Case study (BERST region): Western Macedonia

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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**: the 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](image-url)
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

<table>
<thead>
<tr>
<th>Good Practices</th>
<th>BERST regions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ghent (Belgium)</td>
<td>Central Finland (Finland)</td>
</tr>
<tr>
<td>North Rhine Westfalia (Germany)</td>
<td>Straubing (Germany)</td>
</tr>
<tr>
<td>Toulouse (France)</td>
<td>Biobase Westland (Netherlands)</td>
</tr>
<tr>
<td>Manchester (UK)</td>
<td>Biobased Delta (Netherlands)</td>
</tr>
<tr>
<td></td>
<td>Madrid region (Spain)</td>
</tr>
<tr>
<td></td>
<td>Western Macedonia (Greece)</td>
</tr>
<tr>
<td></td>
<td>Slovenia</td>
</tr>
</tbody>
</table>

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. Western Macedonia (Greece)
Authors: Manolis Karambinis (CERTH), Valantis Ketikidis (CERTH), Nikos Ntavos (RWM) and Calliope Panoutsou (Imperial)

Place and date: London, Athens and Kozani, May 2015

2.1 Executive summary
The rural region of Western Macedonia in northern Greece is of national significance from the energy perspective. More than 50% of Greek electricity is produced in Western Macedonia mostly from power plants fuelled from lignite mined within the region. The contribution from renewable energy has grown in recent years. Considerable efforts have been made by the Regional Authority, research institutes and other key stakeholders to improve the policy, socio-economic and R&D landscape regarding the bioeconomy. However, due to the financial crisis many of the proposed investments have not yet been implemented.

Several bioeconomy sectors - primary biomass production, energy, textiles and clothing, food and R&D - have significant presence in the region. From these sectors, primary biomass production and energy have been organised in a triple helix structured cluster named Bioenergy and Environment of Western Macedonia (CluBE). There are around twenty members currently of CluBE include Regional and Local Authorities, research institutes, forest and agricultural associations as well as private sector companies. CluBE was recently formally created as a non-profit company although it has existed for more than ten years.

Key recommendations were drawn from the interviews and categorised as follows.

Organisation:

- Foster investment for the reduction of the environmental impacts of productive systems.
- Investments attraction towards regional RES companies, through the organisation of commercial missions and facilitating soft landing process.
- Support local supply chains financing cross-sectoral collaboration (example agro-energy chain) and promoting the adoption of business network contracts.
- Simplification of bureaucratic procedures for projects financed by public programmes and calls for proposals.
- Increase the coordination between research bodies, scientific/engineering universities, economics universities and private companies, by focusing on the projects with most probable industrial impacts: Clusters as structure to establish permanent collaboration among research and industry.
- Developing a «Cluster culture».

Actors:
• Support collaborative R&D activities for new sustainable technologies, new products and services.
• Development and support of vocational education and training networks in domains with potential shortages/domains needing new or upgrade of existing competences or networks linking relevant actors in the green economy/bioeconomy field related education and training such as universities, other research institutions, business etc. to address knowledge, skills and competences needs and gaps.
• Upgrade the competences of the work force, adapting the supply of vocational education and training to the economic trends and productive system needs.
• Life-long training and improved retraining programmes in addressing companies employees at all levels (workers, managers, entrepreneurs, professionals).

Biomass supply:

• Enhance and update legal framework in order to yield more competitive wooden products (up to now only wood logging cooperatives are allowed to harvest wood in public forests).
• Informing and promoting the “collaborative spirit” to biomass producers in order to establish trust between production and demand site.

Biobased products:

• Sound system of agencies and tools (e.g. business network contracts) to increase competitiveness of companies in a) innovation, b) internationalisation

Funding:

• Fiscal and administrative measures to attract foreign industrial and financial investors.
• Smart Specialisation Strategy - elaboration of joint calls for proposal among European Regions.
• Public funding of projects should be secured and further enlarged, especially in periods of recession as it can contribute to the development of small companies, which are lacking financial resources.

Policies and support measures:

• Review of current legislation to facilitate a broader involvement of local communities in authorization processes (for new plants installation, public works, infrastructures, etc.).
• Clusters and other enterprise aggregations as tools to create enabling environments for the birth and growth of emerging industries in bioenergy. Involvement of clusters in the elaboration of the regional work programs for each area of specialisation.
• Undertake an important evolution of the way education and training are delivered in order to build a new entrepreneurial mind-set in the people at all levels.
Disposal of biomass should be controlled in order to achieve the best environmental impact. For example, the practice of burning crop residues in the field persists although this is illegal. Removal of residues from agricultural fields needs careful consideration since it may affect environment (soil properties, air quality etc.), and agricultural productivity.

2.2 Introduction

The work presented here provides a structured narrative for the development of the biocluster in Western Macedonia, which may serve as a practical guidance and source of inspiration for other regions intent to develop their bioeconomy potential. It is based on analysis of statistical data, literature and interviews with key actors involved in the development of bioeconomy and the biocluster in the region (see Annex 1).

The report is structured in three main chapters. Chapter 2 provides an overview of the socio-economic and environmental situation in the region. Chapter 3 translates the findings from literature review, stakeholder interviews and consultations with regional partners in a narrative that follows the two main dimensions of the analysis conducted in BERST; i.e. key assets and long time horizon. Finally, Chapter 4 provides concluding remarks, lessons learnt, opportunities, barriers and recommendations.

The biocluster in Western Macedonia has been further categorised into sectors in order to allow comparison and better understand synergies and interactions of the various elements involved in the formation of bioregions. The BERST project recognises eight bioeconomy sectors, agreed with regional partners and interviewees, namely: primary biomass; food; construction; chemicals and polymers; pulp and paper; textile and clothing; energy; R&D services.

Two research dimensions have been used to analyse the development of the bioeconomy sectors within the bioclusters in the study regions, as follows:

- Clusters’ key assets and their interaction
- Time horizon and stages of development

Clusters’ key assets and their interaction

Clusters can be considered forms of network structures. A cluster is characterised by multiple, networked groups or teams who seek to accomplish organizational objectives. Team-based organizations offer much by way of flexibility while projects can be approached on a planned or ad hoc basis (ref).

