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D4.1 - Analysis of local context

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Executive summary

The present deliverable ***D4.1 "Analysis of local context"*** has been developed in the framework of ***WP4*** activities related to ***"New and updated network-oriented business models, governance and local capacity building"*** and it is the outcome of ***T4.1 "Analysis of local baseline, value chains and ongoing initiatives"***.

The aim of this document is to analyse the bio-baseline in the regions participating in BIOLOC project, regarding current socio-economic activities, bio-based value chains, productive districts, specialisations, strengths and pain points. To achieve this goal, an analysis was carried out for each region on the main sectors that make up the bio-based value chains. The analyses were conducted using data available online and collected by local partners, who provided important information available in the original language. Other information was collected using a specific questionnaire shared with local partners.

In this analysis, the following regions were analysed:

- Spain – ***region of Aragon***
- Greece – ***region of Western Macedonia***
- Bulgaria – ***region of Plovdiv***
- Slovakia – ***the Nitra Self-Governing Region***
- Slovenia – ***whole country***
- Croatia – ***region Adriatic Croatia***
- Hungary – ***region North-Hungary***
- Romania – ***West region***
- Czechia -***region BIOEAST***
- Netherlands – ***region Apeldoorn***
- Germany – ***region Baden-Württemberg (Ba-Wu)***
- Italy – ***region Campania***

The analyses developed in this document for each region have as a common basis the study of bio-based sectors, however, although in general these sectors are more or less the same for all countries, the analyses will have some differences between them. This is due to the presence in each region of particular economic, social and environmental conditions that significantly affect the bio-based sectors and produce substantial differences.

The information collected and analysed in this document will be the basis for the work that will be developed in ***Task 4.2- Matchmaking and creation of opportunities for local value chains***, and specifically in ***D4.2 - Opportunities for local value chains***.

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1. Introduction

The aim of BIOLOC is to advance the role and impact of Circular Bioeconomy (CBE) and social innovation to revitalise European local communities and accelerate the all-inclusive transition to resource-efficient and circular biobased production and consumption systems. BIOLOC project will inspire and support the communities of participating European regions to unlock and propel local development potentials by fostering sustainable, innovative, tangible, and participatory pathways to green transition through grassroots inclusive CBE nexuses.

Within this context D4.1 "Analysis of local context" has been developed in the framework of WP4 activities related to "New and updated network-oriented business models, governance and local capacity building" and it is the outcome of T4.1 "Analysis of local baseline, value chains and ongoing initiatives".

The purpose of this document is to assess the baseline in the regions participating in BIOLOC project, regarding current socio-economic activities, bio-based value chains, productive districts, specialisations, strengths and pain points. This analysis was conducted using existing local knowledge and initiatives for each region. Specifically, the assessment is based on the analysis of development plans, smart specialisation strategies, and other available documents available online or provided by consortium members.

The capacity of local partners to extract information from documents in the local language to provide a first-hand perception of strengths, weaknesses, opportunities, and threats was crucial in carrying out this activity.

The region analysed in this paper are as follows:

- ***Spain – region of Aragon***, represented by Region of Aragón (DGA)
- ***Greece – region of Western Macedonia*** (WM), represented by CERTH
- ***Bulgaria – region of Plovdiv***, represented by Agricultural University of Plovdiv (AUP)
- ***Slovakia – the Nitra Self-Governing Region***, represented by Business and Innovation Centre Bratislava (BICB)
- ***Slovenia – whole country***, represented by Chamber of Commerce – Chemical Industry Association (ACIS)
- ***Croatia – region Adriatic Croatia***, represented by Society for Sustainable Development Design (DOOR)
- ***Hungary – region North-Hungary***, represented by Regional Centre for Information and Scientific Development (RCISD)
- ***Romania – West region***, represented by Banat University of Agricultural Science (BUAS)
- ***Czechia -region BIOEAST***, represented by Association of Research Organisations (AVO)
- ***Netherlands – region Apeldoorn***, represented by Municipality of Apeldoorn (GA)
- ***Germany – region Baden-Württemberg (Ba-Wu)***, represented by University of Hohenheim (UHOH)
- ***Italy – region Campania***, represented by Italian Cluster of Green Chemistry SPRING (SPRING)

2. Methodology

To carry out the analyses reported in this document, information was collected on the biobased value chain in each reference region. Thanks to the help of the partners, it was possible to identify and use information in the original language.

The characteristics of each region and above all the presence of different documentation, with different degrees of detail, do not allow to develop a homogeneous analysis between the different areas.

The results presented in D4.1 were achieved through a comprehensive analysis of several key elements essential to the project's objectives. The development of D4.1 relied on the following main sources of information:

- **Data from Regional Partners via Tailored Questionnaires**

Regional partners of the BIOLOC project provided crucial information through custom-designed questionnaires. These questionnaires, developed in collaboration by several consortium members, served as a basis for analyses across Work Packages WP2, WP3, WP4, and WP5. They enabled the collection of region-specific data that would otherwise be unavailable, including information available only in local languages, deep local expertise, and access to diverse databases.

- **Supplementary Contributions from Regional Partners**

To deepen the analysis of bio-based value chains within the target regions, partners were asked to share additional resources, such as reports, strategic plans, databases, and publicly available links. This input formed the backbone of D4.1, with local partners facilitating translation and offering insights into the most relevant and up-to-date information sources. Their expertise and collaborative efforts were instrumental in ensuring the reliability and quality of the data collected.

