

# Creating Competitive Advantage in the BioEconomy Through Clusters

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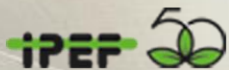
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## Is this a historical opportunity?

There is movement on the part of the forest products sector, internationally, towards **bioeconomy business transformation**.

What is needed to? What is can be done to address **bottlenecks** that may be **stalling** progress?



# Cross-Canada Workshops: Overview



CAN YOU ACCELERATE THE DEPLOYMENT OF THE  
BIOECONOMY FOR YOUR ORGANIZATION?  
A DYNAMIC LANDSCAPE  
TODAY'S GREAT OPPORTUNITIES



- 6 workshops were held, whose goal was to **identify value chain gaps** which if addressed, would increase **the potential for success** of bioeconomy strategies at the value chain level.
- BioEconomy stakeholders were involved such as **value chain operators** including **Anchor Firms** and **Ultimate Market Pull Firms**, leading **technology developers**, **cluster service providers**, and **government**.
- In total, the workshops attracted **142 BioEconomy Stakeholders**, and **22 potential BioEconomy value chains** were identified.

# Targeted Workshop Outcomes



- **Some important concepts:**

- What are **clusters**, adapted for success in the BioEconomy?
- How much of the **value chain** should my organization be considering?
- What is the link between clusters and **value chain “gaps”**?

- **Broaden perspective:**

- **Industry, government and academia** will exchange on these issues, and better appreciate each other’s challenges related to the BioEconomy
- Downstream BioEconomy **value chain stakeholders** will better appreciate the needs of upstream stakeholders, and vice-versa
- **Technology providers and cluster service providers** may identify new approaches to support BioEconomy value chains

# Targeted Workshop Outcomes



- **Networking:**

- **Modest value:** Exchange between the gamut of BioEconomy stakeholders
- **Get ambitious:** develop new value chain concepts during the break-outs...

- **Potential other outcomes:**

- Could my organization's **BioEconomy strategy be strengthened?**
- What **federal and/or government programs** should my organization be considering to support our BioEconomy strategy?
- How might my organization link with **government priorities?**



# **OUR OBJECTIVES**

## **Of this presentation...**

To introduce the concept of “value chain gaps” and their attributes...

To summarize the most critical of the value chain gap attributes identified in the workshops...



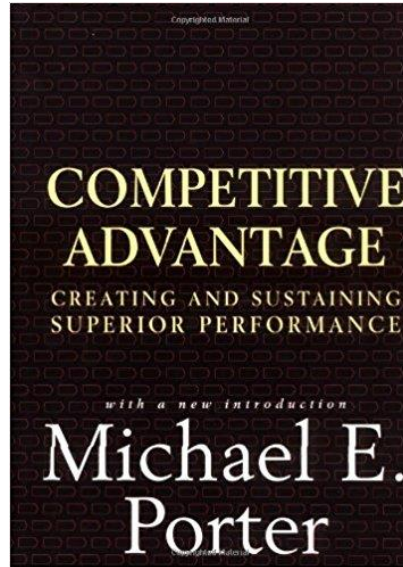
# OUR OBJECTIVES

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# 3-Minute Primer on Value Chains and Clusters



