



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

Task 3

Case Study Report [Slovenia]

Contract: RTD/F1/PP-03681-2015

05.12.2016

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1. Short Regional Bioeconomy Profile

Name of the case region/country	Slovenia
Member State	Slovenia
GDP – Euro per capita (2014)*	17 400
Total ESIF Research & Innovation per capita per year*	54.86
Total H2020 per capita per year*	18.10
Value Chain Approach to the Bioeconomy**	Broad: Biomass supply and Waste; Biomass processing and conversion; Bio-based products Specific: Foods and beverages; Forest-based primary production; Pulp and Paper; Bio-based construction and furniture; Bio-based materials and plastics
Thematic Focus of the Bioeconomy Approach**	Broad: Agro-Food; Other bio-based Industries Specific: Forestry and Wood; Food Processing; Conversion to Fibres and Lignocellulosic biomass; Bio-based construction material; Biopharmaceuticals
Research and Innovation Fields highlighted for the Bioeconomy**	Broad: Advanced Manufacturing, Machineries; Primary Production with quality Specific: Advanced Manufacturing; Agronomy and crop sciences, oenology, etc.; Natural Resources and Ecosystem Management, Environmental sciences.
Bioeconomy Activity Level**	Middle
CASE STUDY SUMMARY	
Bioeconomy Approach	Focus on bioenergy, bio-chemicals as replacement to traditional polymers.
Bioeconomy Ecosystem	Fill in briefly, Twitter style, after elaborating the report
Bioeconomy Policy Support	Supportive, strong push for gap analysis and problem resolution, strong initiatives in circular economy and strategic development innovation partnerships.
Successful initiatives and Good Practices	National institute of chemistry has innovative research projects, likewise Poly4Eml in bio-based materials, and BERST with cross-border participation.
Main Needs, Gaps and Bottlenecks	Financial support to drive innovations from TRL 4-6. Funding for innovative, smart and green products and services to the transnational / global market

* 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

This chapter describes the general characteristics of the regional bioeconomy ecosystem, its origins, main stakeholders and driving forces. It gives an overview on the recent evolution and trends on bioeconomy-related issues in the area and some of the main activities and initiatives.

2.1 Origin of Interest of the region in the Bioeconomy

Local Trends and Origins

Recent trends show a rise in prices and a high volatility of certain key materials, which could result in increased demand and cost of exploiting natural resources. Slovenia has quite preserved and pristine natural resources, however, due to the pressures outlined has called for better management and preservation of natural resources. Consequently, linear economic systems have been transforming to circular ones, as emphasis on conservation inherently forces value chains in this orientation. This shift will eliminate the concept of waste, and provide a better circulation period of products. However, for such systems and innovation to be possible, to be researched, developed, and to reach the market, innovation of business models is necessary.

According to estimates, by 2020, the bio-based products market will amount to 200 billion EUR. Likewise, between 2014 and 2030 the bio-based field is expected to create 1 million new jobs, a large proportion of these in rural areas. Similarly bio-based plastics are anticipated to replace up to 90% of conventional plastics, whereas, currently less than 1% of biopolymers used are made from renewable raw material.

Given this mode, the following industries face great opportunities in bioeconomy, the chemical industry (one of the most competitive industries of Slovenia), paper, wood, textile industries, agriculture, agroindustry, and service activities. For example, according to the RIS 4 Strategy: 'In the field of "Materials recovery" (E38.3) Slovenia does not demonstrate revealed comparative advantages, however companies demonstrate an average value added per employee of over EUR 48,000 which exceeds the Slovenian average by more than a quarter'¹.

Market potential is growing in sustainable energy production (solar and wind) with an anticipating grown in combined heat and power (CHP). The intention in Slovenia is to focus on segments where local companies already have presence in global markets, thereby, having a greater potential for breaking through. These include

¹ Slovenia's Smart Specialisation Strategy S4

sustainable energy production, value added products, bio-chemical products used in CO2 capture, and propylene alternatives.

When completing the entrepreneurial discovery process, 30 initiatives in the area of Networks for transition to circular economy, were developed. The overall estimated investment value was 950 million EUR. More than 250 stakeholders participated, of these stakeholders more than 150 are representatives of the economy. The technologies represented include: secondary raw material re-use, biomass for energy and new biological materials, etc.

