

# Bio-based business models for the replacement of fossil fuels with bio-based fuels and for the novel uses of bio-based materials for non-energy purposes

Henrik Barth  
Associate Professor  
Center for Innovation, Entrepreneurship and Learning (CIEL)  
Halmstad University  
Sweden

# Background

- Business models and business model innovation are seen as a key to companies' competitiveness, renewal and growth (Teece, 2010; Foss & Saebi, 2017).
- However, empirical research on the business models is predominantly European-based in the sectors of media, information technology and biotechnology.
  - research on business in the biomass area have gained limited attention

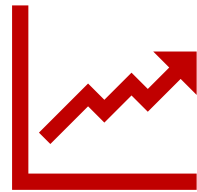
# Most cited articles on BM and Biomass

Authors	Year	Title	Journal Title	Impact factor of the journal	No of citations (Scopus citations)
C. K. Prahalad Di Benedetto, C. Anthony Nakata, Cheryl C.	2012	Bottom of the pyramid as a source of breakthrough innovations	Journal of Product Innovation Management	4,305	224
Tom L. Richard	2010	Challenges in Scaling Up Biofuels Infrastructure	Science	41,063	203
Peter Asmus	2010	Microgrids, Virtual Power Plants and Our Distributed Energy Future	The Electricity Journal	0,89	184
Mansoornejad, B. Chambost, V. Stuart, P.	2010	Integrating product portfolio design and supply chain design for the forest biorefinery	Computers and Chemical Engineering	3,334	73
Wesley Foell Shonali Pachauri Daniel Spreng Hisham Zerriffi	2011	Household cooking fuels and technologies in developing economies	Energy Policy	4,88	64
Gireesh Shrimali Xander Slaski Mark C. Thurber Hisham Zerriffi	2011	Improved stoves in India: A study of sustainable business models	Energy Policy	4,88	57
Xu, Dongmei Hao Liu	2018	Carbon Sequestration Capacity of The Forest	Chemical Engineering Transactions	0,76	53
Pantaleo, A. Candelise, C. Bauen, A. Shah, N.	2014	ESCO business models for biomass heating and CHP: Profitability of ESCO operations in Italy and key factors assessment	Renewable and Sustainable Energy Reviews	10,556	52
Antonios D. Livieratos Panagiotis Lepeniotis	2017	Corporate venture capital programs of European electric utilities: Motives, trends, strategies and challenges	The Electricity Journal	0,819	49
Sari Hämäläinen Annukka Näyhä Hanna-Leena Pesonen	2011	Forest biorefineries – A business opportunity for the Finnish forest cluster	Journal of Cleaner Production	6,395	49

