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## Bioeconomy: towards a conceptual framework

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## Outline

1. Bio-economy: a fuzzy word
2. Two approaches to bio-economy
3. Some final considerations

Presentation available on the web: search "pettenella"



# 1. Introduction: bio-economy a fuzzy word

## Bioeconomy: a fuzzy word...

A definition:

Bioeconomy “encompasses the **production of renewable biological resources** and their conversion into **food, feed, bio-based products and bioenergy**. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries” (EC, 2012)

Bioeconomy: the **3 “F”** (food, feed, fiber) + **bioenergy**

## Definitions of bioeconomy

A fuzzy word...

No consensus was found in the literature as to whether it presents:

- a **concept** (Cooper 2007, p. 27; Rose 2007, p. 6–7; Thorup Larsen 2007, p. 9; Schmid, Padel & Levidow 2012; Arancibia 2013, p. 79; McCormick & Kautto 2013, p. 2593),
- a **paradigm** (Kitchen & Marsden 2011, p. 753; Marsden 2012, p. 258),
- a **master narrative** (Levidow, Birch & Papaionnou 2012, p. 100)
- or a **discourse** (Cooper 2007, p. 37; Birch & Tyfield 2013).

(Staffas, Gustavsson, & McCormick, 2013) (Pülzl, Kleinschmit, & Arts, 2014) taken from material prepared by Carmen Rodriguez and Valentino Govigli

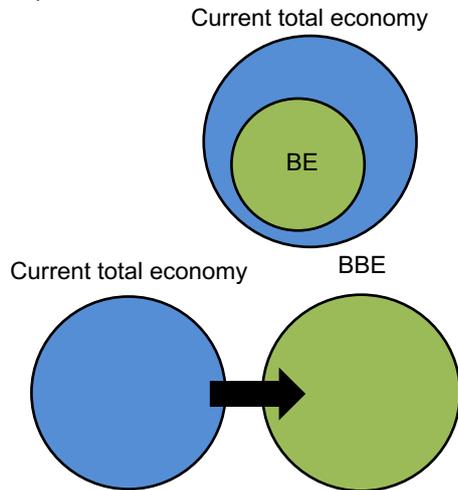
## A global view: Bioeconomy Policies/Strategies around the World ([www.gbs2015.com](http://www.gbs2015.com))

- dedicated bioeconomy strategy
- bioeconomy-related strategy
- be-related strategy; dedicated be-strategy is under development
- dedicated be-strategy is under development



**A difference that is not outspoken nor defined** (Staffas *et al.*, 2013)

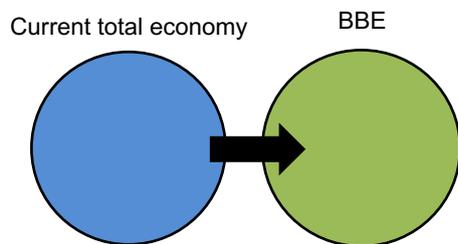
- **Bioeconomy (BE)** → a sub-part of the nation's total economy (often in relation to white biotech and life science)
- **Biobased economy (BBE)** → an economy where renewable resources instead of fossil ones and mineral constitute feedstocks for both energy, food, feed and materials



This could be, **more than a dream**, a **nightmare for the forest resources** in Europe: already the EU 2030 objectives for the use of forest biomass are perceived by some scientists excessive,

what could happen in case with develop the bio-plastic, bio-textile, bio-pharmaceutics use of forests?

- **Biobased economy (BBE)** → an economy where renewable resources instead of fossil ones and mineral constitute feedstocks for both energy, food, feed and materials



## Five points about the bio-economy strategies and visions that demand critical attention (Staffas *et al.*, 2013)

- **Scarcity of resources** → Only mentioned in a few of the documents
- **Sustainability focus** → Sustainability is not heavily emphasized and it is over shadowed by economic growth
- **Measures of success** → Few measures are presented in the documents, but the importance of measures is highlighted
- **Consumption patterns** → Not addressed (except for the documents by Finland and Sweden)
- **Stakeholder interaction** → This is acknowledged in the documents as critical, but needs increased efforts.