- **Publicly Available Information**

To integrate the partner-provided data, an extensive review of publicly available online resources related to the bio-based value chains in the studied regions was conducted.

The methodology adopted ensured that the analysis presented in D4.1 is both thorough and unique, with findings supported by a diverse range of reliable sources, as detailed in the references section.

Disclaimer: It is important to highlight that analyses presented in this document have been developed with local experts and the information and considerations made also reflect their experience and expertise.

Methodology Adopted for the Analysis of Bio-Based Value Chains

The analysis of bio-based value chains in the target regions was conducted using a structured approach that integrated data from multiple sources and the direct expertise of regional partners. The process was organized into the following key phases:

1. **Definition of Objectives and Data Collection Methods**

Before initiating data collection:

- Specific objectives for the analysis were clearly defined to align with the goals of the BIOLOC project.
- A tailored questionnaire was developed to meet the consortium's needs. This was achieved collaboratively with other members of the BIOLOC project, including partners from WP2, WP3, and WP5.

2. **Data Collection**

Data collection was carried out through various methods to ensure a comprehensive and detailed understanding of the bio-based value chains:

- Structured Questionnaires: Questionnaires were distributed to regional partners and designed to gather information on various aspects of the value chains, such as:
  - Industrial sectors involved in bio-based transformation.
  - Local strategic initiatives.
  - Key players in the value chain (e.g., companies, research institutions, and support organizations).
- Supplementary Contributions: Partners provided additional resources, including regional reports, strategic plans, and links to online resources. This documentation was reviewed and integrated with the data collected through the questionnaires.
- Publicly Available Sources: An extensive online search was conducted to include data and information not directly provided by partners, further enriching the reference database.

3. **Analysis of Value Chains**

After completing the data collection, an in-depth analysis was performed to examine the bio-based value chains in each region.

4. **Synthesis of Results and Report Preparation**

The results of the analysis were synthesized to provide a detailed overview of the characteristics and potential of bio-based value chains in each region. The findings were presented in a clear and concise format, offering valuable insights into the development opportunities within these chains.

3. Analysis of local baseline, value chains and ongoing initiatives

The aim of this chapter is to analyse the local bio-baseline, value chains and ongoing initiatives in each region participating in BIOLOC project. As previously described, this analysis was conducted using existing local knowledge and initiatives for each region.

The information in this chapter will be the basis for the construction of a list of possible opportunities for each participating region that will be realized in D4.2 “Opportunities for local value chains”.

Several factors such as population growth and climate change are creating the increasing need to use renewable biological resources, to make primary production more sustainable and make production processes increasingly efficient, through less use of production factors, less waste production, and a decrease in polluting emissions.

The bioeconomy can be described as the socioeconomic system that interconnects activities that use soil and sea bio-resources to produce food, materials, energy etc. More specifically, the bioeconomy embraces economic activities that produce, develop or use biological products and processes in primary production and industrial sectors. The following are the main sectors of the bioeconomy:

- Agriculture
- Forest
- Bioindustry (food industry, paper, chemical, energy, biotechnology etc)
- Marine bioeconomy

Bioeconomy allows to use the organic products from these sectors to create an economy based on circularity.

Through the bioeconomy, it is possible to start a path in which the communities involved can prosper economically and in an environmentally sustainable way. As a result, the bioeconomy can be a meeting point to increase economic growth and employment while promoting the environment, avoiding biodiversity loss. This process is based on the local economy, in fact the bioeconomy having a close contact with nature is almost always linked to local traditions, which are based on the surrounding environment (rural, sea and industrial areas).

The main factors that allow the development of the bioeconomy are the knowledge and sustainable use of resources, the presence of local infrastructures and the possibility of interconnection between the different economic sectors, the various stakeholders involved, public and private, and citizens. Another very important factor is the presence of active policies.

In Europe, the bioeconomy has reached a value of about 2 000 billion euros in turnover and further growth is expected in the coming years that can generate new jobs. In terms of size and growth expectations, the main sector for the development of the bioeconomy in Europe is food[1].

[1] BIT La bioeconomia in Italia - available at https://cnbbsv.palazzochigi.it/media/1767/bit1_it.pdf.

3.1. Spain – region of Aragon

Arable land in the region of Aragon is 1.78 million hectares, or 37.46% of its area. 47% of Aragon's arable land is occupied by cereals, almost all of it barley and wheat. Maize is the third crop in terms of surface area in the cereals group and the largest irrigated crop in the whole region. As fruit trees, the predominant area is dedicated to nuts and dried fruits but famous for their quality are also the cherry trees in the Jalón valley and peaches in Lower Aragón.

Figure 1: Cherry trees in Aragon

Source: https://identidadaragonesa.wordpress.com/2016/06/09/aragon-lider-de-las-cerezas/

The vineyards represent just 3% of the total cultivated area. The average annual cereal production in Aragon is 83 830 262. Among them, barley is the main cereal. The average yield in Aragon for winter cereals was around 4 tons per hectare, higher than the average of the last four seasons, which was 3.59 tonnes per hectare, and slightly lower than the 2020 season with 4.62 tonnes per hectare.

