



# Mapping of EU Member States' / regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy

## Task 3

### Case Study Report Central Hungary region

Contract: RTD/F1/PP-03681-2015

November 30, 2016

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## 1. Short Regional Bioeconomy Profile

<b>Name of the case region/country</b>	Kozep Magyarország (Central Hungary Region) NUTS 2
<b>Member State</b>	Hungary
<b>GDP – Euro per capita (2014)*</b>	16 700
<b>Total ESIF Research &amp; Innovation per capita per year*</b>	4.92
<b>Total H2020 per capita per year*</b>	9.74
<b>Value Chain Approach to the Bioeconomy**</b>	Foods and beverages; Forest-based primary production; Crop-based primary production; Bio-energy and fuel from biomass; Bio-based chemicals
<b>Thematic Focus of the Bioeconomy Approach**</b>	Forestry and Wood; Crop Production; Wood-based biomass; Food Processing; Food Processing
<b>Research and Innovation Fields highlighted for the Bioeconomy**</b>	Biology, biotechnology, chemistry, life sciences, nano technologies, new materials; Quality, health, security in processing; Agronomy and crop sciences, oenology, fisheries; Forestry sciences
<b>Bioeconomy Activity Level**</b>	Moderate innovator (for the whole country)
<b>CASE STUDY SUMMARY</b>	
<b>Bioeconomy Approach</b>	Two major bioeconomy fields – the first linked to crop production with weaker links between R&I and businesses, the second based on biotechnology and ecology linked to water quality, waste water treatment, waste management.
<b>Bioeconomy Ecosystem</b>	Scattered and diverse; a number of science based actors involved either in fundamental or applied research with varying links to businesses; a few actors strong in applied research in the field of biotechnology or quality agriculture production; Small and medium innovative biotech companies prevail in the business sector together with few branches of international bioeconomy companies providing services to Central and Eastern Europe;
<b>Bioeconomy Policy Support</b>	No particular bioeconomy aimed support; general innovation support available; bioeconomy covered implicitly; RIS3 priorities cover various bioeconomy fields;
<b>Successful initiatives and Good Practices</b>	There are both, FP 7 and H2020 funded projects in bioeconomy in Central Hungary though usually covering the whole country. Two major types of successful initiatives may be found: (i) in agro-food sector aimed either at improving quality of production, stability of supply or technology innovation, (ii) in biotechnology aimed at new use of resources that used to be or are considered waste. Each type has one case described below.
<b>Main Needs, Gaps and Bottlenecks</b>	No particular bioeconomy strategy or schemes either regionally or nationally; bioeconomy competes regionally and nationally with other domains; lack of entrepreneurship and weak commercialisation outside capital Budapest;

\* Source of the data: S3 – Regional Viewer: <http://s3platform.jrc.ec.europa.eu/synergies-tool>

\*\* Data collected by this Study project in Task 1.

## 2. Regional Bioeconomy Ecosystem

### 2.1 Origin of Interest of the region in the Bioeconomy

The Central Hungary Region with the capital Budapest is a national core of academic, research and business activities in general and in bioeconomy as well. This central region represents the large bioeconomy potential of the whole country. Hungarian economy is traditionally strong in agriculture and food production and processing though forestry and wood processing are also important sectors in some areas. Hungary has favourable climate, soil and environmental conditions for agricultural production and agriculture is an important economic activity, particularly in rural areas. For large parts of Hungary are considered rural (with about 45% of population living in rural areas), agro–food sector is rather important though agriculture represents only 3,7% of Hungarian GDP and about 4,6% of employment.<sup>21</sup> Compared to the EU average the Hungarian agricultural sector is atypical with very high share of arable land (81% of agricultural land) and low grassland (14.2%). The most frequently grown plants in arable farming are cereals (wheat, corn, sunflower, rapeseed). There is also a significant production of livestock. Hungarian agriculture is capable of sustainably producing biomass in excess of food and feed demands. There is also a significant biogas production potential linked to agricultural production.