The specifics of Slovenian bioeconomy market shows that investment in bioeconomy has been steadily rising from 2007 onwards, whereas private investment in bioeconomy is mostly present in manufacturing of food products. Job skills, as a percentage of research and development personnel in total employment, is also steadily rising in manufacturing of food products, whilst the total employment in bio based industries has declined².

A cross-border dimension

Joint cross-border projects have been implemented in Slovenia. Their benefit in the field of bioeconomy lies in forming links between foreign research and industry partners. The EU Joint Technology Initiative works with bio-based industries. Partners cooperate under Horizon 2020, inter alia, NMP (advanced materials), FoF (Factories of the Future), Sprite (sustainable industry), and others. In Slovenia, some initiatives and connections are already in place. For example, nanomaterials are being explored with partners from Belgium, the Netherlands, Israel and Sweden. Advanced technologies in processing pulp and paper is underway with partners from the Netherlands, German, Italy, Finland, Portugal and Spain. As is the development of next-generation microbial cell factories in the production of green chemicals, algae, and biogas technologies. EU projects have helped fund and support stakeholders establishing strong cross-border links, such projects include BERST “BioEconomy Regional Strategy Toolkit” and the Poly4Eml project. Both will be discussed in greater detail in the following sections.

2.2 Bioeconomy Stakeholders

The main stakeholders to be considered when assessing the state of play of bioeconomy in Slovenia, are:

- SMEs and big companies which are working and producing in way of circular economy (sustainable energy, biomass and alternative raw materials, recycling, functional materials, process and technology), or they have plans

² – <https://biobs.jrc.ec.europa.eu/country/slovenia>

and goals to be a part of network of circular economy. These are considered for both statistical regions of Slovenia –West (Zahodna Slovenija) and East (Vzhodna Slovenija) Slovenia Cohesion Regions;

- Research institutes, such as: The National Institute of Chemistry and Faculty of Chemistry and Chemical Engineering, University of Maribor, University of Ljubljana, University of Maribor, The Jožef Stefan Institute, Slovenian national building and civil engineering institute, Pulp and Paper Institute and others;
- Chamber of Commerce and Industry of Slovenia, Chamber of Craft and Small Business of Slovenia;
- NGOs, such as: Association Ecologists without Borders, European Cultural and Technological Centre of Maribor and social enterprises.

2.3 Bioeconomy – strategies, plans and projects

The predominant bioeconomy strategies, plans and projects can be considered as the following:

- Research and Innovation Strategy of Slovenia (2011 –2020),
- Slovenian Industry Policy (2014–2020),
- Sustainable urban strategies of municipalities,
- The government framework program for the transition to a green economy (www.vlada/zeleno.si)
- The S4 Slovenia’s Smart Specialisation Strategy 2014–2020.

In particular, the S4 document establishes that the deployment bioeconomy at various levels is a priority for Slovenian R&I in the next years. There are several areas with relation to bioeconomy in the RIS3 document:

- Priority 1 Healthy Working and Living environment (within the focus area: Advanced materials and products, including wood composites)
- Priority 2: Natural and Traditional resources for the Future with its focus areas: 2.1. Circular Economy (Technologies for sustainable biomass transformation and new bio-based materials, Technologies for use of secondary and raw-materials and reuse of waste, Production of energy based on alternative sources), and 2.2 Sustainable food production (Sustainable production and processing of food products into functional foods, Technologies for sustainable agricultural production (livestock and plants))
- Priority 3: (S) Industry 4.0 with its focus area 2.3.2 Health (Biopharmaceuticals, Natural medicines and cosmetics).

3. Bioeconomy Policy Support

This chapter gives a brief account of the existing policy instruments and action lines to support the bioeconomy in the area. It highlights the most important value chain approaches to promote the bioeconomy, the thematic focus of the Bioeconomy-related research and innovation, as well as some of the research fields that are relevant for further deployment of the bioeconomy.

3.1 General support framework

The general support framework in bioeconomy includes a Ministry funding through Smart Specialisation, and EU funding, including ESIF and H2020.