Family farming has traditionally been the model on which primary food production in Aragon has been based, however, the process of globalization of agricultural markets and the need for high investments to ensure both environmental and economic sustainability, is placing these companies at a competitive disadvantage compared to other models of corporate farming that are spreading. For this reason, the income of the family model has a decreasing weight. Thus, family farming not only suffers from a serious income gap, but its contribution to the agricultural sector is gradually decreasing, to the point of being seriously threatened. Another point of attention is the limitations imposed by the small economic size of farms in terms of economy

of scale. In Aragon, little more than a third of family farms exceed 25 000 euros of standard production and less than 3% exceed 150 000 euros.

Agri-Food accounts for 10% of the GDP of Aragon, with 1 027 companies. The main products are meat, milk, skins, derivatives of these products such as cheese, butter, cream and the manufacture of utensils using the skins of animals such as sheep, goats, pigs, bulls and cows. In the agri-food sector, employees in the fourth quarter of 2022 were 1 311 600 people (6.4% of the total economy), with a decrease of 45 800 employed persons compared to the previous year. The agriculture, forestry and fishing sectors employ only 4% of the total number of workers in Spain. Between 2023 and 2027, Aragon will have 107 million euros for the incorporation of young farmers and the modernisation of farms. The agri-food industry supports more than 11 000 jobs in Aragon.

The forest area in Aragon is 2 608 312 hectares, which represents 54.7% of the total regional area, and it is increasing. The main uses of forestry biomass are as an energy resource, in fact existing forest biomass in the natural environment is an excellent source of energy for biomass boilers. The most common solid biofuel obtained from forest biomass is wood chips. In Spain, the potential biomass resources calculated in the Renewable Energy Plan (PER) are around 19 000 ktoe, of which more than 13 000 ktoe correspond to residual biomass and almost 6 000 ktoe to energy crops. The capacity of forestry harvests that can be used for biomass, originating in the forests of the Autonomous Community of Aragon, amounts to some 600 000 tonnes per year. Royal Decree 661/2007 of 25 May 2007, which regulates the activity of electricity production under the special regime, established the legal framework to produce electricity and thermal energy from biomass.

Currently, the main renewable source used in Aragon is wind, while the main non-renewable source is natural gas. There are several lines of subsidies for energy efficiency and within the European Regional Development Fund in Aragon. Renewables are expected to generate 80 000 jobs and 6% of GDP in Aragon by 2024. The Department of Industry, Competitiveness and Business Development of the Government of Aragon, through the Hydrogen Foundation, promoted in 2021 an action plan for the GetHyGA initiative, with the aim of consolidating an energy and technology path of hydrogen in Aragon, creating a "hydrogen valley".

In addition, another very important national initiative for the development of bio-based sectors is the GIRA plan. The GIRA Plan is the Integrated Waste Management Plan of Aragon for the period from 2018 to 2022 (currently in force). The objective of this document is to minimise the amount of waste generated, its reuse and recycling or when this is not possible to guarantee its correct disposal and increase environmental awareness. The Autonomous Communities are responsible, through planning, for the implementation of the hierarchy principle at all levels of management. They also intervene in waste production and management activities through authorisation, monitoring, inspection and sanctioning, guaranteeing that they are carried out without risk to health or the environment. The GIRA Plan 2018-2022 is in draft form and needs to be revised to comply with the new provisions included in 2018 in the Waste Framework Directive (Directive 2008/98/EC, as amended by Directive (EU) 2018/851).

The need to develop a new waste planning is also due to the fact that the Cohesion Policy for the period 2021-2027 includes as a condition for financing European investments compliance with certain requirements, including the existence of waste management plans, with the minimum content established in the Waste Framework Directive, as amended by Directive (EU) 2018/851.

In this region biotechnology, transformation and strategic alliances and bio-waste are the main bio-based solutions that have high deployment potential but still need support.

A very important sector for the development of this region is the social economy that is a fundamental for the entire economy of Aragon region due to the large number of entities present in this territory and their distribution in different sectors. The intrinsic characteristics of the social economy allow to overcome social and economic barriers by adapting to the difficult situations. The social economy contributes to create quality, equal and inclusive employment in this area, with subsequent economic development. This has increased the importance of this sector both nationally and internationally in the fight against unemployment, inequality, poverty and global warming. Social economy is an important sector for Aragon, in fact it generates 20 000 jobs with 5 000 organizations/entities active and represents 6% of GDP.

The Government of Aragon, through its public bodies and public companies, has developed numerous actions in recent years concerning both the promotion of Aragonese Social Economy entities, as well as the training, advice and tutoring of Social Economy initiatives through programs managed mainly by the General Directorate of Labour, Self-Employed and Social Economy, the Aragonese Development Institute and the Aragonese Employment Institute.

Social economy entities are companies and organization that have different sizes and are active in different sectors, e.g., industries, health, agriculture, renewable energy, reuse etc. These realities give an important contribution to the sustainable development also due to their presence on the territory and their commitment to a fair distribution of wealth. The social values shared by these entities such as reciprocity, solidarity and social justice, allow for a better inclusion in the society of marginalized groups.

Two important initiatives carried out in this sector are the introduction of a regulatory framework called “social economy law of Aragon” and the creation of the Aragonese Plan for the promotion of the social economy 2022 – 2025. The first one gives more visibility to the work done in the territory for sustainable development, instead the second one aims to promote a model between the government and the Social Economy actors. The Aragonese Plan will increase the collaboration and participation of citizens in public policies and in the decision-making, with a consequent increase in the contribution that the community can give in the context of a social, environmental and digital transformation. The action number 58 of this plan establishes the preparation of an Institutional Declaration of "Aragon Social Economy".