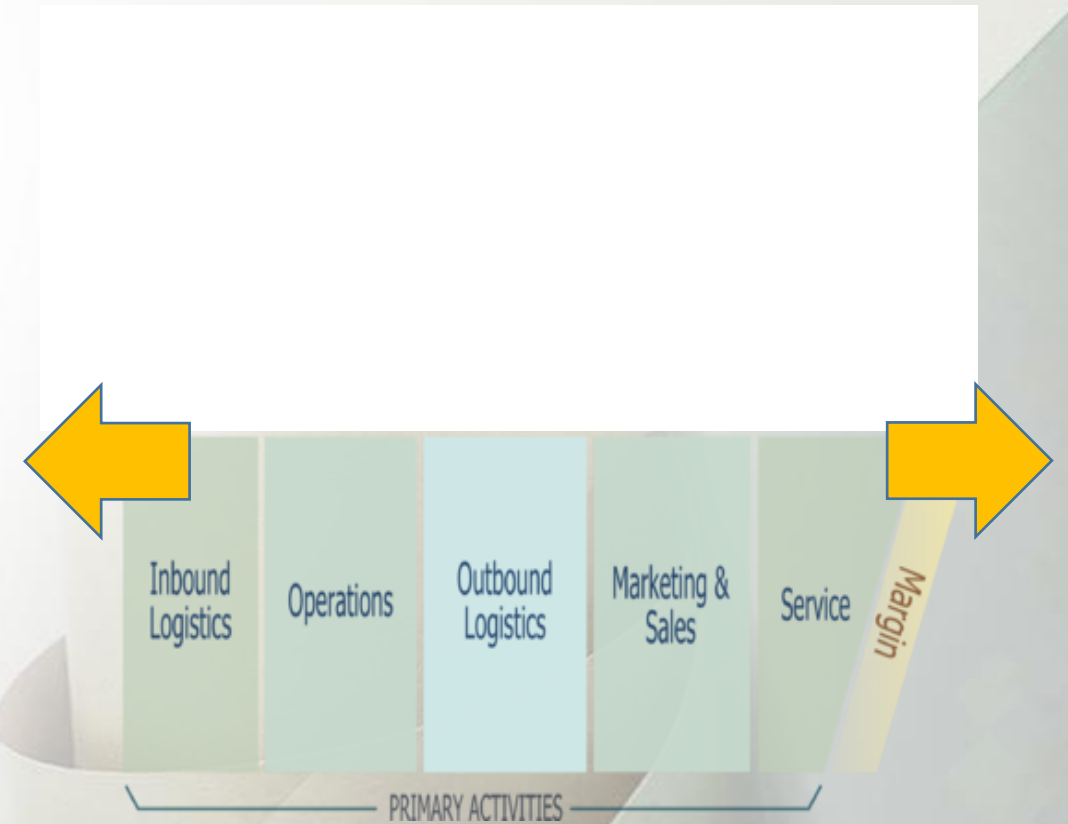
*Michael E. Porter*  
*"Competitive Advantage"*  
*1985*  
*The Free Press. New York.*

- The idea of the value chain considers a manufacturing organisation as a system made up of **subsystems...**
- Each with **inputs, transformation processes and outputs**, involving the acquisition and consumption of resources...
- How the value chain activities are carried out determines its **cost and affects profits...**

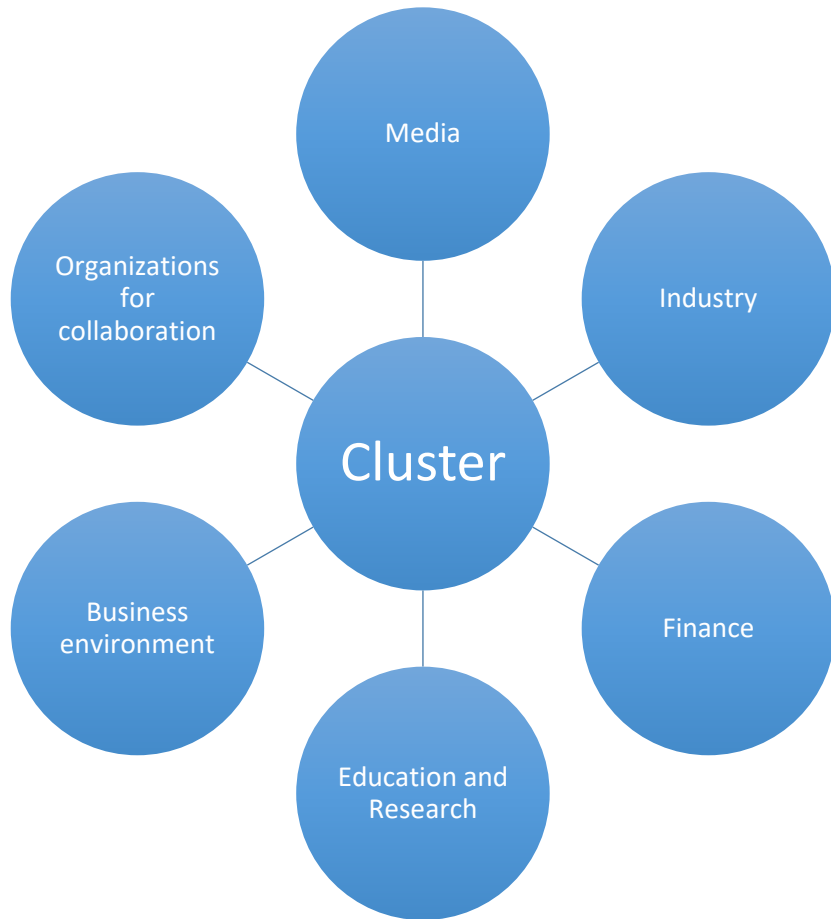


# BioEconomy Value Chain Context

- To achieve and sustain a competitive advantage in the BioEconomy, **typically assisted by information technologies**, companies must understand each component of their future value chain...
- Those who will succeed will likely take risk in becoming “**The Walmarts of the BioEconomy**” ...
- This risk can be greatly mitigated by considering **value chain** and **cluster** approaches...