## In order to solve some limitations: an EFI proposal

### Circular Bioeconomy: more than bioeconomy or circular economy

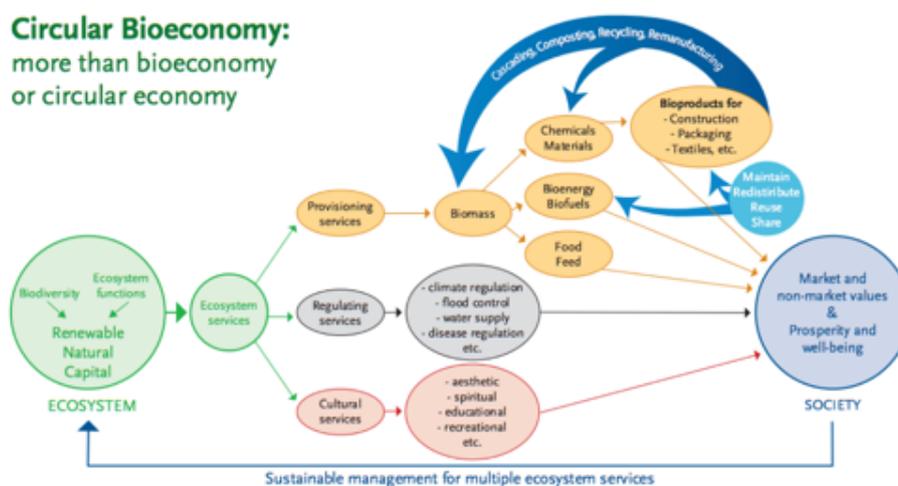


Figure 4. Illustration of circular bioeconomy flows. Source: EFI<sup>1</sup>

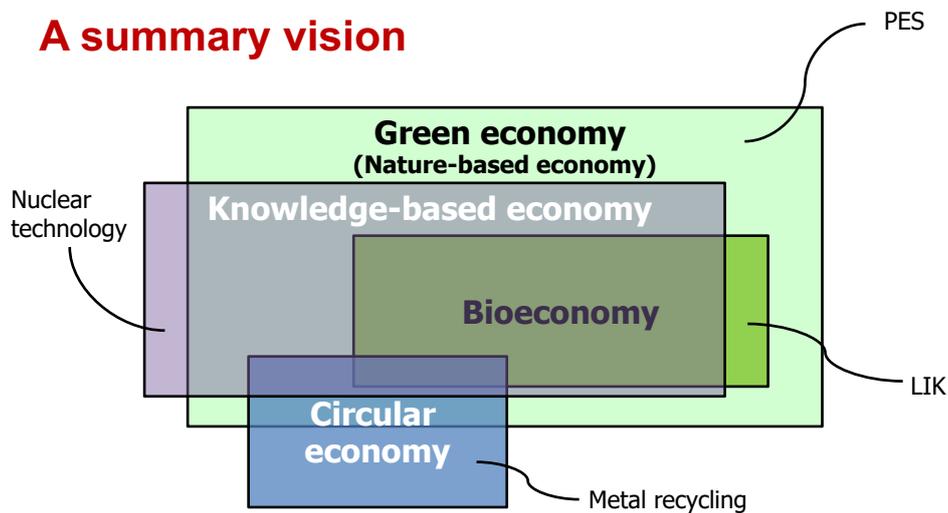
## A personal perception: sometimes we are playing with the words.

Many similar and connected terms ...

- Green economy
- Circular economy
- Circular bio-economy
- Bio-resources economy
- Bio-technology economy
- Knowledge-based bioeconomy
- ...

→ Borders/meanings not always clearly defined!