Social economy organisations contribute to helping Aragonese citizens through the following points:

- promote sustainable development due to their ability to root the economy in the local territory
- creation of higher-quality employment
- creation of social capital in local communities
- spread the importance of the social economy in dealing with unemployment, inequality, poverty and even global warming
- presence in different economic and social areas

In Aragon, these socio-economic companies and organizations take the form of local action groups usually formed by collaboration between public and private entities that have taken the form of non-profits associations. Their main characteristics are the higher-quality employments not only in term of wages but

also for management and social aspects, which consent to increase the productivity and to create a better workplace.

In European countries such as Belgium, Spain, France, Greece, Portugal, and Romania there is already legislation in this area, while in other countries such as Poland and Bulgaria draft laws has been presented. In Spain, the recognition of social entity and the establishment of legal framework for the sector were possible thank to the Law 5/2011 on the Social Economy. In this sense, even at regional level, the Aragon government is working on a draft law on the social economy which guarantees a real engagement of the regional government in this area. The purpose of this law will be to increase the visibility and recognize the effort made by entities active in this sector.

In the table 1 and 2 are the main information on social economy in Aragon region.

Table 1 Number of entitis of Social Economy in Aragon

Entities	**Number in 2020**
Cooperatives	787
Labor Company	278
Special employment centers	71
Insertion companies	17
Association	3028
Foundation	342
Agricultural societies of transformation	695
Total social economy organizations	5 218
Total companies in Aragon	90 682
Representativeness	5.75%

Source: Plan aragonés de impulso a la economía social 2022-2025

As shown in the previous table, associations are the social entities with a greater presence in Aragon region, followed by Cooperatives and Agricultural societies of transformation. The representativeness of the social economy organization on the total companies in Aragon region is about 5%.

Table 2: Employees in social economy in Aragon

Entities	**Employment of the social economy in Aragn (2020)**
Cooperatives	6 758
Labor Company	1 306
Special employment centers	2 855
Insertion companies	302
Association	3 038
Foundation	6 237
Agricultural societies of transformation	NA
Total social economy organizations	20 496
Total companies in Aragon	569 900
Representativeness	3.60%

Source: Plan aragonés de impulso a la economía social 2022-2025

The social economy in the region of Aragon accounts for about 3.60% of the total employment. Cooperatives have the largest number of employees, followed by foundation and association. Cooperatives are central for local development in this region, in fact they achieved a gross added value close to 81 million euro in 2019. These entities operate in many of the rural areas of the Aragonese community and typically have associated forms of agrarian and associated labour cooperatives (the 85% of the cooperatives in Aragon have one of this two types of legal-economic form). About 3% of Aragonese cooperatives are active in the third sector, in particular for commerce and hospitality, extractive and manufacturing industries, agriculture, livestock, hunting, forestry and fishing.

As regards the other entities reported in table 1 and 2, insertion companies facilitate the integration of marginalised people into the labour market by helping them with specific training. Usually, insertion companies are active in the following sector: clothing and textiles, recovery and recycling, cleaning, laundry, care and maintenance.

Associations are not-profit entities that usually carry out charitable activities. Associations in the region of Aragon are mainly active in education, research, training, health etc. The Agrarian Transformation Societies are active in the production, transformation and commercialization of agricultural, forestry and livestock products. In addition, they put a high commitment to promoting agricultural development.

To further develop the social economy sector in the region of Aragon in the coming years, it will be necessary to have a stronger focus on the following points:

- skills for insertion in the labour market
- lunch of activities such as informative sessions, workshops, seminars about social economy
- training actions for entrepreneurs of social economy entities
- analysis of need and opportunities in this sector
- promotion of social economy
- support for professional management in social economy entities
- better access to European, national, regional and local aid

3.2. Greece – region of Western Macedonia

Western Macedonia is the only land-locked region within Greece, covering an area of 9,451 km.2 Its population of 271,500 inhabitants constitutes around 2.6% of the national total. Despite being a center of intensive energy production, the province lags economically, mainly due to the economic reliance on the lignite mining and associated lignite-fired thermal power generation. The coal-based economy contributes more than 34% of the Gross Added Value of the Region (~ € 1.5 billion / year). Regional GDP per capita is 25% lower than the national average and has dropped significantly as a result of the country's financial crisis, which began in 2009. The region has supplied electricity to Greece's interconnected electricity system since 1960, acting for several decades as the Greek energy pillar of economic growth. Until 2019, open-cast lignite mining extended across 160 thousand acres with an additional four lignite-fired power plants (of 12 units in total), representing 20% of the total installed net capacity of the interconnected electric system of Greece. In addition to electricity, about 10.000 citizens of Kozani, Ptolemaida and Amyntaio within the region are heated by district heating systems that utilize heat from these lignite-fired power plants.

Against this backdrop, the Regional Government of Western Macedonia intends to undertake an energy transition that will diversify the economy, reduce existing (and mitigate emerging) unemployment, and safeguard social cohesion. It seeks to do so by progressively restructuring the regional economy away from coal. Such a transition hinges on attracting new investments, re-skilling workers, and repurposing other lands and assets for new economic and social good. It further relies on the development of renewables and other clean energy sources. Even though a comprehensive strategy away from coal is yet to be completed, actions have been taken since 2010 with 4 of the oldest power plant units decommissioned. In 2017, the government released a "Development Action Plan for the Post- Lignite Period" which has in part framed the future adjustment action. The National Energy and Climate Plan (NECP) and PPC (Public power corporation, biggest utility in Greece) plans initially confirmed a two-phase scenario for the lignite sector's adjustment until 2040. The first period from 2020-2030 foresees a 50% reduction in lignite electricity, that is from 33% (2016) to 17 % of the national energy production by 2030.