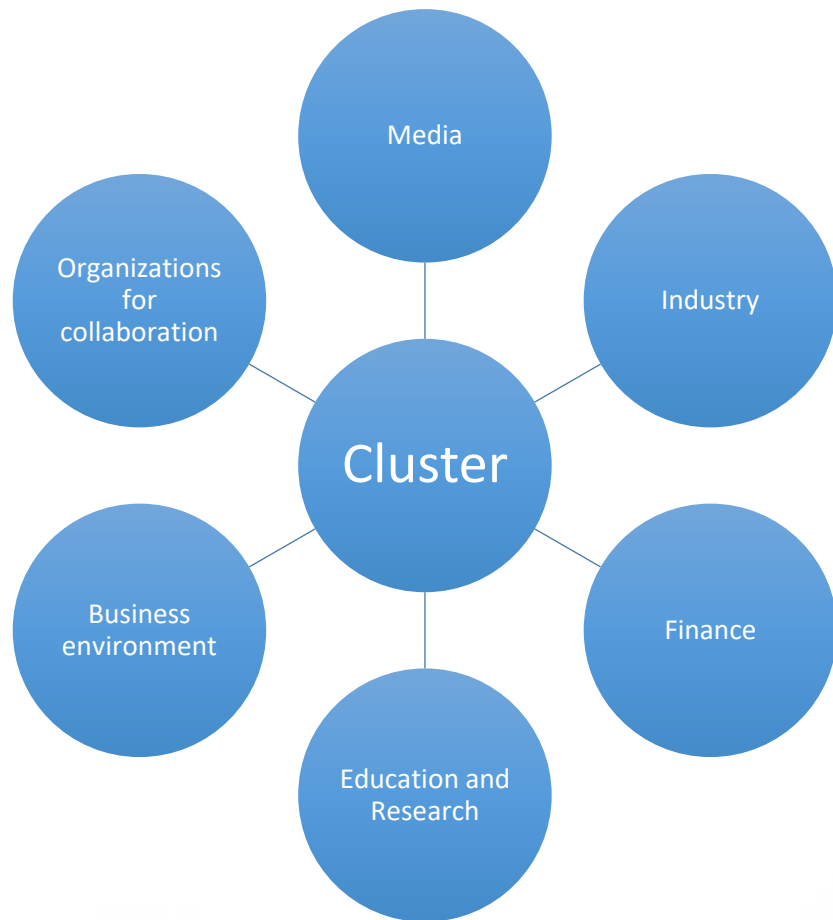
# The Cluster Ecosystem



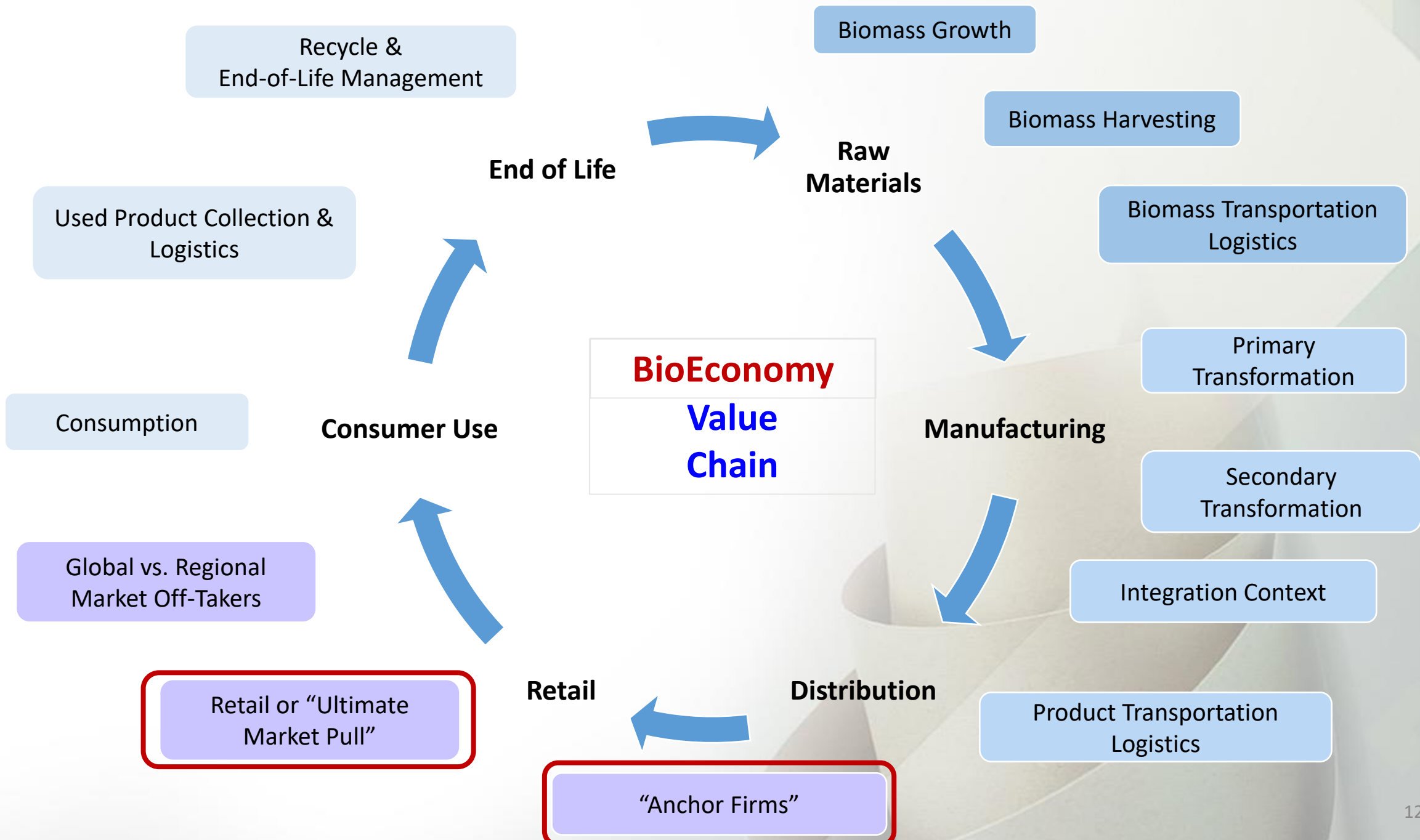
- Clusters increase productivity and operational efficiency
- Clusters stimulate and enable innovation
- Clusters facilitate commercialization and new business formation
- Etc....

