Case BIOCLUS

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The use of biomasses and competition for biomass resources are rapidly increasing in Europe. Central Finland has taken the joint initiative to strengthen the regional expertise, cooperation capacities and innovation environment in the field of sustainable use of biomass resources by the project of BIOCLUS coordinated by JAMK University of Applied Sciences. In each of the five European target regions - Central Finland, Navarre in Spain, Western Macedonia in Greece, Slovakia, and Wielkopolska in Poland - the BIOCLUS partners form a biomass-related research-driven cluster. The clusters first build up regional strategic R&D agendas (SRA) and then joint action plans (JAP) based on the SRAs. The JAPs are also implemented during the project. This article focuses on describing the research-driven cluster in Central Finland and the process of producing the SRA.

Keywords: biomasses, sustainability, research-driven cluster, strategic research agenda

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Introduction

The use of biomasses is growing rapidly in Europe. Competition for biomass resources within and between the business fields is increasing. At the same time, there is a global trend toward the sustainable use of renewable biomass resources. Europe has huge but restricted resources of biomass. The most important biomass resources are forest biomasses, agricultural biomasses, by-products of versatile biomass-based processes, and industrial and municipal wastes. Today, biomasses are used for

- versatile bulk products (e.g. paper, pulp, chemicals, furniture)

- food and fodder production
- renewable energy production (heat, electricity, pellets and transportation fuels)
- construction (wood-based materials are preferred over energy-intensive materials such as steel and concrete to lower emissions and support the Kyoto process)

In Central Finland, forests and forest-related businesses are remarkable drivers in the regional economy. Further, the province has a strong tradition of cooperation between research and development entities, authorities and enterprises in national and international projects. Therefore Central Finland took the initiative to strengthen the regional expertise and cooperation capacities in the field of sustainable use of biomass resources by the joint international project of BIOCLUS - *Developing Research and Innovation Environment in Five European Regions in the Field of Sustainable Use of Biomass Resources* (www.bioclus.eu).

The overall objective of BIOCLUS project is to boost the regional competitiveness and growth in five European regions: Central Finland, Navarre in Spain, Western Macedonia in Greece, Slovakia, and Wielkopolska in Poland (Fig. 1). The project promotes collaboration and integration of target regions and strengthens the innovation environment by improving research potential and innovation management. BIOCLUS also supports sustainable development by improving the use of biomass resources. The development is achieved by

- promoting scientific, strategic and business competence at the regional and consortium level
- developing collaboration capabilities in the regions and consortium
- bridging innovation and business by mutual learning and by mentoring

BIOCLUS is co-financed by the Regions of Knowledge Programme of European Seventh Frame Work Programme (FP7). The three-year project was started at the end of 2009 and is coordinated by the JAMK University of Applied Sciences (JAMK). BIOCLUS consortium consists of 20 partners, six of which – Benet Ltd, Jyväskylä Innovation Ltd, the Regional Council of Central Finland, the University of Jyväskylä, the VTT Technical Research Centre of Finland, and JAMK – are located in Central Finland.

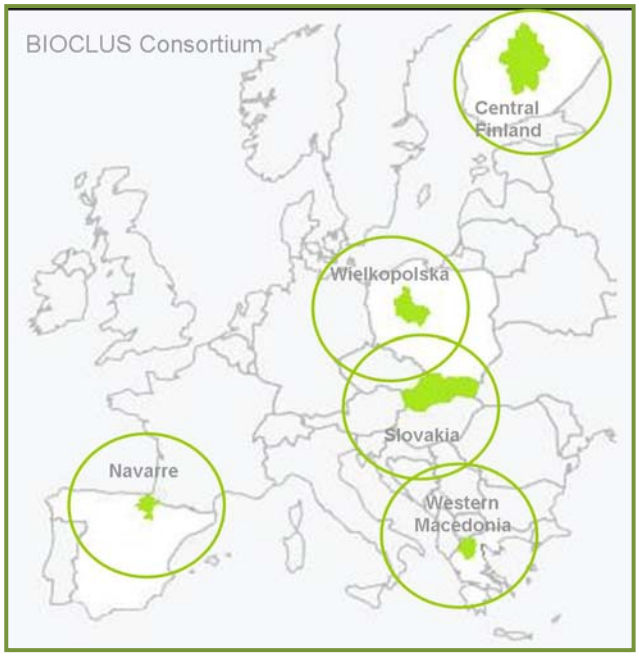

Fig. 1. BIOCLUS regions.