On the other hand the agriculture sector modernisation is still on–going. The average farm size in Hungary is 8.1 ha, much below the EU average, and 87% of the farms have less than 5 ha. Farmers' population has been ageing and the average age of farmers is much higher than is the case of average population. The extent of horizontal and vertical co–operation in the Hungarian agri–food sector is low. Hungary has a limited and outdated irrigation system and only 2.4% of the agricultural area is irrigated. Organic production is among the lowest in EU with 2.7%. Concerning biodiversity 83% of habitats are in poor condition. The main environmental challenges to be tackled concern the protection of biodiversity, the quality of surface and ground water and soil erosion. Despite favourable agro–ecological conditions and great production potential Hungary is frequently hit by significant water imbalances between drought and floods. Hence there is a clear need for more efficient water management.<sup>2</sup>

There is a significant amount of waste or residual materials in agriculture and food processing as well as in forestry and wood processing which can be transformed into by–products or secondary products thus increasing efficiency of the production and also contributing to sustainability of production by more effective use of resources.

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<sup>1</sup> A mezőgazdaság szerepe a nemzetgazdaságban, KSH, 2014 (The Role of Agriculture in the National Economy, Central Statistical Office, Hungary, 2014) <http://www.ksh.hu/docs/hun/xftp/idoszaki/mezo/mezoszerepe14.pdf>

<sup>2</sup> Factsheet on 2014-2020 Rural Development Programme for Hungary (downloaded on 13 July 2016) [http://ec.europa.eu/agriculture/rural-development-2014-2020/country-files/hu/factsheet-hungary\\_en.pdf](http://ec.europa.eu/agriculture/rural-development-2014-2020/country-files/hu/factsheet-hungary_en.pdf)

The biomass produced this way is a large potential source of sidestream products or as biomass for energy production.

Although the above described conditions are relevant to the whole country and its agro-food sector and forestry, the research and development activities in the sector are concentrated in Central Hungary region. Therefore, the Central Hungary is a main source of innovation in bioeconomy and provides services not only regionally but nationally. For the sector faces new challenges in modernisation, efficient use of resources, increase in productivity and innovation (of products as well as technologies) the Central Hungary is an important source of knowledge as well as business ideas for the rest of the country.

Hungary has also developed smart technologies in the bioeconomy field – bionics. These are concentrated in only three counties with the Budapest and Pest Counties being the most prominent in this field. Therefore the Central Hungary region has also potential for advanced technology development in bioeconomy.

## 2.2 Bioeconomy Stakeholders

Central Hungary region includes capital Budapest and its surrounding county Pest. About one third of companies registered in Hungary are located in Central Hungary. Hence, the key actors, private and public ones, are recognised as nationwide bodies rather than regional ones only.

Among the public research and education organisations the **Eötvös Loránd University, Faculty of Science** with its **Institute of Biology** plays an important role particularly in tertiary education and training. The University is the largest in Hungary with about 26 thousand students. The University **Centre for Innovation** provides services to university research teams and departments relating to innovation, cooperation with businesses and technology transfer. It is responsible for facilitating the exploitation of the research results produced by the University by acting as a bridge between the University and industry.

The **Szent István University** main campus is located about 30 km from Budapest in the town of Gödöllő but it has also premises in Budapest and elsewhere. Namely its **Faculty of Agriculture and Environmental Sciences** and also the **Faculty of Veterinary Sciences** can be associated with the bioeconomy field. The university enrolls about 15 thousand students.

**Hungarian Chamber of Agriculture** was established in the spring of 2013 as a public body uniformly organized at national level with mandatory membership following the previous Chamber with voluntary membership. It covers, apart from agribusiness sector, also the food processing industry and is involved in rural development activities. It runs a network of rural consultants across the country. Currently it has 360 thousand members.

**Bay Zoltán Nonprofit Ltd. for Applied Research** is the largest state-owned institution of applied research, its Department for Biotechnology Bay-Bio provides analytical services and undertakes research and development in applied microbiology (biorefinery and biocatalysis) and in biology based energy production (algal biotechnology, renewable energy development).