# Some Attributes of Successful Clusters

## “European Cluster Observatory”

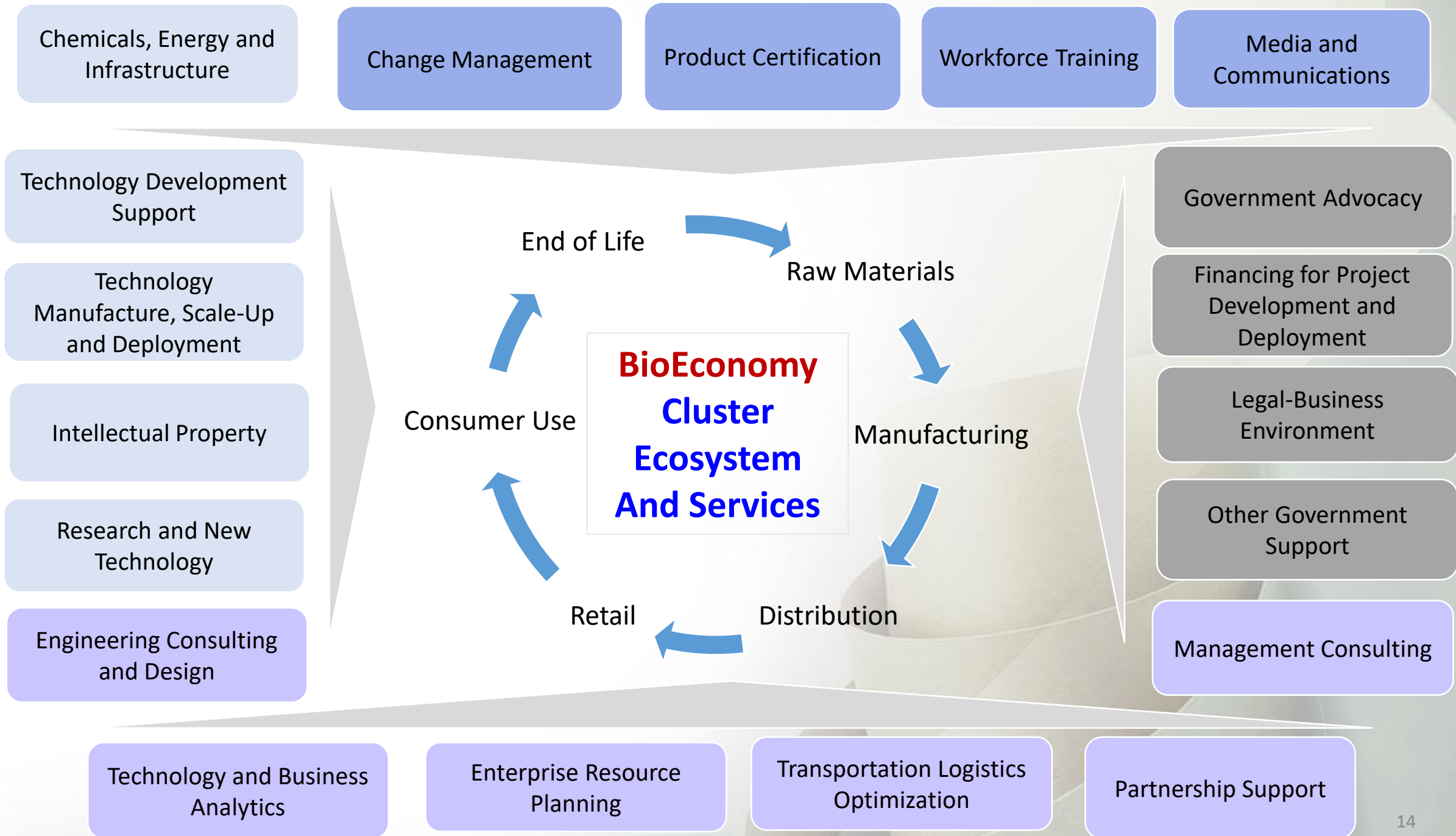


- Spawns innovation to improve **competitiveness** on a **global basis**
- Facilitates **access to funding** throughout research, development and deployment
- Assists with value chain operating **flexibility**, supply chain **efficiency** and **effectiveness** globally
- Communications to **promote the growth of firms** and attract entry of new ones
- Intensity of cluster is increased and **refined over time**, and gives rise to further growth