## A summary vision



## 2. Two approaches to bioeconomy

## Approaches to bioeconomy

2 different (complementary?) approaches that may help to understand the territorial differences in bioeconomy policies:

- the traditional, **technological** approach
- the emerging, **social** approach

## Technological approach: an example from Finland



**MetsäFibre**

<https://www.metsafibre.com/en/about-us/Bioproduct-mill/Pages/default.aspx>

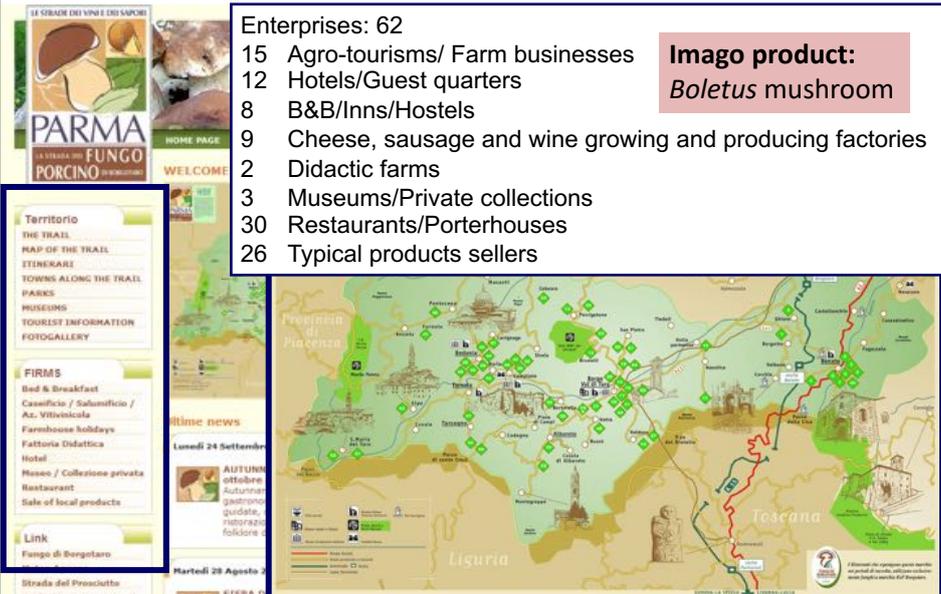
- Largest investment in the history of Finnish forest industry
- **100%** of wood raw material used
- **1.3 million tonnes** of pulp/year + bioproducts (e.g. textile fibres, biocomposites, lignin products, fertilisers...) and bioenergy
- **+150 jobs** created (**12,500** including value chain and consumption)

**Äänekoski bioproduct mill**

 1.2 EUR BILLION INVESTMENT	 1,3 MILLION TONNES CAPACITY	 240 % ELECTRICITY SELF-SUFFICIENCY	 6.5 MILLION M <sup>3</sup> USE OF WOOD
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## Social Innovation in Mediterranean forests

### Example: Borgotaro network (territorial marketing)



**Enterprises: 62**

- 15 Agro-tourisms/ Farm businesses
- 12 Hotels/Guest quarters
- 8 B&B/Inns/Hostels
- 9 Cheese, sausage and wine growing and producing factories
- 2 Didactic farms
- 3 Museums/Private collections
- 30 Restaurants/Porterhouses
- 26 Typical products sellers

**Imago product: *Boletus* mushroom**

**Territorio**  
 THE TRAIL  
 MAP OF THE TRAIL  
 ITINERARI  
 TOWNS ALONG THE TRAIL  
 PARKS  
 MUSEUMS  
 TOURIST INFORMATION  
 FOTOGALLERY

**FIRMS**  
 Bed & Breakfast  
 Caseificio / Salumificio / Az. Vitivinicola  
 Farmhouse holidays  
 Fattoria Didattica  
 Hotel  
 Museo / Collezione privata  
 Restaurant  
 Sale of local products