**National Agricultural Research and Innovation Centre** is an umbrella organisation of 11 research institutes combining applied and fundamental research in the fields related to bioeconomy, such as: Agricultural Biotechnology Institute (Gödölö, Pest), Institute for Animal Breeding Nutrition and Meat Science (Herceghalom, Pest), Central Environmental and Food Science Institute (Budapest), Institute of Agricultural Engineering (Gödölö), Fruit Research Institute (Budapest) and several others located outside the Central Hungary region. The Institutes vary a lot in their research and applications. A few spin-offs have arisen from the Agricultural Biotechnology Institute.

**Research Institute of Organic Agriculture** has got research specialisation in on-farm studies, grass seed mixtures, efficiency of organic farming on arable fields, arable fields research, research on organic agricultural methods, horticultural research. It is a partner of several H2020 projects – **DIVERSIFOOD, OK-Net Arable** – or FP7 project **HealthyMinorCereals**.

**INNOREG – Central Hungary Regional Innovation Agency**, an agency supporting overall innovation activities. The Agency has been active in Framework Programmes since its 5th programming period. Its innovation focus is aimed at networking activities, project development and implementation with a special interest in ICT sector. INNOREG is a ICT-NCP since 1998. Although involved particularly in ICT projects it is active in other sectors. From the bioeconomy field the Agency is partner in “**Young InNOvators Network for SustainaBLE Ideas in the Agro-Food Sector**” (NO-BLE Ideas project) funded by South-East European Transnational Cooperation Programme which includes 6 other countries from the southern Europe and Balkans.

**Budapest Sewage Works** is the largest environmental management company of Hungary. It has invested in a **pilot scale algae production unit** at the North Budapest Waste Water Treatment plant.

**National Research, Development and Innovation Office (NRDIO)** of Hungary is a national strategic and funding agency for scientific research, development and innovation. The NRDIO was established by fusion of National Scientific Research Office (OTKA Office) and National Innovation Office (NIO). The new office has been operating from January 1<sup>st</sup> 2015.

Private companies are also active in bioeconomic research or business in Central Hungary, some of them participate in interesting international projects or develop and implement new technologies: **PannonPro Innovations** active in projects Danubio-NET and Climate-KIC, **Campden BRI Magyarország Nonprofit Kft.**, service provider for food companies in Eastern and Central Europe, a daughter company of Campden BRI, UK,

participating in H2020 and FP7 projects, biotechnology company **Biopolus**, **Geonardo Environmental Technologies, Kft.** and many others.

## 2.3 Bioeconomy plans and projects

There is no specific strategy for bioeconomy, biotechnology or related topics in the region of Central Hungary, bioeconomy topics are implicit part of other, mostly national strategies. Similarly, there is no specific bioeconomy strategy at the national level, neither there is a bioeconomy aimed policy framework.

On the other hand, there are numerous initiatives, projects or activities of various actors in the bioeconomy field, both private and public ones, such as **Biomass Innovation Design Hub**, **Hungarian Biogas Association**, and participation of various actors in international projects, often supported by the EU programmes, such as the **Climate-KIC initiative**. Although these projects are usually nationwide or international, the actors from Central Hungary region are often key bodies for Hungary participation.

The national policy frameworks and documents either implicitly covering the bioeconomy field or specifying bioeconomy related sectoral objectives are described in chapter 3.1.

## 3. Bioeconomy Policy Support

### 3.1 General support framework

“Currently, there is no dedicated strategy or policy framework aiming for the formation of the Hungarian bioeconomy, and due to its complexity, the responsibilities are not clear and interfaces are not provided. However, there are policies which cover aspects of the bioeconomy”<sup>3</sup>.

**Research Infrastructure in Hungary** strategy has been aimed at general infrastructure issues, such as openness, networking, but no specific sector or domains have been stressed.