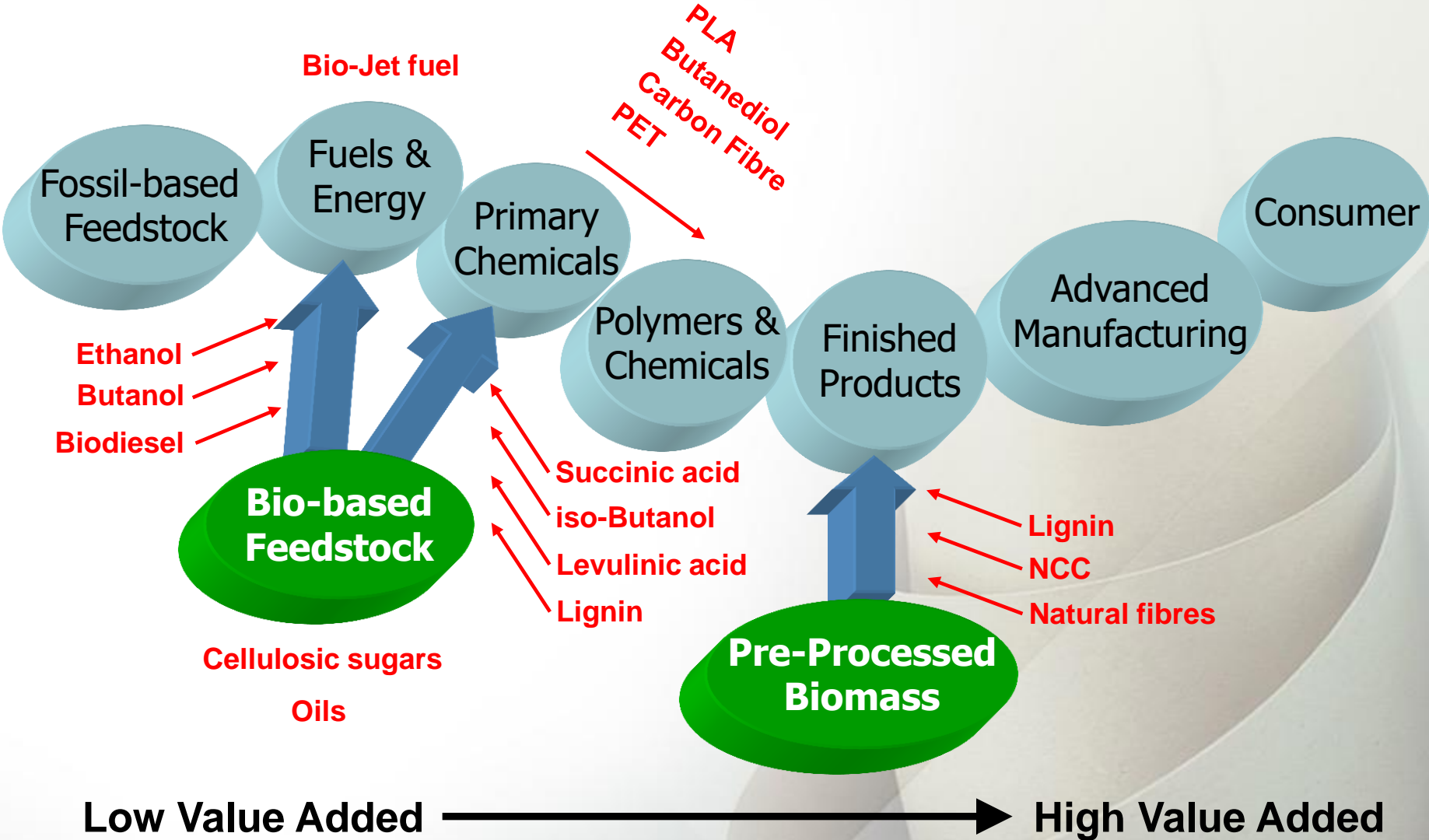


# Added-Value and Commodity Value Chains - Generalities

Added-Value Centric VC Characteristics	Commodity Centric VC Characteristics
Centred on the production of an added value product, eg biochemical or biomaterial	Centred on the production of a commodity product, eg biochemical or biofuel
Lower production volumes	High production volumes
Higher margins	Low margins
Seeks to integrate as much as possible downstream	Generally low influence on the downstream VC
Operate to maximize margins	Operate to minimize costs
Want to maximize market share and control market price	Want to maximize production volume, seek a green premium, and be supported by policy
Specialties operating culture (ie focus on product quality, efficient grade changes...)	Commodity operating culture (ie KPI or operating targets, minimum grade changes...)
Margins-centric SC management strategy	Production-centric SC management strategy