However, following the local and general election in July 2019, the new Government of Greece in September announced its intention to close all coal-fired power plants and their associated lignite mines by 2028.

Recognizing the wide-ranging socio-economic impact for the whole region of the planned transition, stakeholder engagement assumes an even more important role in the overall strategy, in line with the recommendations of the "Managing Coal Mine Closure: A Just Transition for All" (WB, 2018). In December 2019, the Board of Directors of PPC approved its new business plan, confirming PPC will cease operating all of its existing lignite-fired power stations by 2023.

This process involves the withdrawal of the following lignite units: Five units at the Agios Dimitrios lignite-fired power station totaling 1,456 MW, two units at Amynteo (546 MW), one unit at Meliti (289 MW), all four Kardia's units (1,110 MW), and the two units at Megalopoli (511 MW) make up the list of PPC's existing lignite units planned for withdrawal by 2023. Regarding the approximately 5000 PPC's employees working at the units and the mines, PPC's press release indicated that there will be substantial proportion of the workers who have established retirement rights by 2023, while others may either be transferred to a different PPC's Directorate or possibly be transferred to the public sector according to the latest law of the Hellenic Ministry of Environment and Energy.

Without actively taking measures to alleviate the negative impact that the lignite phase-out will have on the region of Western Macedonia, the already problematic economic situation in the region would be further exacerbated, leading to increased unemployment, damage to social cohesion, and requiring increased effort to improve the economic prospects of the region. To that end, the Special Transition Programme 2020-2023 was prepared to bridge the gap until the activation of the Partnership Agreement for the Development Framework (PADF) 2021-2027, to facilitate the energy transition in the coal regions and alleviate its negative impact.
The funding for the project is expected to be provided, inter alia, by the PA 2014-2020, the Green Fund, and the Recovery and Resilience Facility.
The areas of concern are the regional units of Florina and Kozani in Western Macedonia and the municipality of Megalopolis in Peloponnese, i.e the areas where the lignite mines and lignite-fired power plants are located.
The main priorities set by the programme are the following:

- Improving the employment opportunities for unemployed and self-employed; enhancing the adaptability of the workforce and the companies, upgrading the education infrastructure.
- Alleviating the social impact of the transition; enhancing the social cohesion.
- Fostering the economic diversification of the economy.
- Improving the economic climate and attracting more investment.
- Restructuring of the energy profile of the transition regions; increasing the natural resource efficiency.
- Facilitating green economy, digital transformation and urban regeneration.
- Providing technical support to relevant projects and actions.

Territorial Just Transition Plan (TJTP)

The Just Transition mechanism is a funding tool created by the European Union to support regions and communities that are most affected by the transition to a low-carbon economy. Greece has developed a Just Transition Plan to ensure that the transition away from coal is fair and just for workers, businesses, and communities in the regions of Western Macedonia and Megalopolis, Arkadia.
It includes a wide range of measures to support the affected regions, including investment in renewable energy, energy efficiency, and sustainable mobility. The plan also includes measures to support the development of new economic activities and job opportunities in the region, such as in the circular economy and ecotourism.
It was developed in consultation with local stakeholders, including regional and local authorities, civil society organizations, and trade unions. It aims to ensure that the transition takes into account the needs and perspectives of all affected groups, and that no one is left behind.
The Just Transition Plan for Greece is part of a broader European effort to support the transition to a low-carbon economy while ensuring social fairness and inclusion. The European Union has allocated significant funding for the Just Transition mechanism, which will be used to support regions and communities across Europe that are most affected by the transition.
In Greece, it aims to support regions that are heavily dependent on lignite coal and lignite-based electricity production, which are expected to be phased out by 2028, in order to achieve the country's climate goals and align with the EU's climate targets. The Just Transition Plans focus on ensuring a fair and sustainable transition for affected communities and workers, promoting economic diversification and job creation, and supporting the development of sustainable and low-carbon industries.

In conclusion in order for a proper transition in lignite areas to an era of clean energy, growth and operational prosperity, funding is required for projects related to various sectors. More specifically, the aim is to financially support projects in infrastructure and supporting emblematic investments, in Renewable Energy Sources (RES), projects to improve energy efficiency and implementation of electrification, projects to support and strengthen the primary sector, as well as innovation and competitiveness. Initiatives are planned and developed to utilize all available financial instruments and tools.

An emblematic project mentioned in Priority 1 of the Just Transition Development Plan is the creation of an Innovation Zone in Western Macedonia. Its purpose is to serve as a vehicle that promotes innovative entrepreneurship in the fields of clean energy and environmental technologies and act as a lever for the transformation of the economy of Western Macedonia in the post-lignite era. In particular, the main priorities of the Innovation Zone are specified as follows:

- Spatial planning, infrastructure development, and innovation initiatives in the region (e.g. Technological Park, incubators, clusters).
- Coordinating initiatives that take place in the Innovation Zone, to promote technological applications and innovative entrepreneurship in the areas of clean energy and environmental technologies.
- Attracting, and subsequently supporting, investors and research institutions from other regions/countries.
- Planning and implementing projects that serve the above aims.