# Main Areas of Discussion



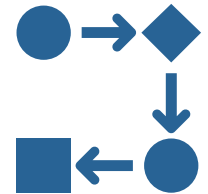
Policy



Long-term  
Viability



Environmental  
sustainability



Process Feasibility

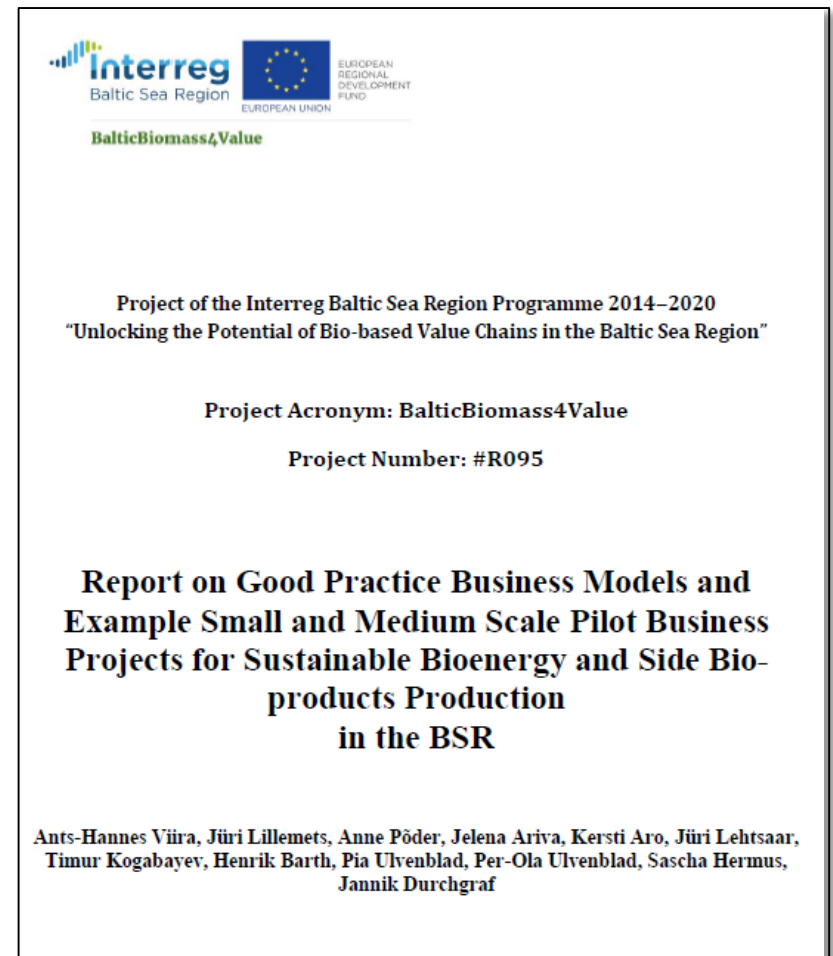
# Preliminary findings from literature review

- Major focus on *value capture* of BM, such as cost structure, feasibility and revenue streams, which is a necessity in the short run...
  - ...but from a strategic perspective attention also need to adress *value intention, value proposition, and value creation and delivery* (Barth et al, 2017; 2018; 2021).
- Sustainability aspects are provided in several cases, but few address (or connect to) framework on Sustainable BM (for example, Bocken et al, 2014) or use checklists/tools/methods for sustainable innovation (for example, Prahalad, 2012)

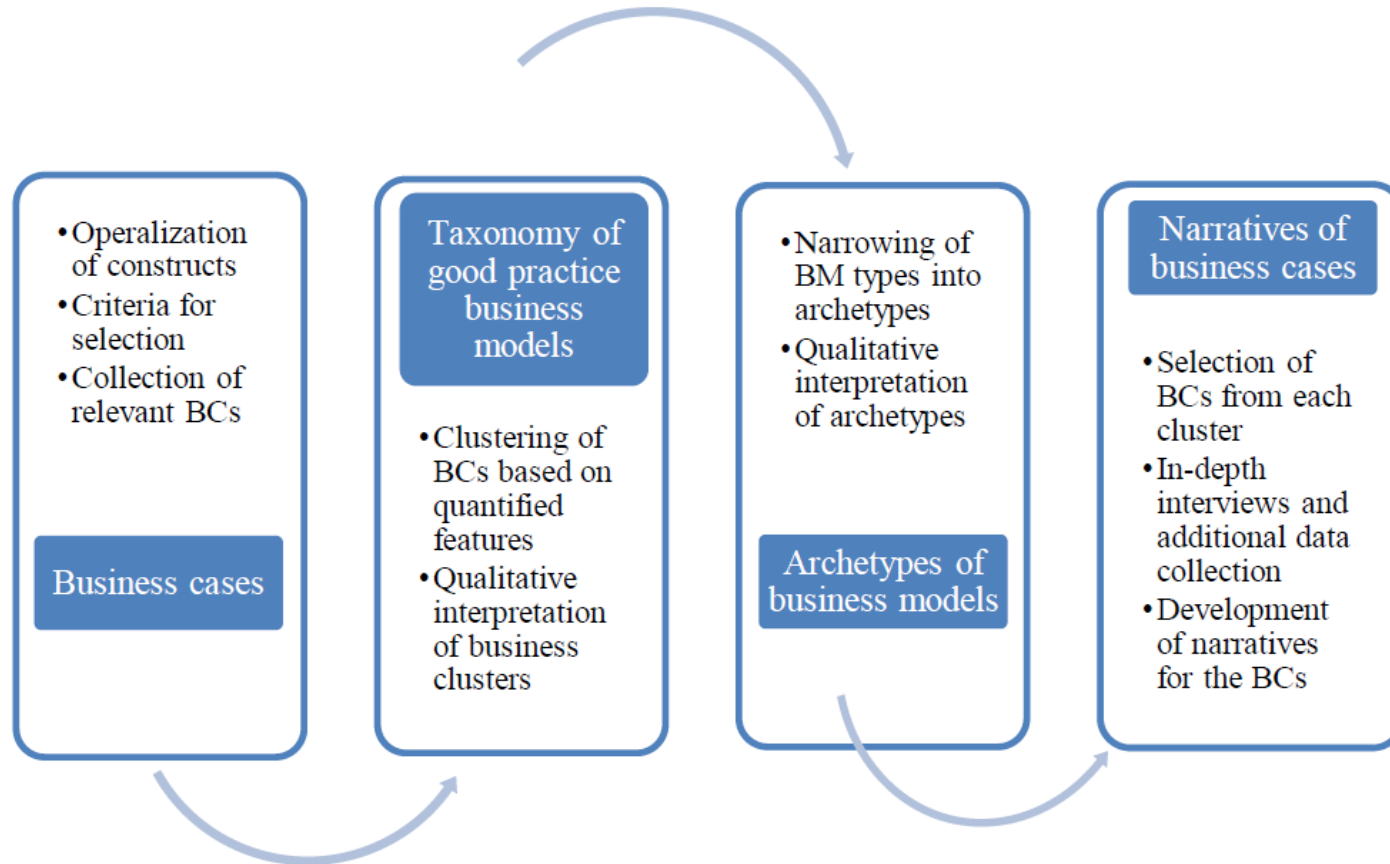
# Development of sustainable business models