- Research and Innovation Strategy of Slovenia (2011 –2020),
 - the main prerogative in implementing reforms is due to the fact that Slovenia has recognised that the world will face shortages of natural resources such as energy, food and water, and major threats associated with climate change. These challenges call for critical reflection and investigation of the causes of this situation, and require above all a change of lifestyle and changes in our socio-economic behaviour.
- Slovenian Industry Policy (2014–2020),
 - emphasises the challenges of creating food, human health and battling ageing. Priority technological fields are considered to be biotechnology and other related technologies. Agro-industry and sustainable food production is considered to be one of key industrial sectors when dealing with this issues,
- Sustainable urban strategies of municipalities,
 - focused on rethinking agri-food production in small and medium-sized cities,
- The government framework program for the transition to a green economy (www.vlada/zeleno.si)
 - emphasizes green economy as Slovenian long-term strategic direction and an opportunity for the development of new green technologies, create green jobs, more efficient management of natural resources, promotion and development of Slovenian knowledge.
- Strategic Development Innovation Partnership on a National Level Initiative (SRIP).
 - creates clusters, and pairs innovation research institutes with industries connecting stakeholders on national level: business entities (SME, big companies), educational and research organizations, NGOs (and collaboration with state) into value chains according to the principle ‘economy of closed material cycles’

3.2 Bioeconomy Policy Support

One very important example of a bioeconomy policy support framework is the Strategic Development Innovation Partnership on a National Level Initiative. Locally titled: Strateška razvojno inovacijska partnerstva (*SRIP*). This initiative creates clusters, and pairs innovation research institutes with industries connecting stakeholders on national level: business entities (SME, big companies), educational and research organizations, NGOs (and collaboration with state) into value chains according to the principle 'economy of closed material cycles' (contribution to 'closing the loop' of product lifecycles) to development new business models for the transition to circular economy, to create added value for companies and to participate on transnational and global markets. The goal of SRIP is to:

1. raise the material efficiency index
2. establish 5 new value chains with closed material cycles, as follow:
 - a) sustainable energy,
 - b) biomass and alternative raw materials,
 - c) recycling,
 - d) functional materials,
 - e) process and technology.

This initiative is very recently, and only in December 2016 will all the participants have been selected. The priority is on natural and traditional resources for the future – particular networks for the transition to circular economy. It will pair different international funded projects, Slovenian research institutes and educational entities, faculties and universities, with industry. One example is a cluster with the Jožef Stefan Institute, Ljubljana, the National Institute of Chemistry, Ljubljana, University of Ljubljana, University of Maribor, etc. The chamber of Commerce and Industry of Štajerska [Štajerska gospodarska zbornica] coordinates the activities of Strategic Development Innovation Partnership – Networks for the Transition to Circular Economy in collaboration with the National Institute of Chemistry and Faculty of Chemistry and Chemical Engineering, University of Maribor and with many companies and other entities.

In regard to this cluster, the projects from the National Institute of Chemistry, Ljubljana (NMP, Mar3Bio, MefCO₂, ADREM), will be funded from the following sources:

Acronym	More data	Funding
NMP	Use of biomass for development of advanced materials and bio based products	Smart specialisation financing of Slovenia; Ministry for education, science and sport, Slovenia
Mar3Bio	ERA NET	ERA NET
MefCO ₂	H2020-SPIRE-2014	H2020
ADREM	H2020-SPIRE-2015	H2020

3.3 ESIF and H2020 resources for the Bioeconomy

ESIF funds for research and innovation relate to Slovene Smart Specialisation Strategy. Over EUR million 210 is allocated in ESIF (TO1) for the financial period. However, no allocations for particular S4 domains has been reserved. The funds are disbursed relating to tendering procedures (calls for tenderers in total sum over EUR 70 mil has been opened in 2016). The TRL 3–6 call (Ministry of Science) assured one program per domain would be funded, while TRL 6–9 call by Ministry of Economy involved no such provision and projects competed on equal basis – top projects will be selected regardless the S4 domain. One TRL 3–6 program within domain 2.1. Circular economy was selected already: this is NMP program by national institute of Pulp and Paper (cofounding 5,95 mio EUR).

Bioeconomy relates to more than one S4 Domain; at least to 2.1. Circular Economy and to 3.1. SI industry 4.0– factories of the future. Stakeholders engaged in bioeconomy could potentially receive funding for RR in a range of more than 20 million EUR. Besides, the Government (ministry of economy and the Ministry of labour) releases funds for clustering under the domains of S4, amounting to 25 million EUR for the program period: the calls for proposals for so called Strategic research and innovation partnership (SRIP) were published this fall and are currently processed. The results (the coordinators of clusters) will be known shortly (this year). Each SRIP (related to S4 domain) can potentially access more than 2,5 million EUR over the financial period for strategic activities (Including SRAs), internationalisation, domain related human resource development etc.

