Good Practice: Toulouse White Biotechnology cluster

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Contents

1. Introduction

The BERST project explains the bioeconomy development path of a) BERST regions and b) selected Good Practices. Aim is to provide a practical guide and source of inspiration for other regions that wish to develop their bioeconomy potential. Under this analysis:

- **BERST regions** are structured narratives for development pathways of clusters in different bioeconomy sectors in the regions of partners in the BERST project;
- **Good Practices** are examples of regions that contain one or more successful bioeconomy clusters at the mature production stage.

Especially, Good Practices have been analysed in order to:

- understand how the various key assets interacted and performed during the development stages;
- draw a number of lessons for the development of bioeconomy clusters within their respective regions; and
- provide recommendations to other regions and clusters for each key asset and each bioeconomy sector on which issues they have to take into account in order to establish, develop and successfully operate similar clusters.

1.1 Bioeconomy clusters

The bioeconomy can be described in terms of an economy that 'encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. In BERST, a **bioeconomy cluster** is perceived as a geographical concentration of actors in vertical and horizontal relationships aiming to develop the bioeconomy. Bioeconomy clusters have been categorised to allow comparison and better understand synergies and interactions of the various elements involved in the formation of bioregions. BERST recognises eight bioeconomy sectors, namely:

- primary biomass;
- food and feed;
- construction;
- chemicals and polymers;
- pulp and paper;
- textile and clothing;
- energy;
- R&D biotechnology.

Given the broad coverage of sectors within the bioeconomy, bioeconomy clusters might be rather heterogeneous in their specific focus. The development and marketing of bioeconomy products does not differ from other products: the challenge is to introduce competitive bioeconomy products that can be sold in profitable quantities on the basis of its price, quality, and service combination preferred by buyers over that offered by competing products. This implies that in the analysis of the development of the bioeconomy clusters the same three factors play a role as in the case of clusters aiming at the introduction and marketing of televisions or cars: input-output linkages among firms, social capital and institutional thickness.

1.2 Key assets and development paths of bioeconomy clusters

The input-output linkages among firms, social capital and institutional thickness in the cluster are all embodied by actors with varying properties. In the analysis of the development path of a bioeconomy cluster, we assume that the actors of the region, in which the cluster is located, apply a strategy to develop the bioeconomy by transforming biomass into competitive bioeconomy products. Such a transformation process takes time. Hence, our analysis is guided by two starting points:

1. a focus on five key assets of a bioeconomy cluster, as outlined in our conceptual model for the analysis of the strategy of a bioeconomy cluster (Fig. 1). These are:
    a. **entrepreneurs**: the presence of an entrepreneurial culture with active, innovative, flexible and risk taking entrepreneurs plays a pivotal role in driving clusters towards successful development;

b. **policymakers**: political leaders who are willing to support the development of the bioeconomy by providing governance, institutional structures and financial support;
c. **knowledge institutes**: organizations that provide the technical knowhow and innovation for the development of bioeconomy products;
d. **availability of biomass resources**: a continuous supply of biomass resources of constant quality is critical for the development of bioeconomy products;
e. **competitive bioeconomy products**: commercially viable products, such as chemicals, medicines, food, bioplastics, transport fuels, electricity and heat.

2. a long run time horizon of a bioeconomy cluster, with 3 phases (Fig. 2):
   a. **initial stage and take off**: the bioeconomy is introduced in the regional planning agenda and the policy, socio-economic and R&D landscape for its establishment and operation is created;
   b. **drive to maturity**: he first competitive bioeconomy products are sold at the market. The cluster grows with the setup of new companies, cluster infrastructure (with incubator, training centre etc.) has been established, and the cluster is able to attract both private and public funding
   c. **age of mature production**: the cluster is able to produce competitive bioeconomy products at an extensive scale.

The exact duration of each of these phases differs from cluster to cluster; according to estimates of PwC (2011) the duration of the initial stage and take off is about 5 years, that of the drive to maturity 5-10 years, and that of the age of mature production 10-20 years.

