Composites Innovation Centre

# Commercialization of Biocomposites and Green Building Products in Western Canada: Where Are We?

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Atlantic Biorefinery Conference

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# Introduction

Composites Innovation Centre

- Biomaterials Cluster
- Commercial Products
- Production Demonstrations
- Supply Chains
- Technology Development (FibreCITY)
- Quality Standards for Industrial Bioproducts
- Summary

# Biomaterials Cluster

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A thriving rural economy through sustainable commercialization of available biomass:

- Create skilled jobs
- Establish new businesses
- Increase producer value
- Reduce GHGs

Resin Developers/ Suppliers

OEMs

Material Distributors

Composite Part Fabricators

Mat Producers

Test Facilities

FibreCITY

Decorticators

Plant Breeders & Producers

Strategic Tactics:

- Product Development
- Supply Chain Development
- Technology Innovation

# Commercial Products

Biocomposite Gazebo Roof
Eastside Composites

Cinder Blocks
TTS

Ceiling Dividers/Tiles
TTS

Planters
Eastside Composites

Hemp Furniture
TTS


Building Signage
Hemp Oil Canada

# Commercial Products

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Horse Bedding
Flax Farm

Bioplastics
Solegear


Epoxy Resins
Ecopoxy

Noncontinuous Fibre Mats
Biocomposites Group

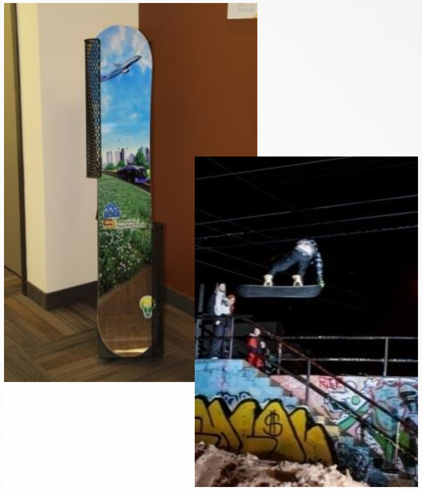
Cell Phone Case
Open Mind Developments

Hempcrete
Plains Industrial Hemp Processing

Quilt / Pillow Flax Fibre Stuffing
Biolin Research

Absorbent Pellets
HempSense

# Product Demonstrators



Snow Board
Magine Snowboards

Tractor Components
Buhler Versatile

Full Scale Electric Vehicle Body
Motive Industries

Mid Range Speaker
Pro Sound

Bus Door,
Sidewall and
Floor Panels
Motor Coach
Industries

Ecocycle Fuel Tank and Fender Panel
Composites Innovation Centre / Chopper College

# Product Demonstrators

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**Green Building Material Applications in CIC Facility**

**Green Garage at the University of Manitoba**

# Supply Chains

- Shive for animal bedding: SWM International / Flax Farm

- Biocomposite mats for tractor hoods, fenders and air intakes

# Technology Development

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- Technology gaps that need to be addressed before quality biofibres can consistently be supplied to industry:
  - Crop quality cannot be readily gauged
  - Most suitable ag-fibre varieties have not been determined
  - Best practices for growing and harvesting are not defined/communicated and optimum equipment has not been developed – quality measurement devices for precision agriculture
  - Crop retting, storage and handling methods are not developed and present a huge risk
  - Effective and economic fibre separation methods (decortication) have yet to be developed for North America
  - Biocomposites are still not realizing their full potential: fibre properties, fibre to resin interface, long term degradation, impact resistance, and moisture uptake

FibreCITY

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| **Genetics** | **Fibre Supply** | **Standardizing** | **Material Production** | **Fabricating** | **End Markets** |
|---|---|---|---|---|---|
| *Working with breeders to design and deliver the optimal fibre resource.* | *Supporting Farmers and Decorticators to produce the highest value products* | *Leading industry and academic efforts to standardize quality assessments* | *Working with component industries to improve their supply and their end product* | *Assisting industries new to biofibres to achieve desirable results* | *Championing the use of biofibre products in the market* |
| • Optimal GxExT combination<br>• Systems biology | • Fibre testing<br>• Managing variability<br>• Regular feedback from higher value chain participants | • Int'l Standards Organizations<br>• Drafting new standards<br>• Standard Operating Procedures | • Product testing<br>• Fibre input testing<br>• Regular feedback from higher value chain participants | • Design guidelines<br>• Technology transfer<br>• Prototyping | • Promoting whole industry<br>• Identifying new markets |