**Smart Specialisation Strategy** enlists, apart from horizontal priorities, 6 sectoral priorities. Out of these 4 are fully or partially linked to bioeconomy field: **Agricultural innovation**, including agriculture, forestry, hunting, aquaculture and water management, horticultural technologies, agricultural biotechnology, such as biotech in plant breeding and healthy food research; **Healthy local food** which aims promoting food processing, locally produced and processed food of high added value; **Sustainable environment**, which deals with natural resource management, advanced environmental technologies such as water cleaning technologies, waste-management related

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<sup>3</sup> Bioeconomy Factsheet Hungary, NNFC The Bioeconomy Consultants, York, UK, 2015

technologies, preservation of natural resources; **Clean and renewable energies** which focus on renewables and bio-energy falls within bioeconomy domain while nuclear energy and possibly also energy efficiency do not.

**Investment in the Future**, which is national research, development and innovation strategy has established overall objectives aimed at RDI performance improvement notwithstanding the sector or domain, such as “R&D centres of the global large companies integrated into the national innovation system”, “R&D-intensive Hungarian medium-sized enterprises expanding in international markets” or “innovative supplier SMEs and start-ups”.

There seems to be a **shift in the policy framework** since the New Széchenyi Plan (2010–2013 national strategic reference framework) which sectoral priorities related to bioeconomy were “new energetic and environmental developments that supports the safety of society” and “agriculture”, thus more general and fewer than in the current strategies and documents.

**Competitive Central Hungary OP Operational Programme** for the programming period 2014–2020 addresses both, the potential for competitiveness growth as well as underdeveloped territories in Central Hungary. First three priorities of nine focus on RDI: 1) improvement of enterprises' competitiveness; 2) R&D and technological innovation; 3) development of ICT. Policy measures related to these priorities include enhancement of SMEs' innovation activities, strengthening of regional knowledge base, support to SMEs' investment in technology upgrading and to SMEs' innovation collaboration, support to start-up formation, and fostering innovation stakeholders' improved access to financing. Though the OP does not explicitly specify any industries or technologies to be targeted **it stresses the importance of the ICT** across all innovation fields.

There are two major national financing resources for RDI in general, apart from EU funded schemes, **National Research, Development and Innovation Fund**, which calls for proposals are often aimed at strengthening international RDI collaboration while **Hungarian Scientific Research Fund** calls for proposals are designed to encourage exploratory research to promote cooperation between research organisations engaged in fundamental researches and industry players. Both of these funds have no specific sectoral focus though the latter is claimed to provide special support, through a competitive system, to fields of sciences that have a particular national economic importance. The Funds are administered by the National Research, Development and Innovation Office.

### 3.2 Bioeconomy Policy Support

There are no specific interventions aimed at bioeconomy neither at regional level nor at national level. Actors in the bioeconomy field participate in general R&I programmes and schemes at the national level and compete for funding with other applicants.



### 3.3 ESIF and H2020 resources for the Bioeconomy

Thematic objective 1 is supported by Competitive Central Hungary OP with the total amount of funds EUR 189.2 mil. There are no specific allocations either for a particular sector or domain in the OP.

The regional R&I allocation from ESIF according to JRC calculation amounts EUR 102,5 mil. for the Central Hungary NUTS 2 region. The regional allocation in 2014 – October 2016 for H2020 amounted EUR 79.7 mil. which is the largest allocation in Hungary. Only minority of this amount has been used to support bioeconomy projects. The figure shows dominance of the capital region in RDI investment supported from the EU funds for the second largest allocation in Hungary, which is in Del–Alfold region amounts 10 times less. The FP 7 allocation for Central Hungary bioeconomy projects that were coordinated by Hungarian bodies amounted about EUR 15 mil. which is majority of funds allocated for this types of projects in Hungary.

Stakeholders from Central Hungary often participate in national projects or programmes yet it is difficult to distinguish their regional scope as these bodies are mostly nationwide and their projects have likely the same scope.