The actors in a cluster are thus a key asset. Several groups play a key role, as follows:

- Entrepreneurs. The presence of entrepreneurial culture plays a pivotal role in driving clusters towards successful development. Clusters usually leverage on the
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presence and active participation of various individuals with an entrepreneurial spirit who are flexible, risk-takers and willing to try new ideas. The level of entrepreneurial culture can therefore be seen as a critical success factor whereas low levels of entrepreneurship would be a cause for concern (PWC, 2011).

• Policymakers. Political leaders who are willing to support the development of the bioeconomy, providing governance, institutional structures and financial support.

• Knowledge institutes. Organisations that provide technical know-how and innovation for the development of bio-products.

Other assets involved in clusters are:

• Biomass supply: Consistent provision of biomass resources is critical. The analysis of case studies and best practices in BERST project includes both indigenous raw material streams and imports (if applicable) and elaborates on the advantages and disadvantages of each option to the cluster development pathway.

• Competitive bioeconomy products: commercially viable products such as fine chemicals, medicines, food, chemicals, bioplastics, transport fuels, electricity and heat.

• Funding: consistent funding both from public and private sources, new funding resources and attractive funding mechanisms for the entrepreneurs and investors.

• Policies and measures: legislative and policy framework conditions affecting the introduction of products made from biomass including measures relating to legislation, policies, standards, labels, certification and public procurement.

**Time horizon and stages of development**

Biocluster development passes through three main stages, typically taking 10-15 years to reach maturity. The challenges at the initiation of the biocluster differ from that during a mature stage. Hence it makes sense to distinguish the phases in the development path of the biocluster. This dimension forms the basis for the second starting point in the analysis within BERST.

It takes considerable time from the launch of a bioeconomy cluster to the time by which a mature cluster is in place. In the analysis of the development path in BERSRT project, we distinguish three phases:

• **Initial stage and take off (IS):** Introducing the bioeconomy in the regional planning agenda and creating the policy, socio-economic and R&D landscape for its establishment and operation.

• **Drive to maturity (DMS):** The first competitive bioeconomy products are sold at the market. The cluster grows with the setup of new companies, cluster

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1 Inspired by Rostow’s stages of growth.
infrastructure (incubator, training centre etc.) has been established, and the cluster is able to attract both private and public funding.

• **Age of mature production (MS):** The cluster is able to produce competitive bioeconomy products at an extensive scale.

The duration of each of these stages differs from region to region; according to estimates of PwC (2011)\(^2\) 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. Within each stage, we analyse the interaction of the key assets, as given in our conceptual model. It is notable that clusters studies were considered to be either in initial stage or in the drive to maturity stage. No clusters were considered to be fully mature although, in some regions, elements of clusters had reached mature state of development.

### 2.3 Environmental and socio-economic indicators of the region and clusters

**The region**

The region of Western Macedonia is situated in north-western Greece, bordering with the regions of Central Macedonia (east), Thessaly (south), Epirus (west), and international borders of the Former Yugoslav Republic of Macedonia (Bitola region) and Albania (Korçë County) to the north.

Although it covers a total surface of 9,451 km\(^2\) (7.2% of country’s total), it has a total population of 283,689 inhabitants (2.6% of the country’s total), thus it is a low-density populated region. This is mainly due to the mountainous, rural nature of the region.

![Figure 2.1 Map of Western Macedonia](http://ec.europa.eu/research/bioeconomy/pdf/regional-biotech-report.pdf)

Western Macedonia is the main energy producing region in Greece with an annual production over 50 million tons of lignite and being the location of six lignite-fired power plants with 4.4 GWe installed capacity.

### Table 2.1 Basic facts about population in Western Macedonia

<table>
<thead>
<tr>
<th>Prefecture/Regional Unit</th>
<th>Population (2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kozani</td>
<td>150,196</td>
</tr>
<tr>
<td>Florina</td>
<td>51,414</td>
</tr>
<tr>
<td>Kastoria</td>
<td>50,322</td>
</tr>
<tr>
<td>Grevena</td>
<td>31,757</td>
</tr>
<tr>
<td>Total</td>
<td>283,689</td>
</tr>
</tbody>
</table>

*Source: National Statistical Service of Greece*

### Table 2.2 Environmental and socio-economic indicators of Western Macedonia

<table>
<thead>
<tr>
<th>Prefecture</th>
<th>Population</th>
<th>Population density</th>
<th>GDP/capita (in PPS)*</th>
<th>GDP in PPS (% of country average)*</th>
<th>GDP in PPS (% of EU-27 average)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>of Grevena</td>
<td>31,757</td>
<td>13,745</td>
<td>12,500</td>
<td>61</td>
<td>57</td>
</tr>
<tr>
<td>of Kastoria</td>
<td>50,322</td>
<td>2,233</td>
<td>12,200</td>
<td>59</td>
<td>56</td>
</tr>
<tr>
<td>of Kozani</td>
<td>150,196</td>
<td>42,454</td>
<td>21,800</td>
<td>106</td>
<td>100</td>
</tr>
<tr>
<td>of Florina</td>
<td>51,414</td>
<td>26,549</td>
<td>20,500</td>
<td>100</td>
<td>94</td>
</tr>
</tbody>
</table>

*Source: Draft proposal for the Region of Western Macedonia for configuration of national development guidelines 2014-2020 (2nd Circular), 28/11/2013*

The Region’s G.D.P. per capita for the period 2007-2009 amounts to 85.6% of the EU-27 average. This does not reflect the current situation of Western Macedonia since the economic crisis affecting the country, especially after 2008 and led to a significant decline of the Greek economy. The GDP per capita (in PPS) of Western Macedonia is even lower than the corresponding ratio of the EU-27, namely 80% of that average.

The unemployment rate in Western Macedonia (ages>15 years), according to Eurostat (2012), has reached 29.9% compared to national average 24.1% and EU-27 average 10.2%. The unemployment situation has declined: according to the Hellenic Statistical Authority for the second quarter of 2013 the unemployment rate in Western Macedonia was 32.9%.