***FibreCITY is situated throughout the value chain***

FibreCITY

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- Bast Fibre Variety Assessment
  - Hemp variety development through producer co-ops
  - Flax varieties:
    - Oil seed flax - 114 varieties down selected for crop trials 2015
    - Fibre (linen) flax – European varieties grown in Manitoba
- Harvesting
  - Specialized equipment for flax and hemp crops
- Conditioning
  - Retting, storage and drying conditions

FibreCITY

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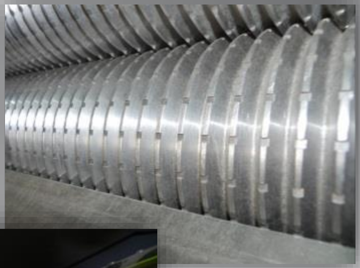
- Fibre Separation (Pilot Scale Decortication Line)
  - Three roller calender (crusher)
  - Three comb upper shaker
  - Three roller finisher (picker-opener)
  - Six comb upper shaker
  - Fibre transporting conveyors
  - Lower shive transporting belts
  - Dust collection system



# Fibre Grading/Testing

- A comprehensive test laboratory has been established to measure the physical, chemical, mechanical and surface properties of biofibres

| | |
|---|---|
| Specimen Preparation Suite | X-Ray Diffraction (XRD) |
| Scanning Electron Microscopy (SEM) | Gas Pycnometry |
| Confocal Laser Scanning Microscopy | Automated Dynamic Multi-Vapour Gravimetric Sorption (DVS) |
| Fourier Transform Infrared (FTIR) and Near Infrared (NIR) | Tensiometer – Contact Angle / Wicking |
| Inverse Gas Chromatography (iGC) | Tensile Strength and Rotational Diameter Imaging |

FibreCITY

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- FibreCITY generates a significant amount of data
- Features a quality control system encompassing data acquisition, processing, management and reporting equivalent to that of the pharmaceutical industry
- Radio Frequency Identification (RFID) is used for sample tracking
- FibreCITY is building an artificial neural network (machine learning) to interrogate the data to identify trends and correlations between fibre properties and composite performance and to guide crop variety selection, breeding programs, harvesting methods, grading programs and materials processing