## 4. Successful Initiatives and Good Practices

### 4.1 Biomass Usage Innovation Network

Biomass Usage Innovation Network was founded by Bay Zoltán Nonprofit Ltd. for Applied Research, in cooperation with the Forestry Research Institute of National Agricultural Research and Innovation Centre, Lavina Foundation and Pilze–Nagy Kft. The network, established on November 9, 2016 after months of preparatory and organisational work has its origins in AGRIFORVALOR, a European–wide project supported by the Horizon 2020 programme. Although the pilot area has been selected in South–East Hungary the network aims at national coverage and has involved central agencies.

The objectives of the network focus on exploitation of agricultural and forestry biomass and on making products based on biomass. The network shall provide better opportunities for researchers to get in touch with businesses (and vice versa), and for more efficient information exchange in developing new products. The objective of the network is also identification of the new market opportunities for biomass based production. International business opportunities or international exchange of information in the field will be promoted as well. Two other countries (Ireland and Spain) will have similar networks which will cooperate with the Hungarian one. This

cooperation of national networks allows market players to gain new experiences, establish international collaboration and find new business opportunities.

The network shall promote upscaling of existing products or technologies and shall stimulate new “side-stream” products, by-products based on biomass usually considered waste. 19 side-stream products have already been identified in Hungary as part of the AGRIFORVALOR project. The network shall increase the number of the new products as well as number of actors involved in developing new ones.

#### 4.2 MAB 2.0 project - Microalgae Biorefinery<sup>4</sup>

The Microalgae biorefinery project is an example of public-private partnership and of development of small scale functional technology in real industrial conditions in order to demonstrate its feasibility and to establish a basis for further development of the technology itself. The project is led by Pannon Pro Innovations, a Hungarian consulting company, the technology has been implemented in Budapest Sewage Works which has already invested in a pilot scale algae production unit at the North Budapest Waste Water Treatment plant. The project has got other partners providing development and innovation concepts and technology support: Wageningen University (The Netherlands), INRA Laboratory of Environmental Biotechnology (France), Utrecht University (The Netherlands), DLO-Food & Biobased Research (Germany), University of Valencia (Spain) and Polytechnical University of Valencia (Spain).

There are two major objectives of the project: (1) to verify and put into market algae-based product line thus creating the example for waste water treatment plants which can prove its operational advantages and (2) to integrate the new technology into an existing value chain which will allow to use biomass produced in waste water treatment plant to be turned into sources of new bio-based products. The technology solution aims at turning certain waste water treatment effluent into added value algae biomass by recovering of nutrients, capturing CO<sub>2</sub> of biogas plant and embedding sunshine. Through B2B business model the project will also secure link to different algae processors to harvest the value. The project started to demonstrate two breakthrough technological and commercial concepts, which were (1) integration of algae technology into a municipal waste water treatment plant to enhance water quality and biogas yield and (2) production of a new products based on algae biorefinery.

The project has been supported by the Climate-KIC initiative, the EU’s largest public private partnership addressing climate change through innovation to build a zero carbon economy. Climate-KIC is supported by the European Institute of Innovation and Technology.

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<sup>4</sup> <http://algaerefinery.eu/>

The project will target waste water treatment companies demanding a solution that can make their operation more sustainable, efficient, reduce emissions and provide additional revenues at the same time. The project will result in a commercial offer for the waste water treatment sector in order to turn certain streams of waste water treatment into algae biomass while removing the excess nutrients of waste water effluent. Also, preliminary results show a demand for algae-based compounds hence the project creates a B2B link between waste water treatment companies and algae processors.

The project builds on the complementary expertise of its partners that is the key to deliver the expected outcomes and business impact. The partnership is a good mix of business and R&D partners. Their special expertise covers the whole production/supply chain starting from waste water expertise through algae production and use, to business modelling.

## *5. Needs, Gaps and Bottlenecks to Deploy the Bioeconomy*

According to reports and studies based on the Hungarian experience, the following challenges and bottlenecks for further bioeconomy deployment can be identified:

Data driven change and challenges in biology science require **close cooperation of bioeconomy sector with ICT sector** which will provide models and tools to obtain maximum value from data available and will allow to gather data efficiently and effectively.