The region produces 2.3% of national GDP which is derived from agriculture (6.8%), industry/construction (38.5%) and services (54.7%) (2008). As regards the sectoral composition of employment in the Region, 16.7% of the working population is

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3Draft proposal for the Region of Western Macedonia for configuration of national development guidelines 2014-2020 (2nd Circular), 28/11/2013
employed in the primary sector, 28.1% in the secondary and 55.1% in the tertiary sector (2008).

There are wide disparities in terms of GDP per capita. Prefecture of Grevena is in a severe position while prefecture of Kozani by far in a better one, mainly as a result of the electricity production and the production of the fur industry. Prefecture of Kastoria and Florina show similar figures concerning demographic indicators, while GDP in the Prefecture of Kastoria is significantly below the one of prefecture of Florina.

The region has identified four focus economic activities around which the capabilities, target markets and strategic development priorities are shaped, energy, bioeconomy, lignite mining and quarrying and alternative forms of tourism and gastronomy. The cluster examined in this report falls into the first and the second of these activities.

Table 2.3 Focus economic activities for Western Macedonia (draft table – to be finalised the next period in order to be registered in S3Platform)

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>Capabilities</th>
<th>Target Markets</th>
<th>EU Priorities</th>
</tr>
</thead>
</table>
| Energy: CHP from lignite power stations, renewable energy including bioenergy production (electricity and/or heat), district heating networks | 1. Energy production & distribution  
2. Energy distribution  
3. Power generation/renewable sources  
4. Agriculture, forestry & fishing  
5. Water supply, sewerage, waste management & remediation activities  
6. Agricultural services  
7. Crop & animal production, hunting & related service activities  
2. Energy distribution  
3. Power generation/renewable sources  
4. Agriculture, forestry & fishing  
5. Water supply, sewerage, waste management & remediation activities  
6. Agricultural services  
7. Crop & animal production, hunting & related service activities  
8. Forestry & logging | 1. Sustainable innovation  
2. Eco-innovations  
3. Resource efficiency  
4. Sustainable agriculture  
5. Sustainable energy & renewable  
6. Sustainable land & water use  
7. Sustainable production & consumption  
8. Waste management |
| Bioeconomy: food and feed, wine & furs | 1. Agriculture, forestry & fishing  
2. Agricultural services  
3. Crop & animal production, hunting & related activities  
4. Energy production & distribution  
5. Energy distribution  
6. Power generation/renewable sources | 1. Agriculture, forestry & fishing  
2. Agricultural services  
3. Crop & animal production, hunting & related activities  
4. Energy production & distribution  
5. Power generation/renewable sources | 1. Sustainable innovation  
2. Eco-innovations  
3. Resource efficiency  
4. Sustainable agriculture  
5. Sustainable energy & renewable  
6. Sustainable land & water use  
7. Sustainable production & consumption  
8. Waste management |
Regional Innovation Strategy 3 (RIS3) for Western Macedonia has been approved. The region has not been registered at the S3 Platform, as other Greek regions (e.g. Central Macedonia, Attica etc.). However, the orientations of the Regional Authority and stakeholders are towards a strategy that sets innovation and knowledge-based development priorities; it is outward looking and promotes critical mass potential, notably in the energy field.

Regional research and innovation policies

For the 2014-20 programming period the Regional Authority of Western Macedonia has strong will in collaborating with the local stakeholders in order to define clear strategic objectives. During a meeting organised by the IMA (Intermediate Managing Authority) in October 2012, stakeholders suggested a number of regional targets for 2014-2020 for research, innovation, digital convergence and SME support, including:

- Creation of sustainable research infrastructures
- Targeted actions supporting entrepreneurship and business clusters
- Collaboration of research and production organizations
- Creation of a pool of innovation ideas – transfer of solutions from other regions
- Ongoing measurement of innovation policy impact and adjustment
- Mapping of investment and resources in networks and applications
- Opening of networks to private investors
- Use of local funds for innovation
- Use of modern marketing practices to promote local products and clusters

Recommendations
- Policies for regional innovation should be based on the priorities defined by previous projects such as RIS, RIS+, K-Clusters, which still remain relevant. The strategy should include a long-term vision for the region with measures of diversification but also of technological modernisation of existing companies.

- Support to existing clusters should be the central element of the RIS3 of Western Macedonia. Clustering should be organised from a bottom-up perspective, as emerging networks among companies and local and regional stakeholders.

- As the region does not have significant RDTI infrastructures, platform mechanisms could be considered as a solution for offering market and technology intelligence, incubation of new companies, export advice and support etc.

- Innovation actions and initiatives should be carefully selected with respect to criteria of (1) sustainability in the long run and mainly after the initial support period; (2) creation of capabilities and know how in the region; (3) offering integrated solutions to technology-production-market-funding; (4) leading to high leverage of private investments; (5) involving a large number of beneficiaries; and (6) contribution to development goals of competitiveness and employment.

**Cluster and entrepreneurship policies**

During the current programming period (2007-2013) numerous actions have been implemented related to research, innovation and entrepreneurship. However, the innovation actions did not manage to assimilate the results into the production process and add significant value in businesses; the key features of the production system of the Region still depend on conventional industries with limited range of sectoral specialization, very small size of companies, the inability to identify and cover with the necessary infrastructure the business needs, the lack of investment in RTDI, the absence of interface between RTDI actors and business activity and low competitiveness.

Furthermore, more qualitative focus studies should be carried out in the activity domains where the region shows relative specialisation to identify niches. This involves expert work on value chain analysis. It also involves an analysis of the linkages between clusters/industries/sectors, in order to examine whether one can talk about related variety across the areas of regional specialisation.

An emphasis should be given to facilitate cross-clustering and the identification of innovation opportunities at the interface between different clusters (e.g. incorporate ICT in priority sectors to increase competitiveness). Specific funding measures and support should be developed aimed at primary and secondary sector innovation and inter-linkages with other key sectors in the region.

A particular focus should be given to strengthening the cooperation of existing/emerging sectors/clusters to make connections to local, national and global value chains. In this respect and due to the fact that the Region has borders and strong relations with the neighbouring countries Albania and FYRoM, it is recommended to develop transnational and transregional clusters in the areas of transport, energy and telecommunications infrastructure, management of common
natural resources and development of common topics of interest (entrepreneurship, rural development, tourism, culture, health, education).