For all of section 3 in addition to the responses provided, the National delegate and NCP for Societal challenge 2 (Bioeconomy), from the Ministry of Education, Science and Sport was contacted. They communicated that they will collect data, review the results so far, and send more information before the holidays. This will hopefully supplement these case study responses, particularly, with regard to ESIF/H2020 funding.

4. Successful Initiatives and Good Practices

This chapter highlights successful initiatives and good practices to promote research and innovation in bioeconomy–related fields.

4.1 Poly4Eml Project

The project Poly4Eml ‘Platform for emerging companies within the cluster polymer industry’ (2014–2017) is focusing on the transition from the fossil–based industrial

paradigm to a more resource-efficient economy that embraces renewable resources, smart recycling and other smart technologies that could contribute to a more sustainable economy based on new “green” technologies.

The Poly4Eml in Slovenia is designed to address the challenges of Slovenian innovation policy through the development of a new policy model for a systemic approach to stimulate the transformation of the industrial structure by exploring the potential of cross-cutting technologies, respectfully the biopolymer materials and related technologies.

The aim of the project is to develop a joint platform of regional clusters for promotion of entrepreneurship and the application of new business solutions. The transformative power of biopolymer materials and technologies is put in focus since it has proved to have potential of being at the forefront of managing structural change from a polymer to a biopolymer based industry, having in regard the Slovenian industrial environment, and can thus strongly contribute to the development of a bio-based industry in this part of Europe.

Poly4Eml is one of 6 projects awarded funding by the European Commission (DG Enterprise and Industry) within the Competitiveness and Innovation Framework Programme (CIP) call "Clusters and Entrepreneurship in support of Emerging Industries". The main distinction between Poly4Eml and other selected projects is in the platform that the project will establish and which other projects can engage in. As such, the project can serve as a playground for stakeholders of other selected projects in initiating the transfer from chemicals to green chemicals and from using polymer to biopolymer materials.

4.2 Bioeconomy projects in the National Institute of Chemistry (Ljubljana)

National Institute of Chemistry Ljubljana is the 2nd largest institute in the country (300 employees). Within this institute, 15 EU funded projects are in operation, and 4 smart specialisation projects (funded by Slovenian Ministry). Regarding bioeconomy, the institute is engaged in topics related to ecology, environment, energy and natural resources. More specifically, the institute actively researches, and oversees projects, in the key areas related to bioeconomy. Expertise is in catalysis and in chemical engineering processes

The first area is in biomass. For example, one project being run by the institute covers how to increase the value of biomass (waste) and lignin streams by depolymerisation and hydro-deoxygenation into various bio-based aromatics (such as polyphenol, benzenes, etc).

The second project focuses on biomass fractionalisation into lignin (nano-cellulose and hemi-cellulose) in order to produce bio based chemicals.

The third topic area, is the conversion of industry waste, where the waste is predominantly carbon dioxide, through the design of processes and catalysis whereby carbon dioxide can be converted into methanol, and biogas, as well as various other streams such as formaldehyde, formic acid.

The fourth topic are concerns how to change biomass through a novel catalytic conversion in order to produce new bio-based diesel products

4.3 Bioeconomy Clusters in Slovenia

[Note – this project description is collected directly from the following case study: [https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20\(BERST%20region\)%20Central%20Finland.pdf](https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20(BERST%20region)%20Central%20Finland.pdf) . (BERST project – www.berst.eu “Catalogue of good practices”]

In Slovenia two clusters that represent two different aspects of the bioeconomy potential were analysed. The wood cluster targets abundant biomass supply in Slovenia. The other cluster is based on connecting RTD institutions with strong references on (bio-) polymer technology and firms in chemicals, which is one of the strongest manufacturing sectors in the country.

Emerging bioclusters in Slovenia– description through case studies³:

Case study 1: Wood cluster

The cluster is a non-profit organization founded in 1999 by seventeen woodworking companies (mainly large scale) and two higher education and research institutions, as a Wood Industry Development Centre. In 2003, the Institute was renamed the Wood Industry Cluster. The initial objective of this cluster was to exchange experiences in development in various companies and this was then expanded to establish joint network for communication with suppliers of materials and equipment. The Wood Industry Cluster comprises a third of employees in forestry and wood processing industry and the most important research institutions in Slovenia. The cluster works on projects chosen according to the needs of individual companies. The common goal of all activities is to strengthen the competitiveness of the cluster members.