In each of the five BIOCLUS regions, the partners form a biomass-related research-driven cluster. The target areas locate in rural regions and possess great biomass resources such as forests, agriculture, industrial and agricultural by-products as well as municipal waste. The biomasses are challenging raw material. The utilization chains require special technical and practical competence and applications. Further, the use of resources should be efficient and sustainable. Furthermore, the biomass resources offer great possibilities to BIOCLUS regions in economic and social terms. The research-driven clusters aim to advance the research and technological development (RTD) activities and innovation systems.

Central Finland may be called Bioenergy Province. The province has a long tradition and world- class expertise in bioenergy supply from small scale production up to large scale combined heat and power production. Further, there are several R&D programmes targeting to development of the entire value chain. Bioenergy is one of the priorities in regional development and there are ambitious targets to increase bioenergy production and utilisation. Already half (almost 9 terawatt-hours/year) of the province's primary energy demand is met by local biomass sources, and the target is to increase the amount by 4 terawatt-hours so that local biomass sources would meet 75% of the primary energy demand in 2015 (http://www.keskisuomi.fi/bev/?id=562).

Educational and R&D&I activities of JAMK are also contributing to the accomplishment of provincial goals by increasing the know-how, innovativeness and competitiveness of especially small- and medium-sized entrepreneurship in the field of bioenergy. The Strategy 2010-2015 of JAMK defines bioenergy as JAMK's regional centre of expertise. JAMK is directing funding in investments and projects that support the implementation of the organization's strategy. BIOCLUS is one example of such a project. The coordination of BIOCLUS and cooperation with the consortium strengthen the role of JAMK in the regional, national and international operational environment.

In BIOCLUS, the five European cluster regions first build up regional strategic research and development agendas (SRA) and then joint action plans (JAP) based on the SRAs. This article focuses on describing the research-driven cluster in Central Finland and the process of producing the SRA.

Research-driven cluster in Central Finland

The successful development of a research-driven cluster requires the commitment of regional research entities and other RTD organizations as well as the commitment of regional authorities and the business entities.

In Central Finland, bioenergy and sustainable use of biomasses play an important role in the province's regional plans and regional programmes (http://www.keskisuomi.fi/fin/suunnittelu_ja_kehittaminen). The regional and national authorities have heavily invested in RTD activities in the field of sustainable use of biomass resources.

The Regional Council of Central Finland has a statutory role to plan and lead regional development work. It guides the financial instruments targeted in research and regional development in co-operation with regional Centres for Economic Development, Transport and the Environment.

The Regional Council has three strategic business fields: metal industry, construction industry and bioenergy. The R&D&I activities related to these business fields are supported by the regional cluster programmes funded by the Regional Council of Central Finland (Clusters in Central Finland):

- Dynamic Bioenergy (2007-2015), coordinated by JAMK during 2007-2010
- Developing Housing (2007-2015), coordinated by the Jyväskylä Educational Consortium during 2007-2010
- New Generation Machines and Equipment (2007-2015), coordinated by Jyväskylä Regional Development Company Jykes Ltd during 2007-2010

All the clusters are related – directly or indirectly - to the use of biomasses and they have challenging development targets.

There are also two Centres of Expertise related to biomasses in Central Finland:

- Jyväskylä Region Centre of Expertise for Energy Technology, focusing on bio-energy production and utilization technologies
- Jyväskylä Centre of Expertise for papermaking technology, focusing on chemical wood processing industries and systems related to chemical wood processing and equipment.

Both Centres of Expertise are formed by the regional business entities, research entities and regional authorities and are coordinated by Jyväskylä Innovation Ltd. (http://www.jklinnovation.fi/default/www/jyvaskyla_innovation_oy/osaamiskeskusohjelma/)

Jyväskylä Innovation Ltd is a development company that develops innovation environment and technological clusters, and supports growth, development and competitiveness of technological enterprises in Jyväskylä Region and Central Finland. (www.jklinnovation.fi/en)

The VTT Technical Research Centre of Finland (www.vtt.fi/?lang=en), the University of Jyväskylä (www.jyu.fi/en) and the JAMK University of Appplied sciences (www.jamk.fi) are major research institutes in the research-driven biomass-related cluster in Central Finland. The VTT and the University of Jyväskylä have high-quality scientific and applied expertise in the relevant fields.