Regional Strategy for Social Inclusion (RSSI)

The RSSI is a comprehensive study on the issue of poverty and social exclusion in the region of Western Macedonia, offering a detailed strategy to combat poverty and foster social inclusion. It is, thus, highly relevant in the ongoing decarbonisation process in Western Macedonia, since preserving the social cohesion during the transition is one of the main goals of the Greek authorities. In that regard, identifying the vulnerable population groups or the areas more in need of support is essential in preparing a comprehensive plan to combat poverty and support social inclusion in the post-lignite era.

An important finding of the study is that the groups that exhibited the most severe issues of social exclusion include retired people with a low income, employed individuals with low income, and unemployed people of all ages (particularly of the age group 54-65). These results highlight the importance of a realistic plan for the post-lignite era, as a lot of the jobs in the region are directly or indirectly linked to the lignite and particularly a lot of the better-paid jobs with a higher added value are related to the mining of the lignite and the lignite-fired power plants. A lack of an adequate response to the challenges presented by the phasing-out of lignite would lead to an increase in precisely those population groups that face the most significant problems in terms of social inclusion.

The situation is more critical in the regional unit of Florina (one of the two coal areas, along with the regional unit of Kozani, in the region) since the number of families that receive benefits is quite high compared to the population of the regional unit (the regional unit of Florina represents 18% of the region's total population, while 30% of the families in the region that receive benefits are residing in it).

In this respect, the strategic aims of the RSSI, and particularly the first strategic aim "Combating poverty and extreme poverty", are closely linked to the goal of the JTDP effect a transition to a more sustainable economic model while preserving social cohesion.

Smart Specialisation Strategy of Greece

For the 2021-2027 Programming Period, the new national Smart Specialization Strategy is a comprehensive economic transformation agenda in conformity with the European Structural Funds Policy objective 1 (PO1): "A smarter Europe – innovative & smart economic transformation". PO1 specific objectives include:

- enhancing research and innovation capacities and the uptake of advanced technologies
- reaping the benefits of digitization for citizens, companies and governments
- enhancing growth & competitiveness of SMEs
- developing skills for smart specialization, industrial transition and entrepreneurship

In order to formulate the new Strategy, it is imperative that all co-competent ministries and departments cooperate closely. To this end, in line with the Ministry of Development and Investments' mandate, the General Secretariat for Research and Innovation cooperates with the General Secretariat for Industry. Under the coordination of the General Secretariat of Public Investment and NSRF, the most dynamic thematic areas or sectors expected to contribute to the country's growth were identified— specifying the thematic areas/sectors and identifying (together with the business sector and the research community) activities. These activities, capitalizing on Research, Technology and Innovation, can facilitate structural change (e.g. modernization, differentiation and transition etc.) in enterprises of the sector concerned, and improve their competitiveness, while also highlighting the critical research areas/technologies (and appropriate policy tools) that should be included in the national RTDI strategy, taking into account the regional strategies developed by each Region.

At regional level, Greek regions and local communities are expected to identify, structure and make optimal use of their competitive advantages, support innovation and concentrate investments, in order to achieve the intended transformation of local economies through engagement of stakeholders in all stages. This is the so-called entrepreunerial discovery process (EDP), a bottom-up approach focusing on enterprises identifying new, innovative activities and the relevant technology needs.

The National Smart Specialisation Strategy (ESEE)[2] identifies the strategic areas of intervention (priorities), on which investments are focused. Identification of priorities is based on the strengths and the potential of the economy as well as the Entrepreneurial Discovery Process (EDP) in which stakeholders are involved.

Table 3: Regional specialization of the national smart specialization strategy

	Sustainable Energy	**Environment & Circular economy**
Region of Western Macedonia	No reference	1. Soil and Water Waste Management 2. Air pollution 3. Adaptation to climate change 4. Response to natural and man-made disasters

Source: https://energy.ec.europa.eu/system/files/2019-03/ec_courtesy_translation_el_necp_0.pdf

[2] Source: https://gsri.gov.gr/wp-content/uploads/2022/11/Synopsis_National-Smart-Specialisation-Strategy-2021-2027.pdf

Priority Areas

The analysis done when drafting the new National Smart Specialisation Strategy (ESEE) led to the identification of eight **priority areas**, in which the country has advantages and on which the transition to a new growth model could be based. These areas are the following:

- Agro-food value chain
- Bio-sciences, Health and Pharmaceuticals
- Digital Technologies
- Sustainable Energy
- Environment and Circular Economy
- Transport and Logistics
- Materials, Constructions and Industry
- Tourism, Culture and Creative Industries

The above-cited eight priority areas are similar to the ones in the programming period 2014-2020.