FibreCITY

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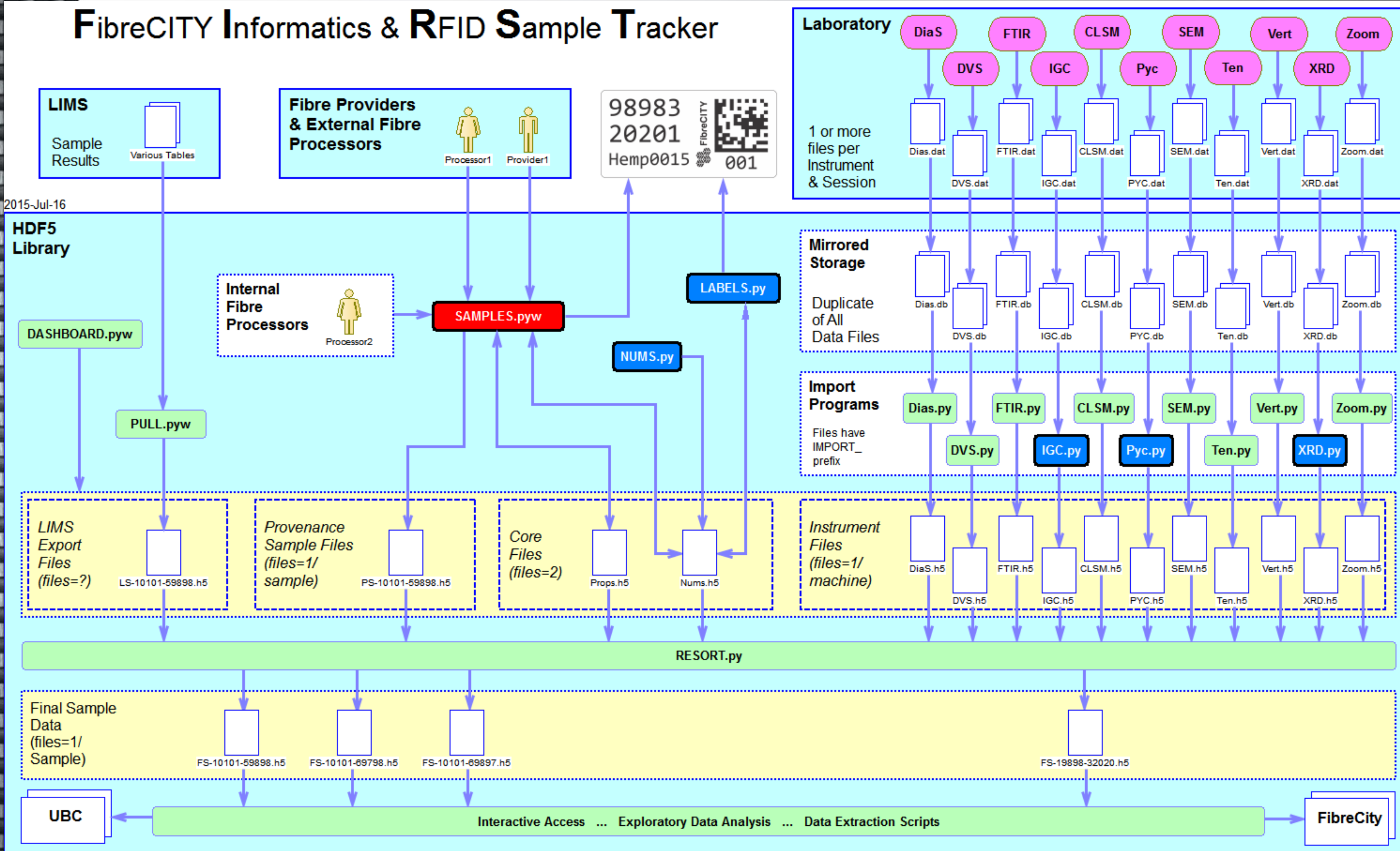
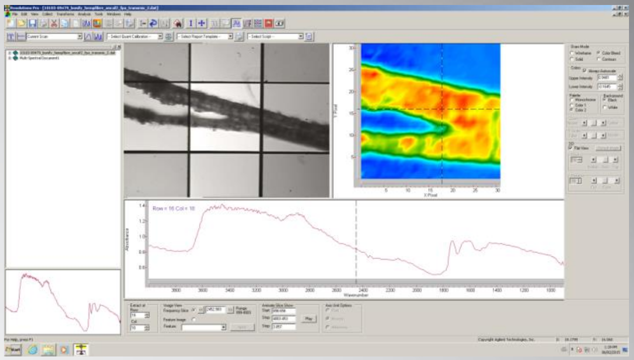
# FibreCITY Informatics & RFID Sample Tracker



- Next Steps:
  - Business development:
    - Hemp Sense: moisture absorption
    - KS Bio Tech: constituent properties
    - Sunstrand: decortication
    - TTS: green building materials
    - Plains Industrial Hemp Processing: bioproducts
    - Ecotechnilin North America
    - Carbon credit assessments
  - FibreCITY 2: Tianjin Polytechnique University – Chinese Standards
  - FibreCITY 3: Queensland Australia
  - FibreCITY: validation, machine learning
  - Overcoming technical barriers: retting, durable biocomposites



# *Quality Standards for Industrial Bioproducts*

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- Industrial Bioproducts Value Chain Committee: quality standards and measurement techniques are required as a key enabler in the commercialization of biomass into bioproducts: biomaterials, biochemicals, biofuels and bioenergy
- MOU executed to establish Biomass Quality Network Canada

| | | |
|---|---|---|
| • Government of Alberta, Ministry of Agriculture and Forestry | • Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec | • Saskatchewan Ministry of Agriculture |
| • Manitoba Agriculture, Food and Rural Development | • Centre De Research Sur Les Grains (Cerom) | • Composites Innovation Centre |
| • Tekle Technical Services | • National Research Council Canada | • Straw Logic |
| • Canadian Standards Association | • Canadian Renewable Fuels Association | • Agriculture and Agri-Food Canada |
| • Bioindustrial Innovation Canada | • Biolin Research | • BiofuelNet Canada |

