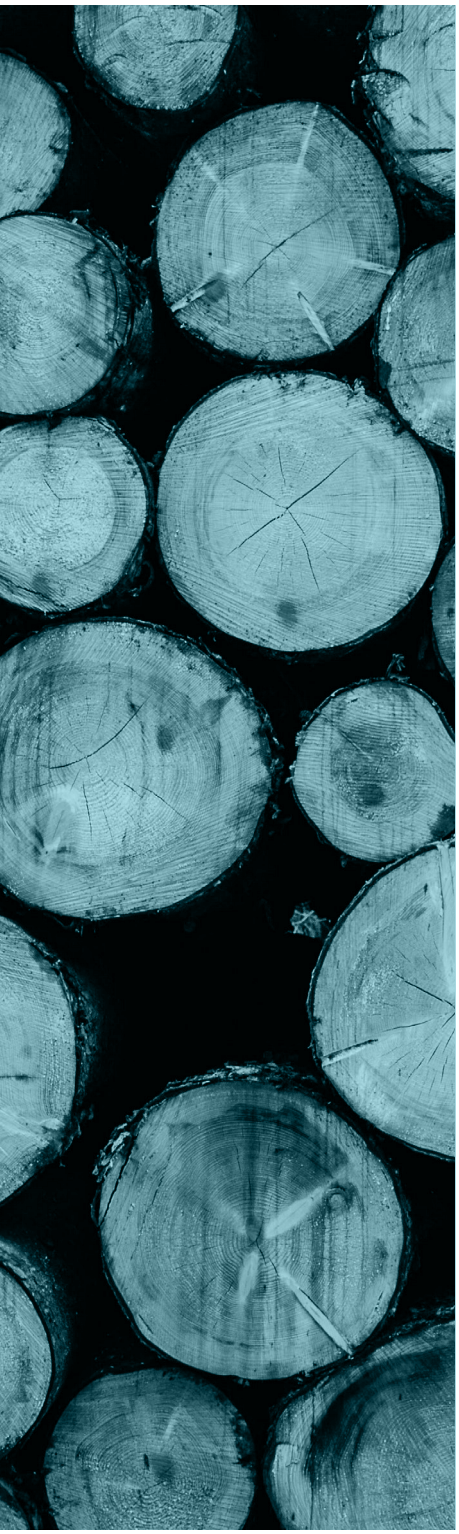
Figure 2 - Stakeholder model , from "Accelerating British Columbia's Clean Economy: A Cleantech Cluster Strategy for the Province of British Columbia", June 2020 | 2. BioDesign, Canada's Bioeconomy Strategy, May 2019

The Benefits: Shorter Innovation Cycles through Market Acceleration

Through a market cluster approach, we are not just advancing R&D as we would in a typical research cluster, but advancing the market all at once through an expanded stakeholder model - resulting in shorter innovation cycles. The benefits of this approach are:

Capital	Collaboration with research and industry is a capital efficient way of doing research, development and deployment Patient capital is needed for solutions, a cluster will help to attract the investment community and centralize activity
Market	Industry challenge programs like Reverse Pitch: Closing the Loop on Circular Bioeconomy Innovation[3] help to fast track commercialization of bioeconomy solutions End users don't always know what they need and education is often required, a cluster is a focal point of this activity, and provides the market intelligence required
Communications	Marketing, educating and telling the story of the ecosystem to customers and branding the sector globally
Technology	Educating researchers and SMEs on technology and industry roadmaps and supporting ownership of IP
Policy	Work with government at all levels (regional, provincial, federal) to ensure the policy frameworks are in place

3: *Foresight Announces Circular Bioeconomy Reverse Pitch Challenge*



A Pan-Canada Model

There are existing bioeconomy related clusters across Canada, however the value proposition for the proposed market cluster is focused on the "market" i.e. end-user engagement, branding the sector and attracting investment for projects. This cluster would collaborate with research and innovation clusters from across Canada and help commercialize their research, shortening the innovation cycle overall.

The benefit of this approach would be to have provinces build on their expertise and create value locally e.g. automotive in Ontario, forestry in British Columbia, or agriculture in Alberta and they can use the virtual market cluster to their benefit when they wish to commercialize products and need customers, market intelligence and investments. Performance of a model like this would be based on metrics like exports supported, investment dollars attracted and number of jobs created through cluster activity.

The Bioeconomy Market Cluster: Closing Regional & National Innovation Gaps

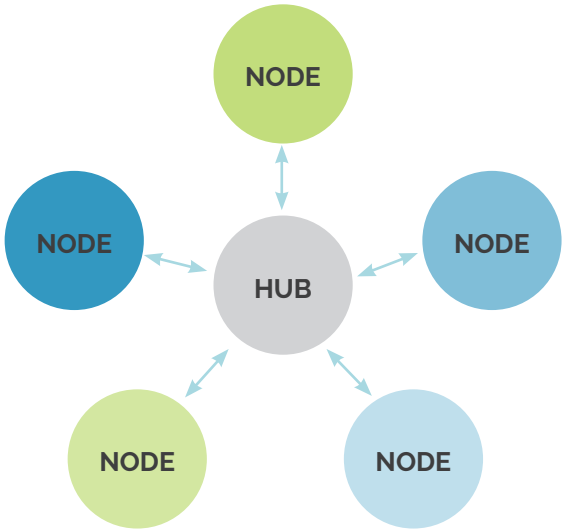


Figure 3 - A Hub and Spoke Model

Foresight

About Foresight Cleantech Accelerator Centre

Foresight is Canada's Cleantech Innovation Centre which supports the identification and validation of cleantech opportunities and the successful commercialization of solutions. We bring together industry, government, academia and technologists to innovate and enable a responsible, more sustainable tomorrow.

Through this project, "Closing the Loop on Circular Bioeconomy Innovation" and through their work in the BC CORE Cleantech Cluster and the WaterNEXT Cluster, Foresight is advancing a unique made-in-Canada Cluster model of economic development that connects market and regional innovation ecosystems through a collaborative Helix-5™ cluster model that fosters partnerships with 5 key stakeholders – industry, SMEs, academia, investors and government.

The cluster model supports economic development goals of job growth, company growth, investment attraction and trade opportunities, by identifying gaps, facilitating engagement, and developing collaboration opportunities through an internationally recognized cleantech cluster. It is market-driven, entrepreneurial focused and is built upon the foundational support and active engagement with stakeholders in multiple sectors and regions across Canada.

Find out more at www.foresightcac.com.