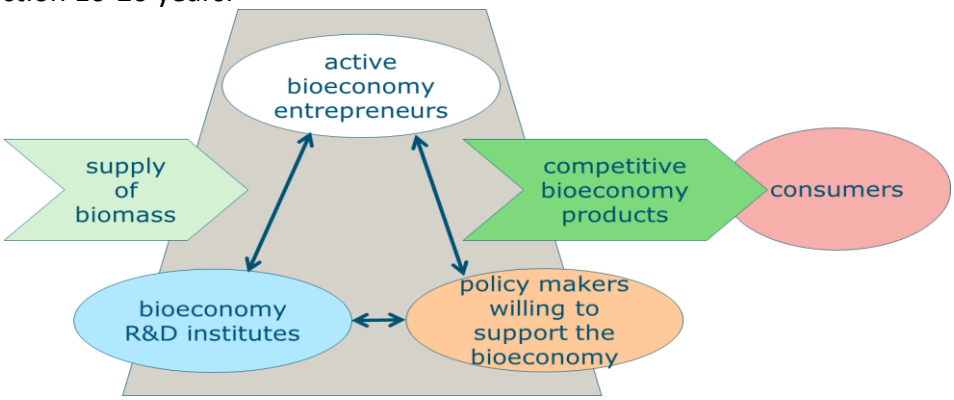

Figure 1 Conceptual model for the analysis of the strategy of a bioeconomy cluster

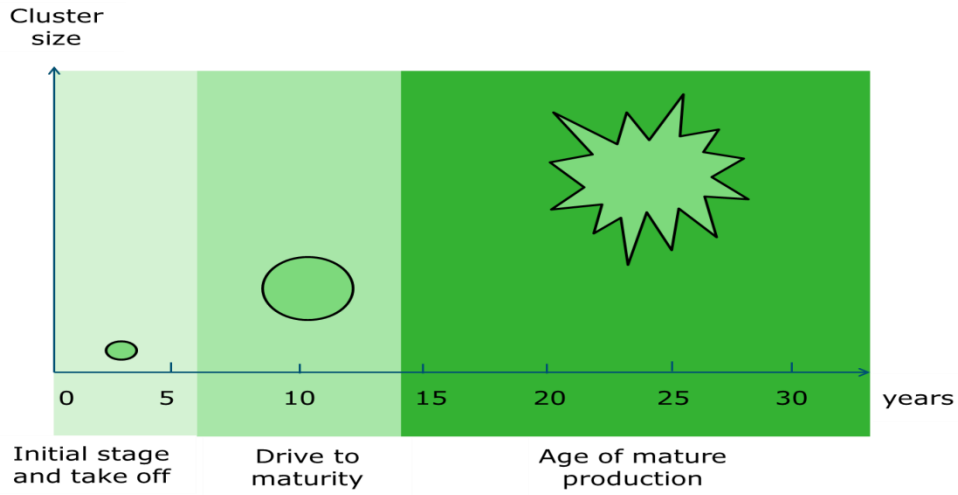

Figure 2 The development path of a bioeconomy cluster

1.3 Bioeconomy clusters in BERST project

The bioeconomy clusters that are analysed in BERST are distinguished in 'Good Practices', i.e. bioeconomy clusters within the age of mature production, and 'BERST regions', i.e. bioeconomy clusters in the regions of partners in the BERST project (Table 1).

Table 1 Studied bioeconomy clusters in BERST

Good Practices	*BERST regions*
Ghent (Belgium)	Central Finland (Finland)
North Rhine Westfalia (Germany)	Straubing (Germany)
Toulouse (France)	Biobase Westland (Netherlands)
Manchester (UK)	Biobased Delta (Netherlands)
	Madrid region (Spain)
	Western Macedonia (Greece)
	Slovenia

The bioeconomy clusters in the BERST regions are in varying stages of development, and some of them can also be regarded as Good Practices (Central Finland, lower Bavaria, Biobase Westland and Biobased Delta). Statistical data, literature and interviews with key actors have been used to collect information on the functioning of each bioeconomy cluster. The analyses of the bioeconomy clusters of the Good Practices have provided a number of key findings on the interaction of actors in the cluster. Subsequently, in the analysis of the BERST regions it has been explored to which extent the key findings of the Good Practices also apply for these bioeconomy clusters and which barriers they face in developing the bioeconomy cluster. The analysis in BERST focuses primarily on the Good Practice mature bioeconomy sectors within the study countries, but as the clusters encompass more than one sector, the performance and interactions of key assets is expected to influence them as well.

2. Toulouse White Biotechnology Cluster

With kind contribution from: Dr Pierre Monsan

2.1 The region and the cluster

The region

Toulouse is the capital city of Midi-Pyrénées region, south west France (NUTS2: FR6). The city lies on the banks of the River Garonne, 150 kilometres from the Mediterranean, 230 km from the Atlantic and 680 km from Paris. With 1,250,251 inhabitants at the January 2011 census[1],[3] Toulouse metropolitan area is the fourth largest in France[2].