- Funding in place and quality standard activities commenced

# *Quality Standards for Industrial Bioproducts*

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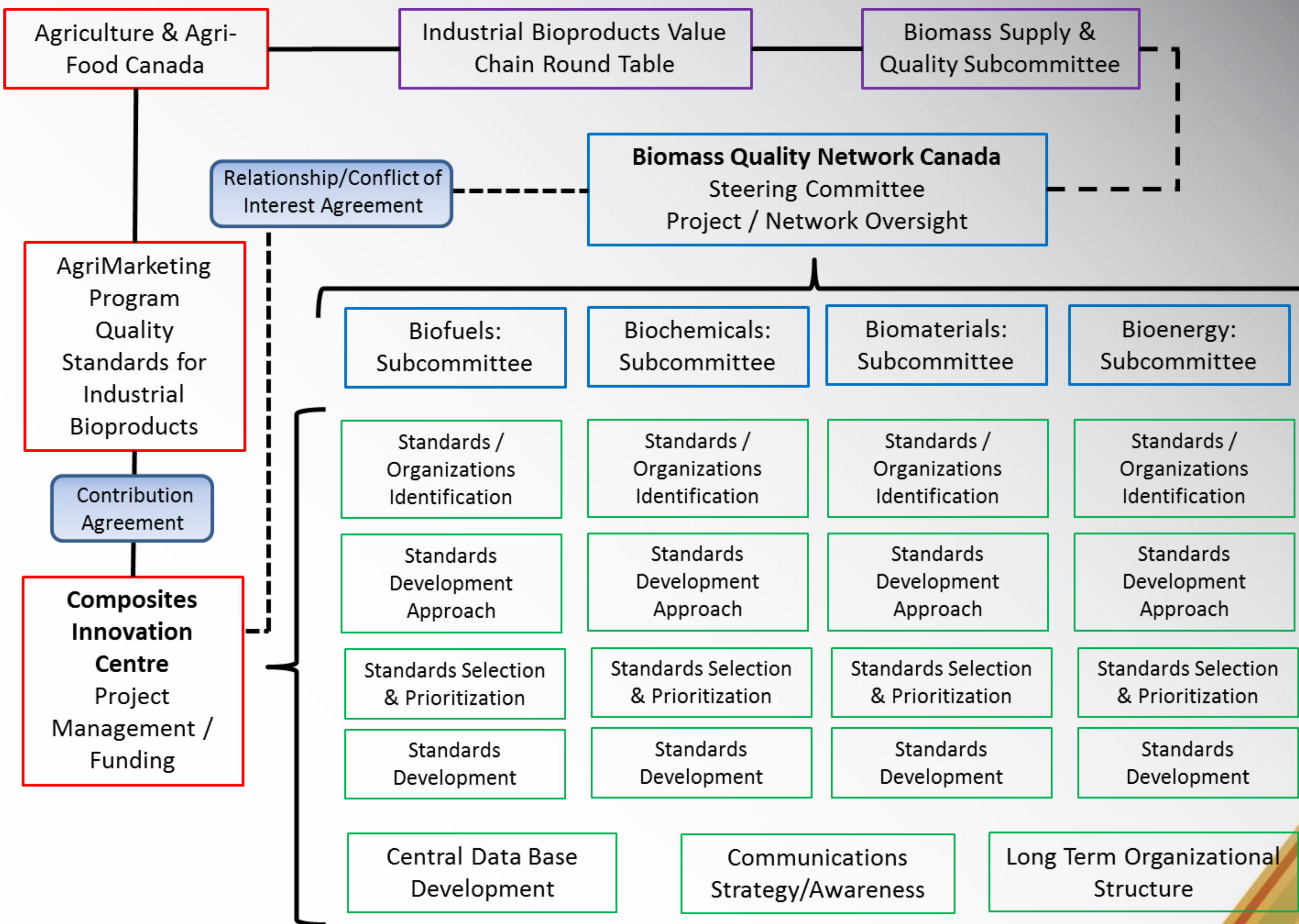

# Summary

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- Product demonstrations have translated to some commercial successes
- Supply chains are starting to emerge to support the industrial adoption of biomaterials
- Technology development activities for fibre grading and improved composite performance are maturing
- Efforts are under way to increase collaborations with national and international entities to expedite technology development and commercialization
- Perhaps we are nearing the tipping point; however, significant public support with producer and industry engagement is still required to establish a self sustaining bioeconomy

# Questions?

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