Vision and Strategy

The vision of the National Smart Specialisation Strategy 2021-2027 is the transition to a new growth model that will be sustainable in social, financial, and environmental terms, based on knowledge and its utilization in the production of high added value products and services that can be integrated into global value chains. This vision can be further analysed into the five **Strategic Objectives** below:

- Production of New Knowledge
- Effective utilisation and diffusion of new knowledge
- Technological streamlining
- Innovation adoption
- Development, networking and internationalisation of Greek enterprises National Smart Specialisation Strategy 2021-2027
- Increase in extroversion
- Involvement in Research, Technological and Entrepreneurial Global Value Chains

In order to achieve the abovementioned strategic objectives, ESEE has identified a number of actions that fall under the following **eight intervention areas:**

- Human Resources (business and academia)
- Research and Innovation Infrastructures
- Innovation support mechanisms, services and facilities
- Link of Research with Production
- Digital Transformation
- Regulatory Framework (Regulations, Administration, Taxation)
- Promotion of innovation by the public sector
- Visibility – Publicity

Entrepreneurial Discovery Process

The Entrepreneurial Discovery Process is linked to the identification of competitive advantage sources and the development of investment plans for innovation and investment adaptation to the requirements of the current digital and green transition of production activities. Good governance of EDP constitutes an initiative to mobilise the innovation ecosystem with a view to helping research in Greece achieve innovation results of high quality and internationally competitive in response to the business community that will have the opportunity -via EDP- to express systematically and clearly its needs, sending the appropriate signals towards the research community.

Entrepreneurial Discovery Mechanism

The Entrepreneurial Discovery Mechanism is supported by the **Innovation Platforms per Priority Area**, which is the core part of consultation at national level for the implementation of the Entrepreneurial Discovery Process. The platforms' combination ensures adequate representation of all axes of the Quadruple Helix (business, public sector, research/academia, civil society) aiming to update and further specify the priority areas of the ESEE and identify the sources of competitive advantage. The platforms meet regularly to ensure the continuity of the process. The new Innovation Agency under the Organisation of Industrial Property (OBI) within the Ministry of Development and Investments has the task to contribute to further improvement of the research and innovation production capacity of enterprises, to their adjustment to the demands of modern digital and green transition of the industrial segment, to the internationalisation as well as to develop the appropriate skills. The Innovation Agency operates in support of the Entrepreneurial Discovery Mechanism and in collaboration with the General Secretarial for Research and Innovation, assesses the EDP results in terms of entrepreneurship and capitalises on the relevant conclusions as an input to the next round of EDP implementation. It can also commission studies with a view to enriching ideas during the next round of EDP implementation and to better documenting its results. The Innovation Agency will communicate the results of the abovementioned studies to enterprises through their liaisons. At regional level the EDP is carried out under the responsibility of the competent regional bodies for the Smart Specialisation Strategy.

3.3. Bulgaria – region of Plovdiv

The Plvodiv region is located in the middle of Bulgaria and is bordered with 7 other regions (Pazardjik, Smolyan, Kardjali, Haskovo, Stara Zagora, Lovech and Sofia). Plovdiv is divided in 18 municipalities, within which the most important are Plovdiv, Assenovgrad and Karlovo.

The most important mineral resources in the region are lead-zinc, especially in Laki municipality, and deposits of building materials. Since this area is also an academic centre, with important research potential, Plovdiv has a high human resource capacity and a high level of professional qualification. In this region bioeconomy may guarantee opportunities for rural employment and sustainable growth.

Bulgaria has an important role in the paper production in Eastern Europe due to its large resources. In Bulgaria the most important products in this sector are wood, paper and cardboard. These sectors account for about 1.4% of the country's industrial production.

Textile and clothing production represent the main opportunities to increase exports and create new jobs, in fact thanks to considerable investments they have become two of Bulgaria's most competitive industries in recent years. The effects of these investments are already visible, as textile exports are growing strongly and are recovering rapidly from the COVID crisis. European market (Germany, followed by Italy, France, Greece and Spain) are the main importers of these products.

The position at the centre of Bulgaria and the broadly diversified infrastructure makes this region an important economic and transport centre. The most important transport infrastructures in this region are the international railroad Belgrade-Sofia-Plovdiv-Istanbul, the international highway E-80 which extends to Burgas and to the Black Sea and the future highway which will extend to the Greek and the Turkish borders.

The main problems currently holding back the economic development of the region are related to the consequences of restructuring its industry and agrarian sectors. Regarding the industrial sector, the current specialisation of some manufacturers in one or two product lines limits the ability of technological restructuring and the creation of flexible products to be placed on the market. Instead, the main problems in the agrarian sector refer to the slow recovery of the region's position in rice, fruit and vegetable growing. In this sense, the help given by the Bulgarian Ministry of Agriculture, Food and Forestry will be important, because it is responsible for the development and implementation of the state policy in the field of agriculture, rural development, food and feed safety, plant protection, veterinary and zootechnics, forestry management, hunting, fisheries, and aquaculture. Furthermore, for this sector regional governments are important actors for the transformation towards climate neutrality since they implement solutions on the ground.

The cultivated area in the Plovdiv region is about 197 660 ha, which is 68% of the total area of the region. In the table below are the data about fruit production for zones in Bulgaria.

Table 4: Main crops in Bulgaria region

Crops	**Surface in hectares**
Cereals	191 954 ha
Wheat	139 235 ha
Rye and Triticale meslin	9 062 ha
Oats and summer	1 710 ha
Barley	12 123 ha
Grain maize	19 770 ha
Other cereals	10 054 ha
Industrial crops incl. tobacco	7 786 ha
Sunflower	117 322 ha
Other oleaginous products	16 542 ha
Protein crops (peas, broad beans, lentils and others)	2 021 ha
Forage plants	35 451 ha
Other forage plants	328 296 ha
Vegetables and horticultural products	10 041 ha
Fresh vegetables	9 0333 ha
Vineyards	15 882 ha
Plants and flowers total	15 092 ha
Potatoes (including seeds)	3 031 ha
Fruits	39 083 ha

Source: Adjarova L., et al,. D 2.1 Country report: Bulgaria, Celebio. Available at: https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf

According to the information in the table above, the main crops in this country are cereals, wheat, and forage plants. Major stakeholders involved in crop production are the private farmers and farmers' associations, such as the Association of vegetable greenhouse producers, Association of essential oils and cosmetics producers, National Association of Grain Producers, Livestock producers' associations, etc. A main part of this sector are also individual farmers owning large or small areas.