Toulouse is the centre of the European aerospace industry, with the headquarters of Airbus, the Galileo positioning system, the SPOT satellite system, the Airbus Group (former EADS), ATR and the Aerospace Valley.

The city also hosts the European headquarters of Intel and CNES's Toulouse Space Centre (CST), the largest space centre in Europe[3]. Thales Alenia Space and Astrium Satellites (Airbus Group's satellite system subsidiary) also have a significant presence in Toulouse. Its world renowned university is one of the oldest in Europe (founded in 1229) and, with 103,000 students, is the fourth-largest university in France[4].

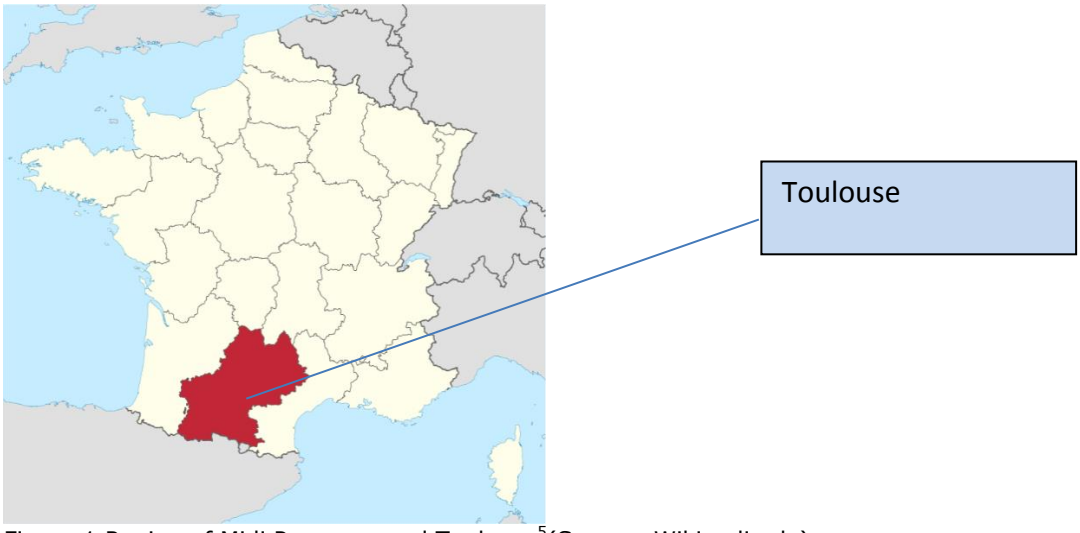

Figure 1 Region of Midi Pyrenees and Toulouse[5](Source: Wikipedia.de)

Midi Pyrenees region has identified six focus economic activities around which the capabilities, target markets and strategic development priorities of the region are

[1]Sérieshistoriques des résultats du recensement - Aireurbaine 2010 de Toulouse (004)". INSEE.
[2] INSEE. "Les 30 premières airesurbainesen 2010" (in French).
[3]CNES. "Ademe.fr" (PDF) (in French). Retrieved 30 May 2007
[4]http://cache.media.enseignementsup-recherche.gouv.fr/file/Atlas_2012-2013/24/0/Midi-Pyrenees_316240.pdf
[5]http://en.wikipedia.org/wiki/Midi-Pyr%C3%A9n%C3%A9es

shaped, namely: manufacturing & industry; motor vehicles and other transport equipment; food; human health; nanotechnology; biotechnology. The cluster examined in this report falls within biotechnology.

The cluster

Toulouse White Biotechnology (TWB) is a pre-industrial demonstrator that supports the development of innovative biological tools (enzymes, microorganisms, microbial consortia), thus opening new avenues for the production of chemical molecules, biopolymers, biomaterials and biofuels based on the use of renewable carbon. The cluster was initiated in mid 1980s, where the Bioresource centre was funded with the support of the pharmaceutical industry. Most participating companies are small and medium size enterprises (SMEs). The cluster is in the transition from drive to maturity to mature stage. It focuses on technology development, provision of innovative technology services, and building scientific capability in biotechnology.

2.2 Performance of key assets during the development pathway of the cluster

Toulouse White Biotechnology is a Good Practice in biotechnology which is part of the chemicals & polymers sector in BERST. This section analyses performance of key assets performed during cluster development stages as well as barriers and enabling factors which have framed progress. Traffic light colour coding is used to illustrate strength and performance of key assets and show how this has impacted in the progress of the cluster's activities. Traffic light colour coding reflects discussions with stakeholders from the clusters and the region as well as the regional partners from the BERST project. Table 1 presents the performance of the key assets within the two bioeconomy sectors which are present in the cluster during the initial stage (IS), drive to maturity stage (DMS) and mature stage (MS).