Today, the cluster membership exceeds 100 members and, following the closure of many large enterprises, members of the cluster come from small and medium-scale enterprises. The cluster itself is managed by a director, who works with a management committee. Members of the Management Committee are private companies and research organisations (University of Ljubljana and Faculty for Design). The Chamber of

³ BERST Slovenia, available at [https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20\(BERST%20region\)%20Slovenia.pdf](https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20(BERST%20region)%20Slovenia.pdf)

Commerce is an observer, without right to participate in Case Study (BERST region): Slovenia 25 decisions. The cluster is financed by a membership fee, and increasingly, with own revenues e.g. by participating in national research projects. The Wood Industry Cluster has been operating together with the Association of the Wood and Furniture Industry at the Slovenian Chamber of Commerce and Industry since 2007. The Association deals with the industry policy and coordinates its members' interests with a wider environment. The Wood Industry Cluster, however, gives operational support to its members, helping them to achieve their goals, mostly by the implementation of projects, integration and internationalization.

Case study 2: PoliMat Center of Excellence

The CE was established in 2009, following a successful bid at the public tender within the OP Regional Development Potentials (ERDF) 2007–2013. In line with other Centres of Excellence, its activities terminated with the end of public financing in 2014. The National Institute for Chemistry with its network of industrial partners took the initiative for the establishment of the CE. Larger industrial partners made their staff available to the project and some people were seconded and employed by the CE for project duration. Despite plans to become a cluster, CE Polimat did not reach this stage. It was an attempt to gather knowledge and expertise of research and corporate sectors working on polymer technologies and, by doing so, to reach the critical mass needed to make an innovative breakthrough in these technologies. Key research institutions and many important private companies joined the project. The project did not fully achieve expectations. While the project successfully reached targets set by the project output indicators (mostly referring to research output, e.g. publications, innovations, patents), actual results with impacts (e.g. industrial application of innovations) were limited. Also the leverage effect was low – a relatively large public research budget was not backed by private participation.

5. Needs, Gaps and Bottlenecks to Deploy the Bioeconomy

This chapter describes the main needs of the area to further deploy the bioeconomy in the near future, as perceived by the regional stakeholders and in the revised documents. In particular, the gaps and bottlenecks that hamper the development of research and innovation for specific bioeconomy-related business areas are described.

In terms of innovation in bioeconomy in Slovenia, two major gaps are evident. The first is moving innovations from TRL 4 to TRL 6. This step requires industrial proof of concept testing which is very costly. The second is moving products from TRL 6 to the market, because this, likewise, is an expensive step. Moving such innovations to market requires, accordingly, innovative marketing and resources for launching the product.

There is a large gap between laboratory proof of concept, and industrial proof of concept. It can be very difficult to find financing for performing the industrial proof of concept tests. This, of course, prevents innovations from moving from TRL 4 to TRL 6. Pairing innovation centres with industry is one way of alleviating this problem. For example, according to the National Institute of Chemistry in Slovenia, they were able to find an industry partner for one of their products and have moved to TRL 6, however, this may create an issue whereby the most innovative products, and novel technologies, may have the most difficulty in finding financing for industrial proof of concept testing.

However, once moving to TRL 6 another gap has been identified preventing products from reaching the market. For example, one innovation launched by the National Institute of Chemistry in Slovenia, received extraordinary research results and was allocated TRL 6. A few industrial partners felt that this was a very useful innovation, however, they did not have the funds to market and launch the product.

6. Information Sources

Literature and Documents:

RIS 3 Strategy Slovenia: "Slovenia's Smart Specialisation Strategy – S4"

Case Study (BERST region): Central Finland. (2015)

[https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20\(BERST%20region\)%20Central%20Finland.pdf](https://berst.vito.be/sites/biobased.vito.be/files/Case%20Study%20(BERST%20region)%20Central%20Finland.pdf)

European Commission. (2009) NMP Expert Advisory Group (EAG) Position Paper on Future RTD Activities of NMP for the Period 2010 – 2015.

https://ec.europa.eu/research/industrial_technologies/pdf/nmp-expert-advisory-group-report_en.pdf

Relevant websites:

Some of the relevant websites used to complete the case study include:

- alstore.eu/national-institute-of-chemistry
- www.poly4emi.eu
- s3platform.jrc.ec.europa.eu/regions/SI?s3pv=1
- www.vlada/zeleno.si

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