## – experience from project BalticBiomass4Value

- Data for the analysis was collected by project partners from seven countries participating in the project, i.e., from Norway, Sweden, Estonia, Latvia, Lithuania, Poland and Germany.
- Each country provided 6–12 business cases, in total 59 cases.
- Download report on: <https://balticbiomass4value.eu>



# Multiple case study approach



Source: Viira et al, 2021

# Derived taxonomy of business models

	Source of biomass				Type of production		
	Agriculture and food industry	Municipal waste and sewage	Fishery and algae	Wood	Energy production	Circular bioeconomy development	Production of non-energy high value-added products
1. Heat and Fuel from Woody Biomass	x			x	x		
2. Fuel and Electricity from Biogas	x				x	x	
3. District Heating and Electricity from Various Biomass Sources	x				x	x	
4. Specialized Heat and Electricity Production and Services		x		x	x		
5. Innovation in Novel Fuels and Bio-chemicals	x			x	x		x
6. Circular Bioeconomy in Agricultural Production	x				x	x	
7. Bio-based Fertilizer for Increased Soil Quality	x	x		x		x	x
8. Sustainable Bio-based Products from Plant-based Biomass	x			x	x	x	x
9. Sustainable and Novel Bio-based Products from Food waste and Biomass	x		x			x	x
10. High-value Products from Knowledge-based Processing	x		x				x
11. High-value Products from Circular Bioeconomy	x		x	x		x	x
12. Utilization of Municipal Waste and Sewage		x			x	x	