In the cluster, JAMK's main focus area is bioenergy and the related topics on sustainable utilization of natural resources. JAMK has strong applied expertise in bioenergy, which is strengthened by other JAMK's expertises in the biomass-related fields such as natural resources, logistics, paper machine technology, mechanical engineering, maintenance, and business management. JAMK's activities in bioenergy are coordinated by the Bioenergy Development Centre (BDC), which is the centre of

expertise and technology of applied R&D&I (Bioenergy Development Centre). BDC is located in Saarijärvi about 60 kilometres north-west of Jyväskylä. BDC has high-quality facilities to carry out applied research on biomass production, logistics technologies and combustion technologies. The Centre was established in early 2000 by the Interreg IIIB BSR Programme. The operational model of BDC is networking with strategic partners such as the VTT Technical Research Centre of Finland, the University of Jyväskylä, and the Vocational Education and Training Centre in Northern Central Finland/Natural Resources and the Environment. The activities at BDC are customer-oriented and take place in the interface of enterprises and working life.

There are some business entities that have a major influence in biomass-related activities in Central Finland, such as Vapo Ltd, Jyväskylän Energia Ltd and Benet Ltd. Vapo Ltd is an international biomass supplier and energy producer and Jyväskylä Energy provides electricity and heat for domestic markets. Benet Ltd is a small company managing the Benet Network, which was established by the European Altener project more than 10 years ago. The aim of the Benet Network is to increase and develop the regional collaboration between bioenergy RTD organizations, forestry organizations and system suppliers. Benet Ltd also manages the Energy Agency of Central Finland, which was founded more than 10 years ago by the European Save Programme.

The Forestry Centre of Central Finland is responsible of regional forest management and promotes the Regional Forest Strategy, which is in line with the national Forest Strategy. The regional Centre for Economic Development, Transport and the Environment has the best regional knowledge about environmental issues and promotes the Environmental Strategy. Those strategies also support the sustainable and multi-functional use of forests.

In Central Finland, the pulp and paper industries and paper machinery production play a remarkable role in the regional economy. The pulp and paper markets have recently been in deep recession and there is a need to find new competitive products. Consequently, there is a strong drive by authorities, regional development companies, and industries to meet these challenges.

Presently, the annual number of spin-offs and start-ups is about 2 to 4 new technology enterprises and 3 to 5 consultancy companies related to the use of biomasses in

the province. Many of these companies are directly in the global market. They often co-operate closely with large companies, such as Metso Paper Machineries Plc. In the fields of logistics and maintenance of forest products, tens of companies are established yearly. These companies are typically operating in the biomass procurement chain and have regional orientation.

BIOCLUS procedure

The work to produce regional strategic research and development agendas (SRAs) for sustainable and multi-functional use of biomasses was started in the beginning of 2010 in the five BIOCLUS regions. The agendas consider the economic, environmental and social impacts of utilization of biomass resources. The SRAs are based on a comprehensive understanding of regional biomass resources. Consequently, the strategy process was started by analyzing the operational environment in each BIOCLUS region. The collected data was then used for SWOT analyses. All the analyses provide information for regional SRAs, which will be completed by the end of 2010. Based on SRAs, regional joint action plans (JAPs) and a common international JAP will be produced in spring 2011. The implementation of JAPs will be facilitated in the project until the end of 2012. The whole BIOCLUS procedure is shown in Fig. 2.