Only a few actions were implemented in the areas of technology transfer and improvement of cooperation networks between small businesses (SMEs), assistance for research and technological development, in particular for SMEs and support services for firms and groups of firms. Entrepreneurial and innovation support services (like one-stop-shops) have been promoted by various organisations, notably through Structural Fund projects. However, despite the efforts of such intermediaries, collaboration between innovation actors remains limited. The regional innovation pole programme was discontinued even though it produced some noteworthy results/deliverables (e.g. the biofuels report). It is recommended to create a one-stop-shop within existing structures or a new structure for potential investors/SME start-ups with the appropriate improvements and sustainability plans based on lessons learnt and known deficiencies of current implementations. Apart from horizontal structures, it is also strongly advisable to create such schemes in the sectors where the region shows some regional competitive advantage (e.g. energy, food and feed, textiles, agriculture, etc.).

The Region of Western Macedonia has only one operational industrial zone and two others at planning stage while no incubator has been established so far. The zone offers mainly real estate services and is not sector-specific. It is recommended to further develop the zones and parks by offering added-value services to tenants and provide incentives for the establishment of incubators in combination with other policies like clusters. Again, in response to the need for some sector specialisation, an incubator should focus and be jointly developed with a relevant cluster in the sectors where the region shows some regional competitive advantage, namely the energy sector.

The Cluster of Bioenergy and Environment of Western Macedonia

Four bioeconomy sectors, i.e. primary biomass production, energy, textiles and clothing, food and R&D have significant presence in the region but at the time of the analysis only the primary biomass production and energy sectors were organised in a triple helix structured cluster named Bioenergy and Environment of Western Macedonia (CluBE). The analysis presented in this report is focused mainly on the energy and R&D sectors that are included in the cluster. Interviews were also held with representatives of the food as well as textiles and clothing sectors and this report integrates findings from those interviews. The report seeks to suggest optimal organisation of assets to lead to the future integration of all sectors.

CluBE is a non-profit company established among local actors and stakeholders of the Region of Western Macedonia. CluBE emerged in the early part of the decade starting 2000 from previous collaboration of regional players on projects such as assessment of bio-energy potential.
CluBE aims at developing R&D and business activities in the fields of bioenergy and environment, in order to reinforce green economy in the region and the neighbouring area. Initial strategic objectives are as follows:

- Energetic exploitation of biomass for household and industrial use.
- Energetic exploitation of biomass for district heating systems for small, medium or large towns.
- Co-firing with lignite in existing power stations and/or future heating plants.
- Optimization of heating systems.
- Improvement of energy efficiency for households, public and private buildings.

In February 2014, the cluster has been actually established as a legal form by 21 initial triple helix members from the public sector, R&D institutions and private sector entrepreneurs. Members of the CluBE include Regional and Local Authorities, Universities and Research Institutes and various corporations such as municipal district heating companies, boilers and wood industries, biomass logistics enterprises and forest and agricultural associations.

Members have notable experience in the field of biomass and bioenergy. They have managed and successfully completed several European and Transnational Projects in the field of research and dissemination of knowledge and have assisted the regional business sector promoting and fostering entrepreneurship in Western Macedonia.

In addition to energy oriented activities, three bioeconomy sectors have significant presence in the region. The focus of their main activities and their potential integration with CluBE is briefly outlined below.

a) The Rural Cooperative Producers Organisation (A.S.O.P.) «Dimitra» operates in Velvento with more than 170 producers, which cover the cultivation, harvesting, packing and distribution of the fresh fruits. The cooperative was established by a group of producers, solely located in the municipality of Velvendos, in the Prefecture of Kozani. Its strategic agenda is embedded in RIS3, as well as in the National Regional Operational Program. It is envisaged that the cooperative could be one of the suppliers of residual biomass for local bioenergy plants and also exploit it for its members energy requirements during packaging and processing the primary produce. This would enlarge the resource base of the region and expand from the primary forest oriented supply towards agricultural (fruit tree prunings) and agro-food residual streams.

b) Amyndeon Oenos is a wine cluster which has been established in 2012 and runs the coordination and the management of the wineries’ cooperation with eleven local wineries being the entrepreneurs that form its primary membership. In a similar perspective with the agricultural cooperative, it is envisaged that it could be one of the suppliers of residual biomass for local bioenergy plants and also exploit it for its members’ energy requirements during wine making/storing (space heating and cooling).
c) The Panhellenic Association of fur animal breeders was founded in 1984 by a group of breeders who wanted to share their knowledge and experiences. It now has more than 100 members. The development of the fur farming industry is rapid in the area of Kastoria and Siatista in the Region of Western Macedonia, producing two million fur skins annually. The continuous activity developed by the Association has led to the creation of 100 farms in the area. Moreover, two biogas CHP plants from fur animals manure are already in operation in Western Macedonia with installed capacity of 240 and 120 KWp respectively. It is envisaged that the association, through its members can have active participation in further development of heat and electricity from biogas.

2.4 Analysis of the development path of the biocluster

This chapter translates the findings from literature review, stakeholder interviews and consultations with regional partners in a narrative that follows the two main dimensions of the analysis conducted in BERST; i.e. key assets and long time horizon. The work presented here provides a comparative analysis of the key assets, their performance and rationale as well as their evolution and interactions across the development stages of the cluster CluBE\textsuperscript{4}. The outputs from this analysis facilitate the dev--elopment of recommendations i) for the cluster’s successful transition to the next stage and ii) for other clusters with similar characteristics in terms of sectors and assets.