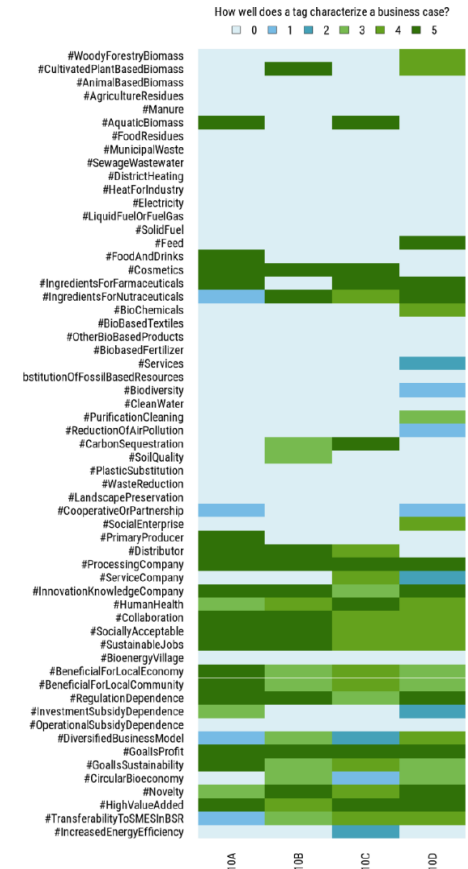
Source: Viira et al, 2021



# Business model canvas analysis

## -an example

<b>Key partners</b> Farmers Aquatic biomass (seaweed, algae) suppliers R&D organisations Regulatory authorities	<b>Key activities</b> Collecting biomass Procurement of biomass Production R&D Marketing and sales Services for biochemical analysis	<b>Value propositions</b> Processing of high-value novel and natural ingredients and products for cosmetics, pharmaceuticals, nutraceuticals, food and feed industry	<b>Customer relationships</b> Personal sales Automated online sales	<b>Customer segments</b> B2C, B2B Food industry Pharmaceutical industry Animal feed industry Cosmetics industry Private persons
	<b>Key resources</b> Raw material Equipment and machinery Processing plant Staff Technical know-how Market knowledge Patents Trademarks		<b>Channels</b> Sales force Online selling Intermediaries Retail network Exhibitions	
<b>Cost structure</b> Raw material costs R&D costs Investment in the processing plant Production costs Patent applications Labor costs Marketing sales costs		<b>Revenue streams</b> Sales of bio-based products Sales of intermediary products to industry Sales of services for biochemical analysis Grants and subsidies for R&D		



Source: Viira et al, 2021

# Sustainable business model archetypes

Business model type in taxonomy	Archetype
1. Heat and Fuel from Woody Biomass 2. Fuel and Electricity from Biogas 3. District Heating and Electricity from Various Biomass Sources 4. Specialized Heat and Electricity Production and Services 5. Innovation in Novel Fuels and Bio-chemicals	Replacement of fossil fuels with bio-based fuels
7. Bio-based Fertilizer for Increased Soil Quality 9. Sustainable and Novel Bio-based Products from Food Waste and Biomass 12. Utilization of Municipal Waste and Sewage	Waste recycling
8. Sustainable Bio-based Products from Plant-based Biomass 10. High-value Products from Knowledge-based Processing 11. High-value Products from Circular Bioeconomy	Novel uses of bio-based materials for non-energy purposes
6. Circular Bioeconomy in Agricultural Production	Integration of complementary biomass production activities into circular production loop

Source: Viira et al, 2021

# Narratives of business case

- 20 cases were selected to represent different countries as well as BM types.
- Additional interviews were conducted with the enterprises, focusing activities related to bioeconomy, market and their innovative aspects.