Table 1 Performance of key assets by bioeconomy sector during development stages

Key asset	Chemicals & Polymers		
	IS	DMS	MS
Cluster Organisation			
Actor			
Entrepreneurs			
Policy makers			
Knowledge institutes			
Biomass supply			
Competitive bioeconomy product			
Funding			
Policies and measures			

Low **Moderate** **High**

Biocluster organization

Initially there was no central management for the cluster but there were already four scientific parks where an entrepreneur could set up a company.

Table 2 Cluster performance by organisation-related key assets

Issue	Chemicals & Polymers		
	IS	DMS	MS
Central organisation that coordinates, manages, and facilitates the biocluster			
Role of key actors			
• *Entrepreneurs*			
• *Policy*			
• *RTD*			
Funding			

Following there was a network which interfaced between the academic world and the companies. The knowledge and scientific support came through the University of Toulouse which has a strong presence in the biotechnology field at international level and also the critical mass in terms of human resources, research infrastructures and funding.

Barriers

- Lack of central management at the initial stage prohibited efficient communication and transfer of knowledge

Enabling factors

- Strong commitment from the leading individuals facilitated the organisation of the cluster.

Actors

The University of Toulouse has a key role as the main knowledge providing institute. Other key actors included CNRS, INRA and several biotechnology companies. Biocluster entrepreneurs were located at the four science parks within the region so they are geographically close which has facilitated cooperation.

Table 3 Cluster performance by actor-related key assets

Issue	Chemicals & Polymers		
	IS	DMS	MS
Entrepreneurs activity			
Interaction of entrepreneurs with RTD			
Geopolitical position of the region			

From the early stage, there has been strong political commitment at both local and national levels, including provision of incentives to establish scientific parks to host start-up companies.

Barriers

- Highly innovative products or components require long and consistent efforts for training, education and knowledge transfer to entrepreneurs prior to commercialisation.

Enabling factors

- Excellency in research from the main knowledge provider, University of Toulouse;
- Increased awareness and consistent interactions among policy, industry and research actors.

Supply of biomass

The biocluster is based on carbohydrates and lipids. There are limited options of local supply for these materials so they are usually imported either from other regions in France or from abroad.

Table 4 Cluster performance by biomass supply-related key assets

Issue	Chemicals & Polymers		
	IS	DMS	MS
Biomass availability			
Indigenous supply			
Biomass trade			

Most biomass is supplied to south France from other French regions where there are starch processing plants, rapeseed oil factories etc that have by-products which can be diverted to the production of carbohydrate and lipids.

Barriers

- Lack of indigenous resources
- Sourcing lignocellulosic biomass is a big challenge
- Ensuring constant supply of raw materials with consistent quality is a challenge when producing bulk products from seasonal feedstocks.

Enabling factors

- Well-developed road infrastructure
- Using residual or by-products from agricultural industries increases the potential for adding value both to the farmers and the traditional markets.

Competitive bioeconomy products

The following bioeconomy products have been developed within the cluster to date:

- Diabetics- monocronalant bodies for therapeutic use;
- cosmetic products;
- polysaccharides and oligo saccharides;

- diagnostic kits for medical products;
- recombinant protein production for the pharmaceutical industry;

Toulouse also has strong presence of major seed production companies (Syngenta, Pioneer) and the cluster has developed strong links with plant biotechnology.

Table 5 Cluster performance in competitive bioeconomy products

Issue	Chemicals & Polymers		
	IS	DMS	MS
Innovation of bioeconomy products			
Cross over/ Transfer between sectors			
Degree of innovation			

Barriers

- Volatility of raw material prices
- High energy costs
- Complexity over meeting product specifications due to variable and volatile physical properties of the bio- based products

Enabling factors

- Increasing consumer demand for products that can be recycled or composted strengthens the role of biotechnology and bio-based products

Financing

The cluster has good access to public RTD funds. The main source of funding continues to be national funds aimed at competitiveness clusters in medicine and agriculture. These funds have a relatively long ten year duration although there is more frequent (three years) monitoring of progress and outputs. During the drive to maturity stage, the cluster has gained substantial additional funds directly from industrial actors.