**Link**  
 Fungo di Borgotaro

**Strada del Prosciutto**  
 Emilia Romagna Tortono

**Strada dei Vini e dei Sapori**  
 PARMA  
 LA STRADA DEL FUNGO  
 PORCINO

**WELCOME**

**Time news**  
 Lunedì 24 Settembre  
 AUTUNNO  
 ottobre  
 Autunno  
 gastronomia  
 guide  
 ristorante  
 folklore

**Martedì 28 Agosto**  
 FIERA  
 Il fungo  
 L'azienda di Borgo Val di Taro, Toscana

## The traditional (dominant) approach (modified from Toman, 2012; Pettenella, 2015; Secco *et al.*, 2015)

	<b>Technological approach</b>
<b>Focus on</b>	<ul style="list-style-type: none"> <li>• Technological innovations</li> <li>• Large scale investments</li> <li>• Value chain perspective</li> <li>• Sectoral development</li> <li>• Vertical integration</li> </ul>
<b>Input/output diversification</b>	1 or more inputs Diversification in outputs
<b>Market power</b>	Increasing role of business owning/controlling the (new) technologies
<b>Model regions</b>	Northern EU (UK, Scandinavian countries)

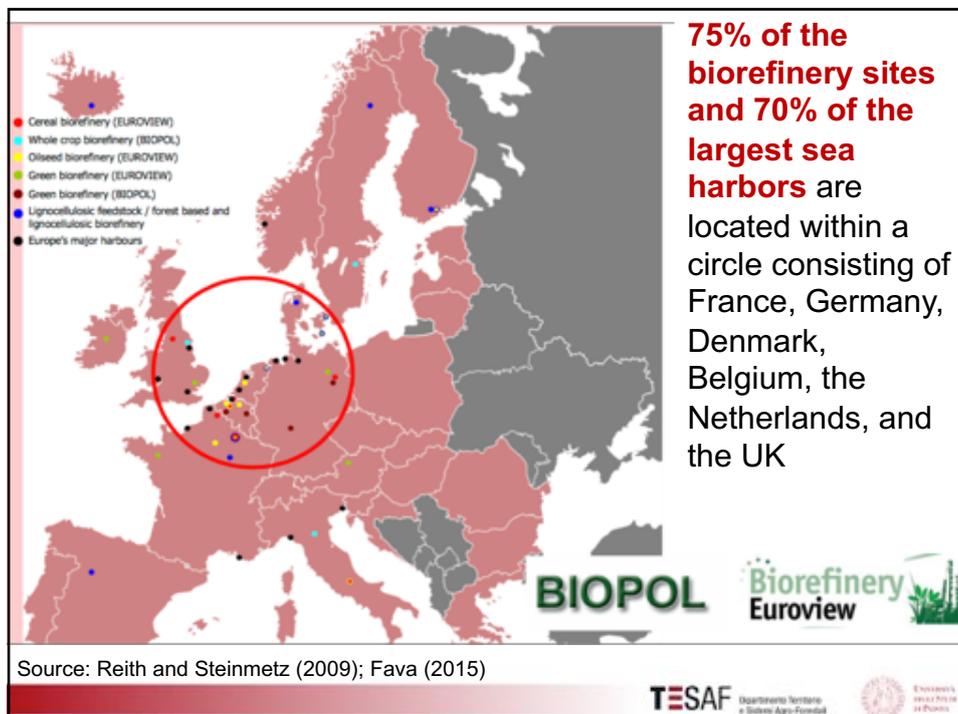
## A strong emphasis on biorefinery within the bioeconomy framework

- A **key factor** in the transition to a bio-based economy will be the **development of biorefinery systems** (Scarlato *et al.*, 2015)
- Biotechnology and the biorefinery concept are **essential components** of the bioeconomy (McCormick and Kautto, 2013)
- The bioeconomy is integrating traditional agricultural, forest and marine biomass feedstock production systems with a **range of biorefinery options and applications** (SCAR, 2014)
- Biorefineries are increasingly **at the core** of the bioeconomy vision at the EU level and worldwide (World Bioeconomy Summit, 2015)