# Challenges

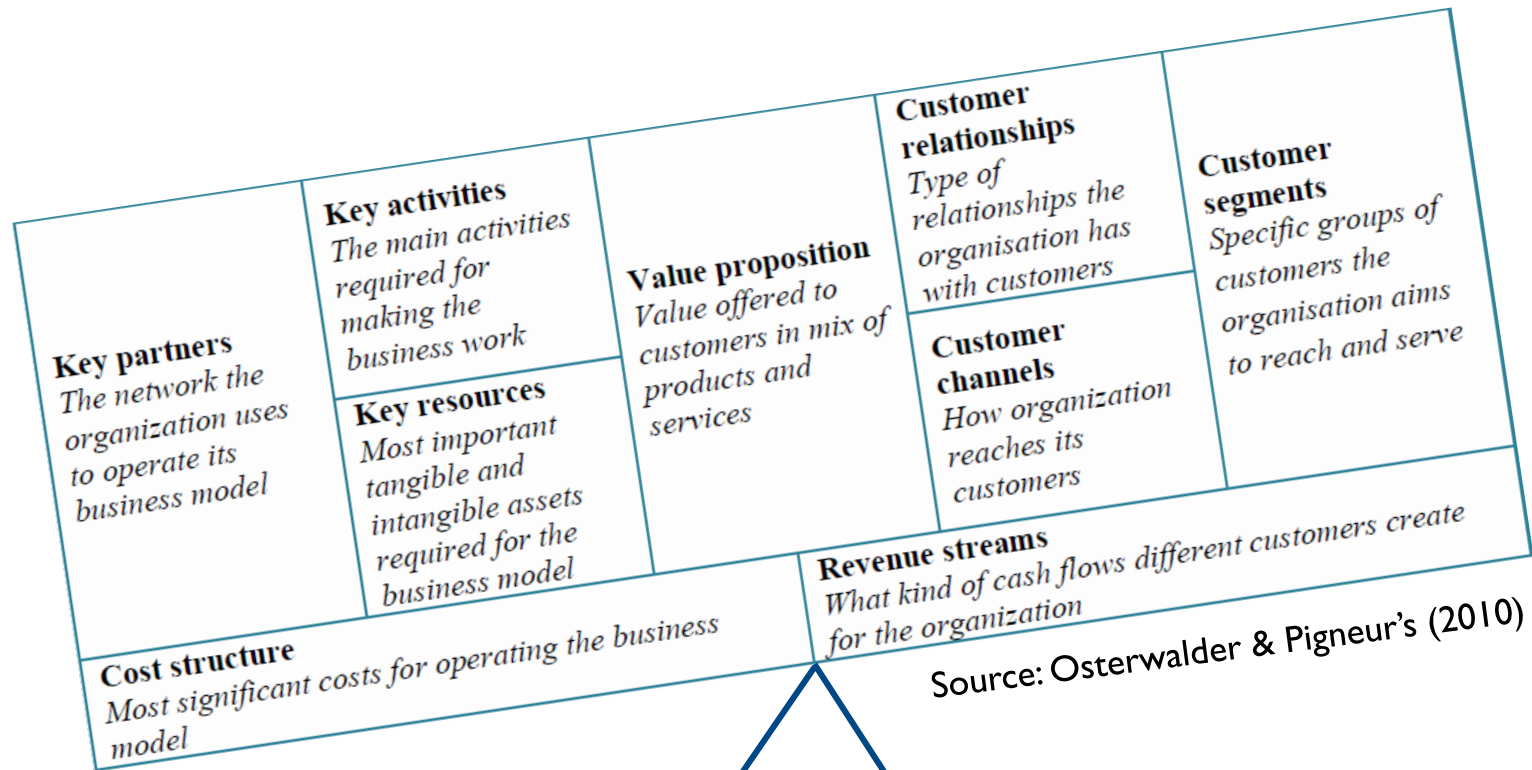
## Regulatory setting

- “The biggest challenges are connected with the laws and the legal frameworks...” (3B Bioenergie)
- “The main limit for expansion is the EU and national policy on bioenergy production.” (UAB Kurana)
- “The major limitations are legal framework and social perception” ( NutriBiomass 4LIFE project)
- “The biggest problems for the business development are legislation and its implementation...” (Emsland Group)
- “Unsustainable business environment and regulation” (SatiMed)
- “...company managing heat sources and municipal heating network is facing many new challenges...” (MPEC)

## Market development

- “One of the biggest challenges in the near future is to increase the market share...” (Ecopellet)
- “...reaching the bioactives market...” (oceanBASIS)
- “...biggest challenges is to find new customers, to increase sales and volume.” (Est-Agar)
- “...a challenge to reach customers who are not aware of those unique organic ingredients exists.” (Aloja Starkelsen)