<table>
<thead>
<tr>
<th>Table 3.1 Cluster performance by key asset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key asset</td>
</tr>
<tr>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Cluster Organisation\textsuperscript{5}</td>
</tr>
<tr>
<td>Actors\textsuperscript{6}</td>
</tr>
<tr>
<td>Entrepreneurs</td>
</tr>
<tr>
<td>Policy makers</td>
</tr>
<tr>
<td>Knowledge institutes</td>
</tr>
<tr>
<td>Biomass supply\textsuperscript{7}</td>
</tr>
<tr>
<td>Competitive bioeconomy product\textsuperscript{8}</td>
</tr>
<tr>
<td>Funding\textsuperscript{9}</td>
</tr>
<tr>
<td>Policies and measures\textsuperscript{10}</td>
</tr>
</tbody>
</table>

\textsuperscript{4} The analysis presented in this report focuses on the energy and R&D sectors that are included in the cluster so far but includes also issues detected within interviews with representatives of the food, and textiles\& clothing sectors and integrates the most important elements found within the respective recommendations in an attempt to suggest an optimal organisation of assets which can lead to the future integration of all sectors;

\textsuperscript{5} An organizational structure with many groups or teams to accomplish organizational objectives.

\textsuperscript{6} The key types of actors involved in the cluster formation and operation

\textsuperscript{7} The consistent provision of biomass resources at given prices throughout the operational periods

\textsuperscript{8} Commercial/cost competitive products such as fine chemicals/medicines, food, chemicals/bioplastics, transport fuels, electricity and heat

\textsuperscript{9} Consistent funding both from public and private sources, new funding resources and attractive funding mechanisms for the entrepreneurs and investors.

\textsuperscript{10} Measures related to legislation, policies, standards, labels, certification and public procurement.
Table 3.1 presents the performance of the various bioeconomy sectors which are present in the cluster across the key assets, during the initial stage (IS) and drive to maturity stage (DMS), based on the results from the questionnaire survey. Details on how the individual key assets performed across the two development stages are provided in the following sections alongside with barriers and enabling factors which have framed their progress. The traffic-light colour coding has been introduced to reflect the strength and performance of each key asset during the development stages and how this has impacted in the progress of the cluster’s activities. The ranking of the traffic light coding reflects the discussions with stakeholders from the clusters and the under study region as well as the regional partners from the BERST project.

The need to develop more organized forms of cooperation was already depicted through the Regional Innovation Strategy projects “RIS” and “RIS+”, while the “Knowledge Clusters” Innovative Actions Program first introduced the term in the form of sector specific calls for innovative projects with scientific support. Since 2006, consistent cooperation among its present partners and various collaborations within national and European funded projects has been in place.

The first attempt to form a “biocluster” was the “Regional Innovation Pole of Western Macedonia” which was a national project undertaken over the period 2007-2008. Through this project, regional stakeholders including the national electricity utility Public Power Corporation (PPC), the University of Western Macedonia and CERTH, cooperated under a common scheme and focused on various research activities in the energy sector, including the first tests of biomass co-firing at the Kardia power plant.

An FP7-funded project (Demonstration of Large Scale Biomass Co-Firing and Supply Chain Integration project or DEBCO) followed up these activities and linked the co-firing PPC’s research actions with similar activities in Belgium and Italy as well as with the experience of EU R&D centres and industrial actors.

In 2010, the “BioClus” FP7 project formed the “proto-cluster” core, made of four of the present partners, which boosted the development of the Cluster.

**Biocluster organization**

Finally, the biocluster was officially established in February 2014 through the Strategic Med project “Proforbiomed”, which covered some limited costs for the initial stage of the establishment and regional and national promotion of CluBE. Its
form is a not-for-profit company, it is rather sector-specific and its members cover the Triple Helix regional tissue for bioenergy and environment topics.

Table 3.2 Cluster performance in biocluster organisation

<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary biomass sectors</th>
<th>Energy (CLUBE DIAZYMA)</th>
<th>R&amp;D services in biomass (CERTH)</th>
<th>Textiles and clothing (FUR)</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central organisation that coordinates, manages, and facilitates the biocluster</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Role of key actors</td>
<td>• Entrepreneurs</td>
<td>IS</td>
<td>IS</td>
<td>IS</td>
<td>IS</td>
</tr>
<tr>
<td></td>
<td>• Policy</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>IS</td>
</tr>
<tr>
<td></td>
<td>• RTD</td>
<td>IS</td>
<td>IS</td>
<td>IS</td>
<td>IS</td>
</tr>
<tr>
<td></td>
<td>• Funding</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>IS</td>
</tr>
</tbody>
</table>

The performance of the bioeconomy sectors in terms of organisation has been quite moderate across both the initial stages, while it has significantly improved through the drive to maturity stage. The role of key actors has been moderate in both stages for most of the sectors with the exception of strong RTD in energy, strong presence of entrepreneurs in textiles and food and strong involvement in energy, R&D and textiles sectors.

**Barriers**

- There are a number of organisation-related barriers. The private sector lacks an innovation culture and innovation is not promoted adequately by regional and local authorities. Lack of funding has prohibited the official formation of the cluster despite the fact that there have been strong collaborations for more than a decade.
- Small scale of enterprises implies time-consuming and significant level of training, networking and complex interactions and this is expected to delay the integration of the various sectors.
- There is a low level of science-business collaboration and also a lack of cooperation mentality on the entrepreneurial sector.

**Enabling factors**

Consistent participation of entrepreneurs and good cross sector collaboration among primary and end use sectors.

Central location of the cluster and the cooperatives provides excessive exposure and public awareness of the primary sector’s stakeholders about the cluster’ existence and activity.

**Actors**
Various actors have been participating in the biocluster.

**Public Sector:**

- Region of Western Macedonia (Regional Authority)
- Regional Development Fund of Western Macedonia
- Regional Association of Western Macedonia Municipalities

**R&D:**

- University of Western Macedonia
- Centre for Research and Technology-Hellas (CERTH) / Chemical Process & Energy Resources Institute (CPERI)
- Technological Research Centre (TRC) of Western Macedonia
- Environmental Centre of Western Macedonia
- Technological Educational Institute of Thessaly / Department of Furniture Technology

**Entrepreneurship:**

- Regional Development Agency of Western Macedonia, ANKO S.A.
- Waste Management Company of Western Macedonia, DIADYMA S.A.
- Kozani’s Municipal District Heating Company, DEYAK S.A.
- Ptolemaida’s Municipal District Heating Company, DETYP S.A.
- Forest Agricultural Association of Pentalofo
- Dimitra Agricultural Association
- Alfa Wood S.A. Wood Industry
- Giotas S.A. Wood Industry
- Chliapas S.A. Wood Industry
- Eyxylon Ziogas G.P. Wood Industry
- Kombi Thermodynamiki S.A. Heating Products Industry
- Biozone P.C. Biomass Logistics Company
- Hellenic Forests G.P. Studies Services Company

**Table 3.3 Cluster performance in actors involved**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary biomass sectors</th>
<th>Energy</th>
<th>R&amp;D services in biomass</th>
<th>Textiles and clothing</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneurs activity</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Interaction of entrepreneurs with RTD</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Geopolitical position of the region</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
</tbody>
</table>

They are all expert organizations mostly with complementary competences and could as such work rather well together in comprehensive development of the bioenergy sector.