Supply chain points of entry tend to be global	Supply chain points of entry tend to be regional



# THE PETROCHEMICAL BIOECONOMY VALUE CHAIN CONCEPT



# METSÄ FIBRE BIOPRODUCT MILL IN ÄÄNEKOSKI (FINLAND)

- 1.3 million Adt/a softwood pulp mill
- €1.2 billion capital investment
- 2,500 jobs throughout the value chain, including 1,500 new jobs



- In addition to softwood pulp, bioproducts such as tall oil, turpentine, bioelectricity and wood fuel are produced
- Potential bioproducts created from production side streams include textile fibres and lignin products
- Partners: largely small and medium-sized enterprises





# **OUR** OBJECTIVES

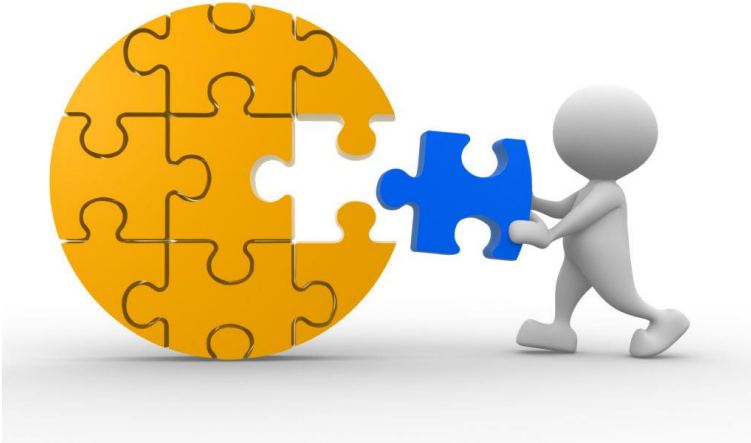
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# Value Chain “Gaps”

- To establish a successful biorefinery VC, it must be innovative, efficient and **competitive** while implicating the **sustainable** use of renewable resources.