# Unbalanced Business model canvas?



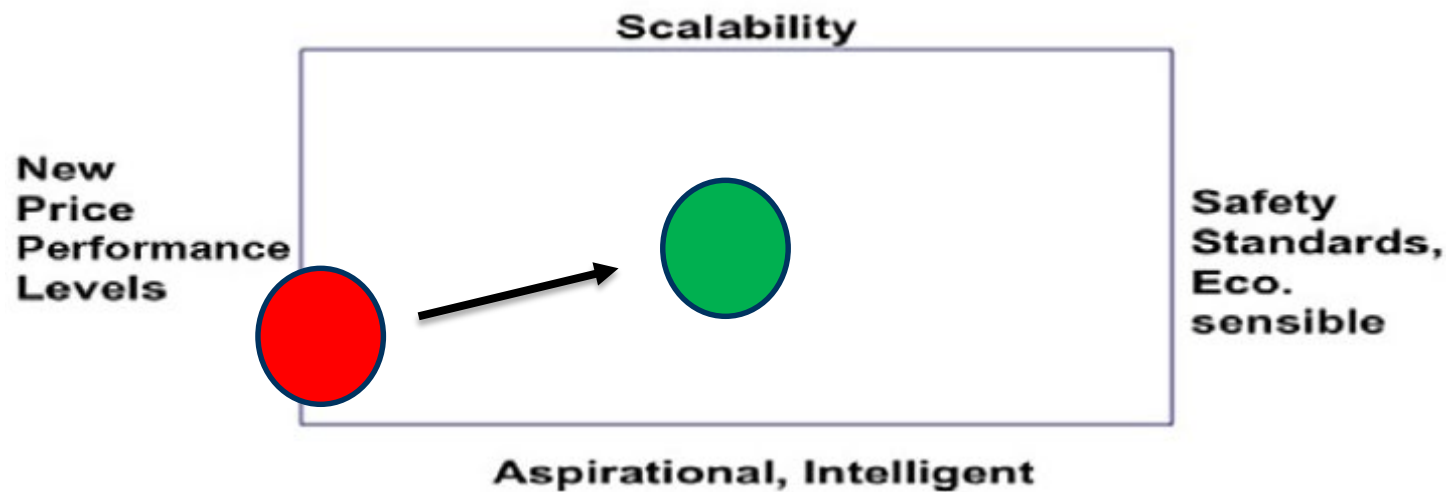
Internal factors ↔ External factors

Cost focus ↔ Customer focus

Value capture ↔ Value creation

Exploitation ↔ Exploration

# The transformation - making the movement towards scalable sustainable solutions



Innovation Sandbox (Prahalad, 2012)

# Innovative solutions identified

## The value chain

- “A crucial challenge for Wapnö, as for other food companies, is the food value chain... Nowadays, Wapnö is closer to the end customer and has built a well-known brand.” (Wapnö)
- “...from renewable energy sources (biogas produced by mesophilic process) into one closed technological loop.” (UAB Kurana)
- “The company handles the entire chain of biofuel from cultivation of raw material to production of fuel and use.” (Energifabriken)
- “The project represents a full scale self-sustainable closed loop circular economy model“ (NutriBiomass 4LIFE project)
- “...product innovation for a more circular production and waste utilization...” (Kaffeeform)

## Differentiation

- “...full utilisation of raw materials and production of several co-products.” (Borregaard)
- “...sustainability-focus as a possibility to build value for customers, and not as a constraining barrier.” (Wapnö)

# Summary

## *Identified (major) barriers...*

- Regulations and laws, Lack of finance, and lack of markets (or access to market)

## *...and potential solutions*

- Develop “Self-contained strategy” → sustainable BM → circular economy
- Develop your network – partners, suppliers and end-users
- Individual level: Change your mind-set → from producer to entrepreneur
- Firm level: from cost strategy to differentiated strategy
- Develop skills in the growth phase → from technology expert/innovator (only) to integration of technology, **business** and sustainability skills



*Thank you for your attention!*

“There are those that look at things the way they are, and ask -why?  
I dream of things that never were, and ask -why not?”  
*George Bernard Shaw*