## 2 large biorefinery models

(Europabio, 2011, European Commission, 2012, Ceapraz *et al.*, 2016)

- A. Port-biorefinery** → **strongly connected to global flows of raw materials**, key-logistic location (inside/nearby harbors, along channels...), high specialization, threshold effects, and economies of scale
- B. Territorial biorefinery** → **strongly connected to local/surrounding territory** and (in general terms) dependent on a more diverse and more thorough valuation of various biomasses



## The social approach

(modified from Toman, 2012; Pettenella, 2015; Secco *et al.*, 2015)

	Technological approach	Social approach
<b>Focus on</b>	<ul style="list-style-type: none"> <li>• Technological innovations</li> <li>• Large scale investments</li> <li>• Value chain perspective</li> <li>• Sectoral development</li> <li>• Vertical integration</li> </ul>	<ul style="list-style-type: none"> <li>• Social innovations</li> <li>• Small scale</li> <li>• Networks</li> <li>• Cross-sectoral development</li> <li>• Horizontal integration (= forests and agriculture as the green infrastructures for rural development)</li> </ul>
<b>Input/output diversification</b>	1 or more inputs Diversification in outputs	Diversification in the use of inputs High added value products & services
<b>Market power</b>	Increasing role of business owning/controlling the (new) technologies	Role of networks, groups, associations, public-private partnerships...
<b>Model regions</b>	Northern EU (UK, Scandinavian countries)	Southern EU (Mediterranean region)

## Different (complementary?) strategies

(modified from Toman, 2012; Pettenella, 2015; Secco *et al.*, 2015)

	Technological approach	Social innovation approach
<b>Focus on</b>	<p><b>Adaptive strategy</b> (“Old wine in new bottles”) → conventional wisdom of innovation generation</p> <p>Focus on forests, agriculture, fishery as <b>raw materials providers</b> with <b>biotechnology</b> being the <b>engine</b> of the growth</p>	<p><b>Bioeconomy: an opportunity to re-think to our consumers’ patterns</b></p> <p>It not only considers the protection of natural capital, “<i>but it stresses as well the importance of addressing equity and social inclusion challenges in moving toward a green economy</i>”</p>
<b>Input/output diversification</b>		
<b>Market power</b>		
<b>Model regions</b>		

## Strategies and Ecosystem Services

	Technological approach	Social innovation approach
<i>Focus on</i>	Provisioning ES, with a focus on wood biomass (with Regulative ES as a possible spillover)	Cultural ES and wild forest products (NWFP), both as provisioning and recreational services (with Regulative ES as an associated services)
<i>Examples</i>	<ul style="list-style-type: none"> <li>• Bio-fuels</li> <li>• Bio-plastic</li> <li>• Bio-textile</li> <li>• Bio-pharmaceutic</li> </ul>	<ul style="list-style-type: none"> <li>• Educational services</li> <li>• Sport services</li> <li>• Mushroom and berry picking</li> <li>• Cultural services (forest concert,, nature art museum, ...) Forest therapy</li> <li>• Inclusive forest activities</li> </ul>

## 3. Some final considerations

## Conclusions

**Bio-refineries**: prevailing **large-scale** investments, **capital-intensive** → increased market power of the industrial complex and lower one of forest owners, asked to produced **low-value raw material** (biomass) and much **exposed to international competition**

Comparing a **family sawmill** with a bio-refinery, the first is producing much **more added value** and **employment** for the local residents (and the forest owners)

## Conclusions

We should catch the real innovative aspects of bioeconomy that are related to **equity, social inclusiveness, promotion of local knowledge and employment creation**,  
i.e. to **social innovation**, more than to problems connected to technology innovation (that can be market driven, without much public support).

## Conclusions

... rural (forest) areas  
needs more social  
innovations than  
technological  
innovations