- BioEconomy cluster services in the VC ecosystem are essential to achieve this – to identify, quantify and provide solutions for **value chain “gaps”**, or critical issues that must be addressed so that the VC is competitive and sustainable.
- A cluster approach is especially valuable to **BioEconomy VCs**, which typically require the transformation of stakeholder relationships, and/or establishing **non-traditional stakeholder relationships between industry sectors**.

# Value Chain Gaps - Terminology

- **5 value chain gaps** were defined
- **30 value chain gap attributes** (or characteristics) were identified, across the value chain gaps
- **Solutions** for each of the value chain gap attributes were identified
- Value chain gaps and attributes were **assessed** by workshop participants



# 5 Value Chain Gaps

1.	<b>Market-Production Imbalance</b>	The inequality between the rate of production of bioproducts from the VC, and market demand. Whether for added value or commodity centric VCs, market-production imbalance results in business model weaknesses.
2.	<b>Waste Streams Innovation</b>	The development of break-through technologies that approach theoretical maxima is essential, and waste streams must be minimized and transformed into added value products.
3.	<b>Proven Second Transformation Technologies</b>	A profitable BioEconomy value chain will produce added-value bioproducts in second transformations. Continually incorporating new technologies into the VC to increase the production of added-value products is an important strategy.

## 5 Value Chain Gaps

4.	<b>Robust Business Model from Market Diversity</b>	More off-takers for the product portfolio implies a more robust business model, in contrast with the case of a small number of large off-takers having undue negotiating position in partnership agreements.
5.	<b>Potential Barriers to Market Access</b>	BioEconomy clusters should focus on adaptive innovation and its implications, particularly for removing barriers to value chain development, for example associated with government policy, environmental regulation, product certification, social licence and the need for highly-qualified personnel (HQP).

# Value Chain Gap Attributes and Solutions

	<b>Proven Second Transformation Technologies: VC Gap Attribute</b>	<b>Potential Solution(s)</b> (AV: added value centric VCs; C: commodity centric VCs)
1.	Experience curve heuristics show that production costs are reduced by at least half between the 1 <sup>st</sup> and the n <sup>th</sup> commercial implementations of a new technology	Focus on distribution channels and supply chain efficiencies while rolling out second transformation implementation strategy (AV); Execute a continuous investment strategy to improve second transformation technology effectiveness over time (AV/C)
2.	Second transformation technologies should be developed through JDAs, taking advantage of VC implementation scales	Develop JDAs with second transformation technology developers seeking to accelerate development and mitigate technology risk by integrating into the VC at smaller scales (AV/C)
3.	Added value bioproducts manufactured by second transformation processes can have different performance than the competing conventional product, and there are barriers to testing with potential off-takers and assessing the value proposal	Work with members of the VC, in a manner equivalent to a vertically-integrated company, proving the value proposal, and developing flexible partnership agreements based on this (AV/C)
4.	Distinct properties of and contaminants in primary transformation bioproducts are unique to feedstocks/processes, which can be a barrier to development of second transformation technologies	Work with VC partners to find innovative solutions requiring a minimum of pretreatment ahead of second transformations, creating competitive advantage (AV)
5.	There is a dynamic landscape for new second transformation innovations that convert bioproducts from the first transformation, considering depolymerization of biomass carbohydrates, and repolymerization to added value products	Close collaboration with research institutes and university to develop break-through second transformation technologies (AV); Monitor technology landscape closely, and implications to VC competitive position (AV/C)

## Value Chain Gap 4 Attributes

**EXAMPLE**

# Most Important Value Chain Gap Attributes

- Workshop participants became **familiar** with the Value Chain gaps in 4 steps, and **assessed** them:
  - The value chain gaps were introduced
  - **Workshop participants were requested to identify most important (MI), least important (LI) and least clear (LC) value chain attributes**
  - Workshop participants reviewed the written description of each value chain gap and attributes – first evaluation
  - After reading, the gaps were discussed between participants – refine evaluation
  - Lastly, break-out groups were carried-out to concretize the VC gap attributes by assessing bioeconomy value chains