Table 6 Cluster performance by financing-related key assets

Issue	Chemicals & Polymers		
	IS	DMS	MS
Public funds			
Accessibility of funds / Procedures			
Private funds			

Barriers

- Private funds were difficult to secure during the initial stage as the cross sector transfers, respective methods and products were not yet developed

Enabling factors

- Increased access to public funding for research, development and demonstration activities provided opportunities for entrepreneurs and for increased innovation in end products.

Policies and measures

Key policy mechanisms which facilitated start-up and successful development were grants for competitiveness cluster creation (which were available ten years ago) and the Investment For the Future Programme. The latter has funds of Euro 35 billion over the period 2010 to 2019.

Table 7 Cluster performance by policy-related key assets

Issue	Chemicals & Polymers		
	IS	DMS	MS
Presence of policy instruments			
Effectiveness of policy instruments			
Consistency of policy			
Monitoring procedures			

Barriers

- Communicating the importance of clusters and innovation to policy makers remains a challenge, especially when it is initiated by the academic sector.

Enabling actors

- Interest in initiative from public authorities
- Possibility for funding of research and infrastructure through national and regional funding

2.3 Difficulties, opportunities and lessons learnt

Difficulties and opportunities during the initial and drive to maturity stages

The most important difficulty has been the efficient communication of benefits and strong impact of the cluster during the initial stage to the policy makers in order to attract their interest, persuade them to include cluster formation both in policy and support financing measures at the regional level.

The major opportunity has been consistent- long term interest from the industrial actors which coincided with good research – industry collaboration and project funding.

Lessons learnt

In this section a set of specific learning points have been collected based on the interviews with stakeholders in the Good Practice clusters / regions. The learning

points are linked to the key assets, the development stages and the respective bioeconomy sectors.

Table 8 provides specific learning points learnt from the development of the biocluster in Toulouse per key asset, development stage and bioeconomy sector.

Table 8 Specific learning points from Toulouse White Biotechnology cluster

Specific lessons per key asset	Stage related to	Specific lessons	Bioeconomy sector
Organisation	Initial Drive to maturity	Develop a strong cluster organisation body with staff combining skills from industry and academia	Chemicals & Polymers Construction
	Initial	Develop a «Cluster culture».	R&D services
Actors	Drive to maturity	Develop a broad network with other institutions from the relevant field as well as with other clusters, both within the country as well as cross-boundary, as this will provide access to latest information as well as a platform for dissemination and promotion of cluster members' activities.	Chemicals & Polymers
	Initial Drive to maturity;	Upgrade the competences of the work force, adapting the supply of vocational education and training to the economic trends and productive system needs	Construction
	Initial Drive to maturity; Mature production	Develop an "open & participatory" approach within the innovation communication channels. Communicate and discuss findings, success and failures frequently.	R&D services
Biomass Supply	Drive to maturity; Mature production	Foster the cascading use of biomass and the circular economy in order to make full use of biomass potential	Chemicals & Polymers Construction
	Drive to maturity	In order to use primary and secondary biomass as feedstock for bioeconomy applications, consistent stakeholder dialogues and coordination needs to be facilitated.	R&D services
Products	Initial Drive to maturity; Mature production	Steer the development of new products according to the principles of smart specialization, resource availability and market demand and in this respect improve learning mechanisms from other regional clusters with a similar economic or geographical profile	Chemicals & Polymers
	Drive to maturity; Mature production	Start up financing from the industry creates better prospects for product development and market uptake.	Construction
	Initial	Cluster management should be more engaged in and informed about product development of its cluster partners in order to monitor project processes, recognize potential cross-overs and facilitate cooperation.	R&D services
Funding	Initial Drive to maturity;	The future strategy and perspectives of the cluster should be carefully considered with the	Chemicals & Polymers

	Mature production	participation of the industry.	
	Initial Drive to maturity;	Subsidies for initial investments can be critical for start-ups	Construction
	Initial	Ask for cluster participation/membership fee, as it will heighten the value of the membership to companies.	R&D services
	Initial Drive to maturity; Mature production	Ensure long-term (co-)funding from public bodies (e.g. ministry).	R&D services
Policies	Initial Drive to maturity	Subsidies for initial investments can be critical for start-ups	Chemicals & Polymers
	Initial Drive to maturity; Mature production	The future strategy and perspectives of the cluster should be carefully considered with the participation of the industry	Construction

2.4 References

http://www.toulouse-white-biotechnology.com/
BIOTECHNOLOGIES EN MIDI-PYRENEES. www.midipyrenees-expansion.fr