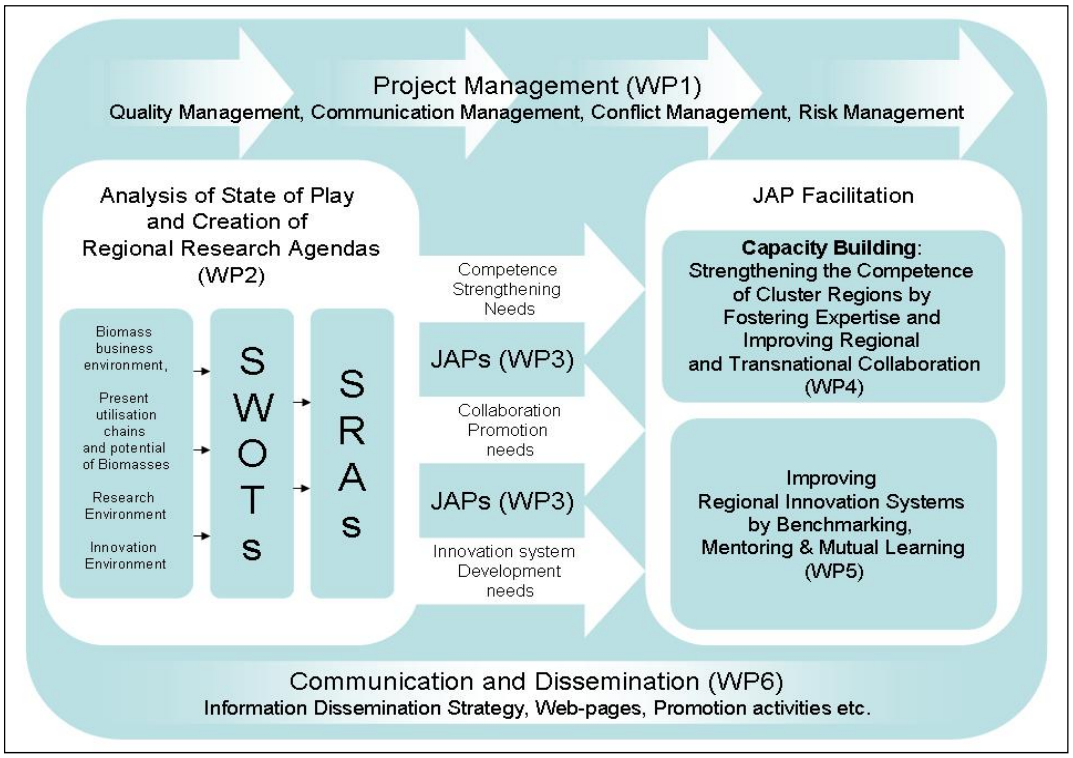

Fig. 2. BIOCLUS procedure. WP = Work Package, SRAs = Strategic Research and Develoment Agendas, JAPs = Joint Action Plans.

Developing the SRAs in BIOCLUS

Operational environment – Analysis of the state of play and development needs

Analysis of the operational environment aims to facilitate the creation process of the regional strategic research and development agendas (SRA) and to provide information for two SWOT analyses. The analyses in Central Finland were carried out by the regional BIOCLUS partners. The analysis of the state of play and development needs was divided in the following tasks (*a-f*):

a) *Analysis of existing innovation environment including financial opportunities*

Regional innovation systems include the producers and users of new information, knowledge and know-how and the various ways in which they interact. Better science, technology and innovation policies may ensure balanced development of the regional innovation systems and strengthen the cooperation within them. This analysis is closely related to those described below in items *b)* and *e)*. The analysis includes the following topics:

- public and private support for enterprises (incubators, IPR-support, commercialisation from research to product, business support services, business facilities),
- networking within the business field,
- financing instruments at the local, regional, national, and European level
- available RTD services for enterprises and their participation in common RTD activities

b) *Analysis of the business potential in the field of sustainable use of biomass resources*

In BIOCLUS regions, there are a variety of companies using biomass resources. However, there are still some potential biomass resources that are not efficiently utilized. Resources that are presently identified as wastes from industrial and agricultural processes should especially be considered for further refinery. That would strongly support sustainable waste management. Furthermore, replacement of products originating from virgin raw materials by products originating from wastes would save natural resources. Even new markets could be invented as well as new financial tools. The development activities should therefore con-

sider these new business areas and support their further development.

c) *Analysis of biomass production, processing, logistics and use*

The production, processing, logistics and present use of biomass resources were analyzed in ecological, economic and social terms. This analysis is closely related to the one described below in item *d)*. The most important biomass utilisation chains in BIOCLUS regions were identified in the fields of pulp and paper industries, food supply, energy production, and wood production.

d) *Analysis of regional biomass potential*

The analysis covered the existing biomass potentials in BIOCLUS regions: wood and other forest origin biomass, field origin biomass, residues and by-products of agriculture, municipal solid waste including biogenic fraction, and others such as fast growing species in river banks and in wind breaks, etc.

e) *Analysis of existing research & development resources and activities*

The existing human resources of research, training and development, and research facilities as well as previous research, training and development activities in the cluster regions were also mapped and analyzed. The resources were located in research institutes, training organizations, and in RTD units of business entities. The human resources included researchers, experts, educational staff, students, and consultants. The research facilities and infrastructure included research centers and units, experiment sites and other machinery, equipment and systems available for RTD activities.

f) *Mapping the operational context*

In this task, the operational environment in regional, national, and international context was mapped. Promotional, regulative, and collaborative conditions at the regional, national, and European level were identified. The aim is also to map the existing links to European Technology Platforms, Joint Technology initiatives, and other European projects.