**Policymakers**
The Regional Authority of Western Macedonia took part in this initial stage and, together with the University of Western Macedonia, initiated an information and dissemination strategic approach, including the production of promotional material (leaflets, brochures, videos, etc.) as well as a number of workshops and technical meetings, in order to spread the concept at regional level and potentially attract new members. At a later stage, the Decentralised Authority of Epirus and Western Macedonia, after being informed, has been quite actively involved in the promotion of the cluster’s objectives.

Some of the regional policy makers have been committed at a rather high level in developing the cluster and its activities, while others are still lagging behind. There is still a lot of work to be done with information dissemination, in order to mobilise more key actors, such as the Managing Authorities of the Regional Operational Program of Western Macedonia.

**R&D institutes**

The following R&D institutes took part in the initial stage of CluBE:

- University of Western Macedonia
- Centre for Research and Technology-Hellas (CERTH) / Chemical Process & Energy Resources Institute (CPERI)
- Technological Research Centre (TRC) of Western Macedonia
- Environmental Centre of Western Macedonia
- Technological Educational Institute of Thessaly / Department of Furniture Technology

The institutes are mainly located within the Region, with the exception of the “Technological Educational Institute of Thessaly / Department of Furniture Technology” which is located in the neighbouring Region of Thessaly, but which maintains strong links with the regional actors and especially the wood manufacturing enterprises.

**Barriers**

- Lack of consistent financing and low cash flow liquidity
- Small scale infrastructures with lack of well-trained human resources and this prohibits fast uptake of innovation and slows knowledge transfer.
- Entrepreneurial and innovation support services (like one – stop - shops) are not working properly – low response and feedback of SMEs to incentives of the Regional Development Agency (Enterprise Europe Network).
- Market vision often short timed.
- Not strategically positioned to long term perspectives.
- Poorly positioned on key technologies.
**Enabling factors**

Strong collaboration with R&D, regional partners and entrepreneurs in several EU and nationally funded projects.

**Biomass supply**

CluBE is based on a wide range of biomass, including forest and agricultural waste (both residual and plantations), urban waste, energy plantations, etc. It is envisaged that in the future, a potential integration of the agricultural cooperatives, the wine cluster and the fur association will enlarge the feedstock base.

**Table 3.4 Cluster performance in biomass supply**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary biomass sectors</th>
<th>Energy</th>
<th>R&amp;D services in biomass</th>
<th>Textiles and clothing</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IS DMS IS DMS IS DMS IS DMS</td>
<td>IS DMS IS DMS IS DMS</td>
<td>IS DMS IS DMS IS DMS IS DMS</td>
<td>IS DMS IS DMS IS DMS IS DMS</td>
<td></td>
</tr>
<tr>
<td>Biomass availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigenous supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biomass trade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Barriers**

- Small scale farms and diverse raw material is a challenge to collect and handle.
- Handling and logistics of agricultural biomass are not yet well developed
- New investments in infrastructures (equipment, storage, handling, etc.) is required to support future development of the clusters activities.
- Changing governmental policies can lead to high/low demand of product with high impact on economy and ecology (e.g. rise in fuel taxation led to a rise in firewood consumption, often leading to illegal logging and environmental pollution after combustion).
- Supply is seasonal dependent (e.g. wood, food).

**Enabling factors**

- Variety of resources can be potentially available.
- Presence of wood industries facilitates the availability of residual biomass.
- Some strong cooperatives with high entrepreneurial culture in the region.

**Competitive bioeconomy products**

The main products at the moment are bioenergy but at cross sector level there is wine, fur and fruits produce which is of high quality with good exporting capacities.

The majority of the products relies mostly on traditional processes which small attempts from cross overs have been made in the field of exploring residual streams for heat and electricity at small, local scales.
<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary biomass sectors</th>
<th>Energy</th>
<th>R&amp;D services in biomass</th>
<th>Textiles and clothing</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation of bioeconomy products</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Cross over/Transfer between sectors</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Degree of innovation</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
</tbody>
</table>

**Barriers**

- Variability of bio-based market sectors increases the complexity for cross over technological transfers, scaling up of new conversion pathways and commercialisation of new bio-based products.
- Competition from Far East based on low cost prices and low quality products
- Market vision often short timed
- Not strategically positioned to long term perspectives
- Poorly positioned on key technology
- In general prefer to play the role of component supplier to large companies
- Business concentration: consolidation of the market into a few major existing international companies

**Enabling factors**

- Consistent and continuous transfer of knowledge and strong collaboration between R&D and entrepreneurs within the energy and R&D sectors
- The economic crisis has highlighted again that the identification of cost effective and environmentally friendly forms of heating is critical for long-term sustainability.

**Funding**

The availability of funds has been rather slow to moderate across the under study sectors and the two development stages. Mostly public funds through EU support activities (cohesion funds, regional operational programs etc.), the recent establishment of the cluster as a legal entity and its promotion campaign. Private funds have been available for R&D, textiles and food sectors during the drive to maturity stage.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary biomass sectors</th>
<th>Energy</th>
<th>R&amp;D services in biomass</th>
<th>Textiles and clothing</th>
<th>Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public funds</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Accessibility of funds / Procedures</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
<tr>
<td>Private funds</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
</tr>
</tbody>
</table>

**Barriers**
Lack of consistent financing prevents growth of the cluster.
Low focus on alternative funding mechanisms such as joint ventures, industrial support.