## Evaluation

# Value Chain Gap Attributes – Most Important

Experience curve heuristics show that production costs are reduced by at least half between the 1st and the nth commercial implementations of a new technology

Focus on distribution channels and supply chain efficiencies while rolling out second transformation implementation strategy (AV);  
Execute a continuous investment strategy to improve first transformation technology effectiveness over time (AV/C)

Open innovation is an effective process to identify approaches for the manufacture of added value co-product streams from waste streams across the VC

Create an open innovation portal and communication program to attract interest by innovators, and design/execute open innovation challenges (AV/C)



## Evaluation



# Value Chain Gap Attributes – Most Important

Cost-effective separation and purification may be essential to turn waste streams into added-value co-products

Work with cluster partners to identify process intensification opportunities that achieve process and product objectives (AV/C)

Second transformation technologies should be developed through JDAs, taking advantage of VC implementation scales

Develop JDAs with second transformation technology developers seeking to accelerate development and mitigate technology risk by integrating into the VC at smaller scales (AV/C)



## Evaluation

# Value Chain Gap Attributes – Most Important

Market demand should be created by Ultimate Market Pull Firms, and/or catalyzed by government procurement policy

Demonstrate the overall competitive advantages that can be accrued by VC partner company off-takers should they purchase bioproducts (AV);

Target Ultimate Market Pull Firms for the VC, and support the identification and comprehension of the customer's voice (AV/C);

Advocate for government to set policies that stimulate demand for bioproducts, including added value biochemicals and biomaterials, as well as biofuels (AV/C)

Opportunities for industrial symbiosis within the VC should create value from streams that are otherwise waste streams; industrial symbiosis

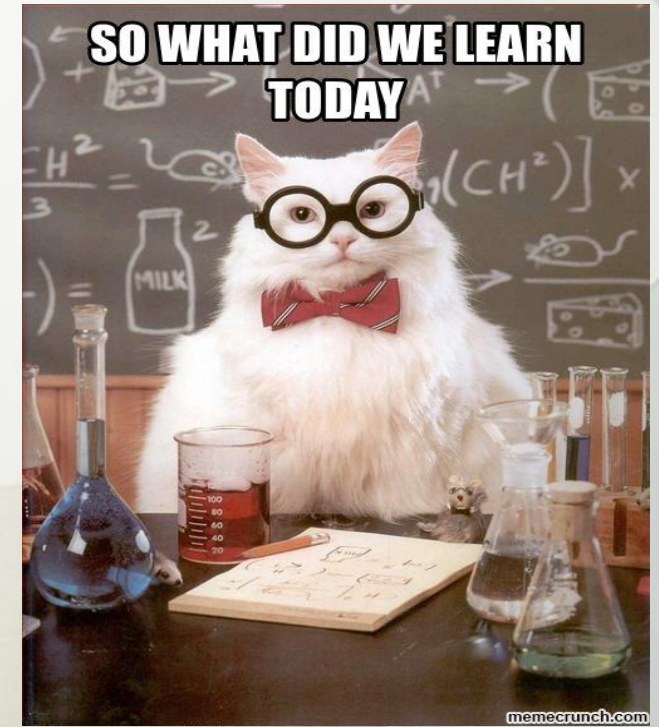
Match waste streams or upgraded waste streams from one VC partner with the raw material needs of a second VC partner, normally in geographic proximity (AV/C)



## Evaluation

# Conclusion: Critical Analysis of the Workshop Results

- **142 different stakeholders and experts** from across Canada were assembled in six 2-day workshops to share experiences and discuss the bioeconomy
- **Concepts** of supply chain, value chain, and clusters were systematically introduced
- **Value chain gaps** for bioeconomy implementation and their solutions were identified, and systematically evaluated
- **22 potential emerging bioeconomy value chains** as well as their strengths and weaknesses were identified by the participants in break-out sessions
- The most important value chain gaps were identified by workshop participants; these can be **systematically addressed through cluster-type activities**
- An **effective, distributed bioeconomy cluster** could serve to accelerate advancement of the bioeconomy for early-market advantage
- **How might such a distributed bioeconomy cluster be designed and financed?**



# Creating Competitive Advantage in the BioEconomy Through Clusters

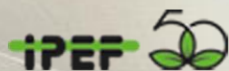
**Obrigado!**  
**Thank You!**  
**Merci!**



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