**Diversified research structures/institutions prevail in bioeconomy** field, though somehow centralised in recent years. Also the performance of various actors in the bioeconomy sector is rather varying. There are excellent international science teams (though perhaps not in large numbers) as well as more development and applied research oriented institutions and professionals providing services or research aimed at local/national actors.

**There is no particular strategy in bioeconomy**, neither regionally nor nationally, though reflection of the sectoral potentials in objectives in various national overall RDI programmes has improved in recent years. This hampers the further deployment and strategic plans to prioritise certain areas of the bioeconomy.

Scattered and diverse bioeconomy business sector with majority of mainly family farms prevailing in agriculture. Thus the innovation demand in this particular sector is not very strong and **innovation performance as well as capacity of the farming sector is low** both, due to lack of financial resources and due to lack of human resources and ageing farming population.

**Local supply chains are traditional** and **cooperation** among industries or between various types of actors **is rare and insufficient**, thus inhibiting innovation, sharing of market and technology experience and knowledge.

**Biomass side-stream production requires new business models or new modes of collaboration** among market actors as well as between market and knowledge producing actors. Such an experience does exist in the Central Region though it is limited, but it is lacking elsewhere in the country.

## 6. Information Sources

### Literature and Documents:

Research infrastructures in Hungary, National Research, Development and Innovation Office, Budapest, 2014

National Smart Specialisation Strategy, National Research, Development and Innovation Office, Budapest, 2014

Investment in the Future: National Research and Development and Innovation Strategy 2013–2020, Ministry for National Economy, Budapest, 2012

Versenyképes Közép–Magyarország Operatív Program (Vekop)

Bioeconomy Factsheet Hungary, NNFCC The Bioeconomy Consultants, York, UK, 2015

Good practice cases in practical applications of agro and forestry side-streams processing, Agriforvalor project, 2016

Publishable version of Compendium on research results on agriculture and forest-biomass side-streams, Agriforvalor project, 2016

### Relevant websites:

Hungarian Chamber of Agriculture <http://www.nak.hu/>

Szent István University <http://www.mkk.szie.hu/en>

Eötvös Loránd University, <https://www.elte.hu/en/>

Agriforvalor project <http://www.agriforvalor.eu/pages/about>

Competitive Central Hungary OP <https://ec.europa.eu/growth/tools-databases/regional-innovation-monitor/policy-document/competitive-central-hungary-operational-programme>

EIP-AGRI <http://ec.europa.eu/eip/agriculture/>

Microalgae Biorefinery

<http://algaerefinery.eu/> ,

<http://klimainnovacio.hu/en/news/2015/08/10/mab-20-project-microalgae-biorefinery>

Climate-KIC <http://www.climate-kic.org>

DanubioNet <http://www.era-platform.eu/news/danubionet-bioeconomy-capacity-building-survey/>

Danube-INCO Net [https://danube-inco.net/ourpillars/energy\\_and\\_bio\\_economy](https://danube-inco.net/ourpillars/energy_and_bio_economy)

S3 Platform <http://s3platform.jrc.ec.europa.eu/agri-food>

Factsheet on 2014-2020 Rural Development Programme for Hungary

[http://ec.europa.eu/agriculture/rural-development-2014-2020/country-files/hu/factsheet-hungary\\_en.pdf](http://ec.europa.eu/agriculture/rural-development-2014-2020/country-files/hu/factsheet-hungary_en.pdf)

Lavina Foundation <http://www.lavina-foundation.com/innovation.html>

PannonPro Innovations <http://ppis.hu/#about>

Campden BRI Magyarország Nonprofit Kft., <https://www.campden.hu/eng/index.php>

Biopolus <http://www.biopolus.org/>

UTB Hungary <http://www.utb.hu/en/#home>

#### Interviews and Contact details:

Name	Position	Institution/ Organisation	Phone	Email	Interview Date