**Enabling factors**
- EU funding through projects
- Strong and continuous project development activities with the collaboration of R&D and entrepreneurs.

**Policies and measures**
The key drivers for policy formation in the region so far have been energy security, improvement of infrastructures and support for rural development and tourism including agro-tourism.

The national policy on RES (Law 3851/2010) and the bioenergy feed-in tariffs have been of high relevance to the initiative of CluBE. Additionally, the European Emission Trading System (ETS) had an impact on the economic investigations, since biomass is considered as CO\(_2\) neutral and its combustion does not require PPC to purchase CO\(_2\) certificates. The Industrial Emissions Directive also had an impact, in the sense that many lignite power plants are scheduled to close down in the coming years due to old age and inadequate environmental performance and biomass co-firing could provide some opportunities for emissions reduction.

The national and EU R&D policies and the funding they could secure for such activities were essential for the research activities performed.

Actually none of the national or regional instruments and measures has been used yet from the CluBE, but there is a discussion and effort to submit proposals to the “Green Fund” and “Local Development Fund”.

**Table 3.7 Cluster performance in policies and measures**

<table>
<thead>
<tr>
<th>Issue</th>
<th>Primary sectors</th>
<th>biomass</th>
<th>Energy</th>
<th>R&amp;D services in biomass</th>
<th>Textiles and clothing</th>
<th>Food (wine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presence of policy instruments</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
</tr>
<tr>
<td>Effectiveness of policy instruments</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
</tr>
<tr>
<td>Consistency of policy</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
</tr>
<tr>
<td>Monitoring procedures</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
<td>IS</td>
<td>DMS</td>
</tr>
</tbody>
</table>

**Barriers**
• The fragmented nature of the various bio-based economy sectors prohibits the fast design and uptake of cross sector targets and the subsequent sectorial policy alignment.
• The complexity of data required alongside with the large datasets required causes delays in providing evidence and informing policy formation.
• Reinforcement of transregional and international perspective would expand business development prospects.

Enabling factors

• Consistency and stability of policy aims and targets in the energy sector.
• High demand of bioenergy (products and projects planned) – opportunity for the region.

2.5 Concluding remarks and lessons for other regions

Concluding remarks

The region of Western Macedonia is of national significance in energy production. More than 50% of Greek electricity is produced in Western Macedonia, mostly by lignite fired power plants although the contribution from renewable energy has grown in recent years. Considerable efforts have been made by the Regional Authority, R&D Institutes and other key stakeholders and policy makers to improve the policy, socio-economic and R&D landscape regarding bioeconomy. However, due to the financial crisis many of the proposed investments have not been implemented.

Difficulties and opportunities during this stage

The most important difficulty is the lack of consistent funding and several sources are currently being explored, such as the Regional Development Fund, the Local Development Fund, as well as other regional, national and EU potential funding resources.

The economic crisis provides an opportunity for the Cluster, as the general population is looking for cost effective forms of heating and the private business sector is looking for ways to survive the difficult period. The period of the new Operational Programming 2014-2020 represents a significant opportunity as well, with the emphasis put upon the bioeconomy, which is in the heart of CluBE’s objectives.

Lessons learned

General lessons from the development of the bio-cluster in Western Macedonia

In this section a set of general lessons have been collected based on the interviews with stakeholders in the Good Practice clusters/ regions. The lessons are linked to
key assets namely: cluster organisation; actors; biomass supply; competitive biobased products; funding and policies/ measures. The lessons are further evaluated with the support of the regional agency as opportunities and/or barriers for the future development of the cluster in Western Macedonia to foster the development of concise recommendations.

The analysis presented in Table 4.1 is integrated into the last section of this chapter dealing with recommendations for the region. It is essential for a Cluster to identify at an early stage those objectives that are common and fundamental for most – if not all – of its members and that all of its members are willing to support and commonly pursue in due time. It also takes a committed core of people that maintain their focus upon developing the Cluster’s activities. Funding is important for the initial stage, because it allows for the events and meetings that will help create the initial momentum of the Cluster.

<table>
<thead>
<tr>
<th>General lesson</th>
<th>Key asset related to</th>
<th>Stage related to</th>
<th>Opportunities/ Barriers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Triple helix is beneficial; Academic sector, public administration sector, industry and private sector.</strong></td>
<td>Cluster organisation</td>
<td>IS, DMS</td>
<td>Several examples of collaboration within EU funded projects exist. Lack of trust and cooperation between business and academia (beyond EU/national funded projects). Lack of substantial support from local authorities, lack of trust between cluster members due to competition among them, inadequate relevant legislation, lack of will and/or knowledge for pooling of different policies.</td>
</tr>
<tr>
<td><strong>Networking is of great importance, in particular joint actions with different target groups having the same targets.</strong></td>
<td>Actors</td>
<td>IS, DMS</td>
<td>Can lead to finding new financial instruments. Openness of markets and truly global competition → requirement to compete at the higher value market segments and demonstrate an ability to innovate and internationalise.</td>
</tr>
<tr>
<td><strong>Relatively open and close cooperation and common targets, shared visions and a kind of open innovation system to some extent.</strong></td>
<td>Actors</td>
<td>IS</td>
<td>Regional authorities are not aware of the research conducted in the region (no repository – platform does exist to capitalize on the results achieved in the region). IPR are almost unknown among the companies of the cluster.</td>
</tr>
<tr>
<td><strong>Location close to raw material is a key success factor</strong></td>
<td>Biomass supply</td>
<td>IS, DMS, MS</td>
<td>Short distance to raw materials is an asset for production and logistics. Widespread forestry area, creation of new green energy jobs, potential for cogeneration and trigeneration systems together with district heating and cooling systems.</td>
</tr>
<tr>
<td><strong>The scale and nature of supply &amp; logistics is complex; it is therefore very important that local</strong></td>
<td>Biomass supply</td>
<td>DMS, MS</td>
<td>Mutual collaboration and information regarding offer and demand is missing.</td>
</tr>
</tbody>
</table>
industry and regional authorities have strong collaborations

Policies with a long term orientation on bioeconomy are more likely to be successful.