SWOT analysis from the perspectives of RTD and the economy

Two SWOT analyses were also produced for developing the SRAs. The SWOTs are

based on the information gathered in the above-mentioned analyses of the operational environment. The regional key-stakeholders were also contacted and invited to participate in the SWOT process.

The first SWOT analysis covers RTD and economic (innovation, business) strengths, weaknesses, opportunities and threats in the field of biomass resources. The second SWOT analysis (Table 1) identifies internal and external factors that are favorable or unfavorable for the sustainable use of regional biomass resources. The SWOTs were built up from the point of view of the biomass user/end-user such as pulp and paper production, energy production, wood product industries and food supply.

Table 1. The table of the second SWOT analysis.

	Helpful for sustainable and multi-functional use of regional biomasses	Harmful to sustainable and multi-functional use of regional biomasses
Internal origin (attributes of the research-driven regional cluster)	**Strengths**	**Weaknesses**
External origin (attributes of the operational environment of the research-driven cluster)	**Opportunities**	**Threats**

Producing the SRAs

The SRA development aimed to facilitate the creation of European research network between the BIOCLUS regions. The analysis of operational environment and the SWOTs for each region provide information, which helps each BIOCLUS cluster to focus their SRA on the knowledge areas most relevant in their region. The strategies cover the identification of possibilities and synergies for mutual learning and for the

exchange of best practices. Thus, the SRAs effectively support the further activities to strengthen the regional research-driven clusters (Fig. 3).

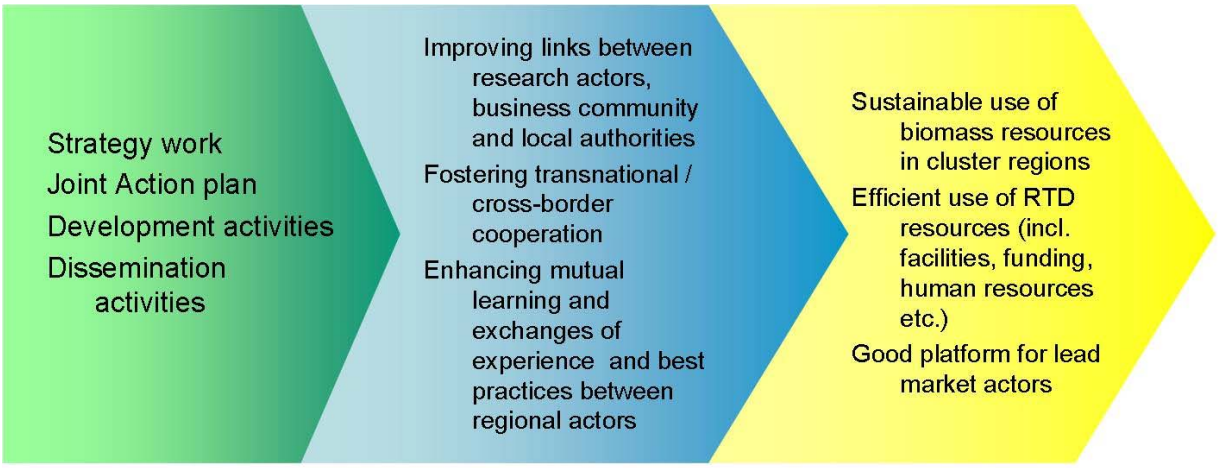

Fig. 3. SRA track in BIOCLUS.