Policies IS, DMS, MS Stable governmental policies/fiscal policies are in favour of new investments and sustainable or long term planning

The future strategy and perspectives of the cluster should be carefully considered with the participation of the industry.

Policy DMS, MS Industry’s needs (new products, processes, new markets, new financial instruments etc.) are essential for the survival of the cluster

If business development is only dependent on public funding, then there is a risk.

Funding DMS, MS Private funding should be secured to impulse competitive products

Subsidies for initial investments in bioenergy have been crucial.

Funding IS, DMS Capital costs should be (partly) covered by subsidies.

Table 4.2 Specific lessons learnt in Western Macedonia compared to good practices

<table>
<thead>
<tr>
<th>Specific lessons per key asset</th>
<th>Specific lessons</th>
<th>Bioeconomy sectors¹¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisation</td>
<td>Central location of the cluster and the cooperatives provides excessive exposure and public awareness of the primary sector’s stakeholders about the cluster’s existence and activity.</td>
<td>Primary biomass Energy Textiles &amp; clothing Food</td>
</tr>
<tr>
<td></td>
<td>Lack of funding has prohibited the official formation of the cluster despite the fact that there were strong collaborations for more than a decade.</td>
<td>Primary biomass Energy</td>
</tr>
<tr>
<td>Actors</td>
<td>Long tradition &amp; strong history in the field</td>
<td>Textiles &amp; clothing Food Energy R&amp; D services</td>
</tr>
<tr>
<td>Research organisations have strong expertise and international leadership</td>
<td>Energy R&amp; D services</td>
<td></td>
</tr>
<tr>
<td>Strong cooperatives with high entrepreneurial culture in the region.</td>
<td>Textiles &amp; clothing Food</td>
<td></td>
</tr>
<tr>
<td>Supply</td>
<td>The establishment of intermediate companies for the organization of biomass logistics is a missing link for medium/large scale applications in Western Macedonia.</td>
<td>Primary biomass Energy</td>
</tr>
<tr>
<td>Products</td>
<td>Variability of bio-based market sectors increases the complexity for cross over technological transfers, scaling up of new pathways and commercialisation of new bio-based products.</td>
<td>Primary biomass Energy R&amp; D services Textiles &amp; clothing Food</td>
</tr>
<tr>
<td>Efficient transfer of knowledge and high rates of adoption of innovation</td>
<td>Primary biomass Energy</td>
<td></td>
</tr>
<tr>
<td>Funding</td>
<td>A stable and secure environment is a prerequisite so that private and public companies invest in bioeconomy</td>
<td>Primary biomass Energy</td>
</tr>
</tbody>
</table>

¹¹ The bioeconomy sectors defined in BERST
Recommendations

Based on the conclusions and the general and specific lessons presented in the tables above, recommendations are provided for the transition to the next development stage (maturity) for each of the key assets examined in the previous sections.

The key recommendations for organisation include the following:

- Foster investment for the reduction of the environmental impacts of productive systems.
- Investments attraction towards regional RES companies, through the organisation of commercial missions and facilitating soft landing process.
- Support local supply chains financing cross-sectoral collaboration (example agro-energy chain) and promoting the adoption of business network contracts.
- Simplification of bureaucratic procedures for projects financed by public programmes and calls for proposals.
- Increase the coordination between research bodies, scientific/engineering universities, economics universities and private companies, by focusing on the projects with most probable industrial impacts: Clusters as structure to establish permanent collaboration among research and industry.
- Developing a «Cluster culture».

The key recommendations for actors include the following:

- Support collaborative R&D activities for new sustainable technologies, new products and services.
- Development and support of vocational education and training networks in domains with potential shortages/domains needing new or upgrade of existing competences or networks linking relevant actors in the green economy/bioeconomy field related education and training such as universities, other research institutions, business etc. to address knowledge, skills and competences needs and gaps.
- Upgrade the competences of the work force, adapting the supply of vocational education and training to the economic trends and productive system needs.
- Life-long training and improved retraining programmes in addressing companies employees at all levels (workers, managers, entrepreneurs, professionals).

The key recommendations for biomass supply include the following:

<table>
<thead>
<tr>
<th>Clear rules and simplified procedures</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies</td>
<td>Energy</td>
</tr>
<tr>
<td>The policy framework needs to be quite stable in order to allow for long term planning.</td>
<td>Primary biomass</td>
</tr>
<tr>
<td>Reinforcement of trans-regional and international perspective would expand business development prospects.</td>
<td>Textiles &amp; clothing</td>
</tr>
<tr>
<td>Food</td>
<td>Food</td>
</tr>
</tbody>
</table>
• Enhance and update legal framework in order to yield more competitive wooden products (up to now only wood logging cooperatives are allowed to harvest wood in public forests).
• Informing and promoting the “collaborative spirit” to biomass producers in order to establish trust between production and demand site.

The key recommendations for competitive biobased products include the following:

• Sound system of agencies and tools (e.g. business network contracts) to increase competitiveness of companies in a) innovation, b) internationalisation

The key recommendations for funding include the following:

• Fiscal and administrative measures to attract foreign industrial and financial investors.
• Smart Specialisation Strategy - elaboration of joint calls for proposal among European Regions.
• Public funding of projects should be secured and further enlarged, especially in periods of recession as it can contribute to the development of small companies, which are lacking financial resources.

The key recommendations for policy and measures include the following:

• Review of current legislation to facilitate a broader involvement of local communities in authorization processes (for new plants installation, public works, infrastructures, etc.).
• Clusters and other enterprise aggregations as tools to create enabling environments for the birth and growth of emerging industries in bioenergy. Involvement of clusters in the elaboration of the regional work programs for each area of specialisation.
• Undertake an important evolution of the way education and training are delivered in order to build a new entrepreneurial mind-set in the people at all levels.
• Disposal of biomass should be controlled in order to achieve the best environmental impact. For example, the practice of burning crop residues in the open field persists although this is illegal. Removal of residues from agricultural fields needs careful consideration since it may affect environment (soil properties, air quality etc.), and agricultural productivity.

2.6 References/ Links
http://www.proforbiomed.eu/project/partners/region-western-macedonia