The Polish partner and WP2 leader, Instytut Technologiczno-Przyrodniczy, provided the model of SRA for BIOCLUS partners. The model was then further developed for regional needs. The SRA defines the strategic research areas as follows:

- biomass production, handling, and processing technologies
- biomass logistics
- biomass combustion technologies
- fibre processes in wood processing industry
- developing the service know-how

The SRA considers regional targets for biomass use and existing research agendas, the present linkage to European Technology Platforms, joint technology initiatives, and other European projects. Key-stakeholders from different entities are involved in the process of producing the SRA. After the regional SRAs will be finalized, the Polish WP2 leader will produce a comparative analysis of the SRAs with the help of other partners. The comparative analysis will support the development of the joint action plan.

SRA provides a competitive advantage

The SRA development and the production and implementation of joint action plans of-

fer new opportunities for BIOCLUS regions (Fig. 4). The process supports innovation development in the field of sustainable use of biomass resources. SRA process strengthens the regional research-driven clusters by increasing the expertise, helping the clusters to apply EU research funding, and by offering a channel to actively participate in regional, national, and European networks.

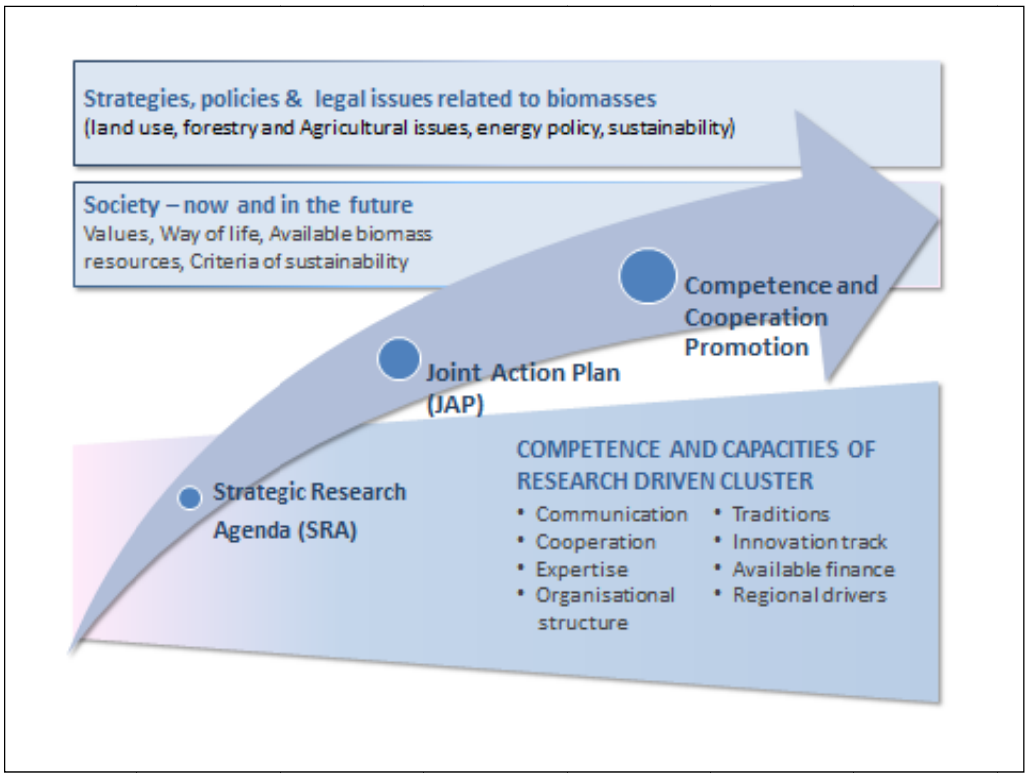

Fig. 4. Strategic research agenda provides a competitive advantage.

In Central Finland, the BIOCLUS project offers exceptional benefit to develop R&D&I activities. The SRA process produces comprehensive biomass-related information for the use of the entire research-driven cluster. Furthermore, the SRA is promoting top-level research in the region by rendering a tool to the cluster for setting common targets for research activities. In Central Finland, the expected results from the SRA process may be summarized as follows:

- Research and development activities become more goal-oriented
- Strategically important expertise grows at the regional level
- Research, training and development environments are used in a versatile and efficient manner
- More top-level research in the region
- Regional-, national-, and European-level networks are built and strengthened
- Cooperation capabilities are improved

- Innovation environment is developed
- Biomasses are used more sustainably

From the coordinator's point of view, the strategic cooperation in the BIOCLUS project strengthens JAMK's role in the innovation systems and in the R&D&I cooperation networks in JAMK's regional, national and international operational environment.