Table 5: Fruit production for zone (2018)

	Apples	Pears	Peaches and nectarines	Apricots and Prunes	Plums and Junks	Cherries	Sour Cherries
Bulgaria total	3 981	571	3 521	2 550	7 357	10 049	1 184
North and South-East	1 685	269	2 566	2 392	4 734	5 277	704
Northwest	437	13	44	13	1 028	128	84
North Central	292	96	375	2 078	1 405	910	237
Northeast	421	71	103	157	1 083	611	314
Southeast	532	89	20 44	144	1 218	3 628	69
Southwest and South Central	2 296	302	955	158	2 623	4 772	480
Southwest	833	87	704	10	761	2 490	165
South Central	1 413	215	251	148	1 862	2 282	315

Source: Adjarova L., et al,. D 2.1 Country report: Bulgaria, Celebio. Available at: https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf

As reported in the table above, southeast (26% of the total) and South-Central region (27% of the total) have the largest part of fruit production in Bulgaria. In the South-Central region the main fruit production are apples (43% of the total), pears (37% of the total), plums (30% of the total), and cherries (29% of the total). In the South-Central region, 35% of the harvesting areas are used for apples while in the North Central region 81% of the areas are used for apricots.

Food and fruit processing residues can improve cost efficiency of agrifood processing companies, for this reason, the generation of yield from waste streams can be considered as a good opportunity to improve competitiveness. In the tables below are the residual biomass potentials for Plovdiv region from arable crops, permanent crops and agrifood processing industries.

Table 6: Residual biomass potentials from arable crops 2020 in ton

Region	Rice straw	Cereals straw	Oil seed rape straw	Maize stover	Sugar beet leaves	Sunflower straw	Total
Plovdiv	12 884	124 860		7 265	-	57 429	202 438

Source: Adjarova L., et al,. D 2.1 Country report: Bulgaria, Celebio. Available at: https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf

The agricultural and food sectors offer the greatest opportunities for the exploitation of residual biomass sources. As shown in table 4, the main residual biomass potential from arable crops in this region is derived by the cereal straw and the sunflower straw.

Table 7: Residual biomass potentials from permanent crops in 2020 in ton

Region	Residues from vineyards	Residues from fruit tree plantations (apples, pears and soft fruit)	Total
Plovdiv	0	255	256

Source: Adjarova L., et al,. D 2.1 Country report: Bulgaria, Celebio. Available at: https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf

While, as reported in table 5, the main residual biomass potential derived from the residues from fruit tree plantations.

Table 8: Biomass potentials from agrifood processing industries 2020 in ton

Region	Cotton gin residues	Rice husk	Pressed grapes dregs	Cereal bran	Total
Plovdiv	2 199	2 792	340	10 583	15 914

Source: Adjarova L., et al,. D 2.1 Country report: Bulgaria, Celebio. Available at: https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf

Cereal bran is the main source of biomass potential from agrifood processing industries in Plovdiv region.

The main energy sources in the region are nuclear (37%), traditional power plants (39%) and renewables 13%. Among the most widely used renewable sources are photovoltaic and hydroelectric. The main tools for investment support in the field of renewable sources is The Energy Efficiency and renewable source fund. The fund provides financial support up to 500 000 euro on annual fee from 4,5 – 6%. This tool is a low-rate loan for every customer who wants to invest in renewable sources. Sources of funding to produce biofuels and renewable energy is RDP 2014-2020.

In the Plovdiv region there is a well-developed practice of using a part of the straw from harvested crops for horticulture and livestock breeding. This practice could be facilitated by shredding wood near pruning areas, such as shredding branches and twigs from forestry. Around 20 % of straw can be used for energy purposes and bio-based materials.

In this region, agriculture and more specifically wheat, corn and sunflower, which occupy the highest share of crops, can contribute to sustainable energy production, in fact after harvesting these can be dried and processed and then used as raw material to produce solid fuels compacted from biomass (briquettes or pellets). Straw can be used for co-firing in fossil power plants, which is very economically efficient and can affect harmful emissions. However, now the use of plant residues for RES is not yet widespread, as in some cases it may not be simple, for example burning straw requires special equipment. Nonetheless, these activities also have numerous advantages, in fact the areas to produce some cereals, corn and sunflower have remained constant over the years, so it is possible to predict the amount of plant residues and the raw material for the possible production of renewable biofuels. All this allows for predictable cash flows and therefore guarantees the sustainability of investments.

Based on the census, in Bulgaria there are 292 000 employees in agricultural sector, most of whom are over 45 years old (about 60%), and male labour dominates in all age groups. In the last 10 years there has been a sharp decrease in workers employed in the agricultural sector, especially due to the modernization of farms and the reduction in the number of farms[3].

Food processing is an important industry sector for the Bulgarian economy due to the high production value, foreign trade, number of employees and its interdependence with other key sectors such as agriculture, machine building, tourism, transport, and logistics. Food industry represents about 10% of the gross domestic product Bulgaria. Half of the companies active in this sector are in the South-Central and South-Western regions. The main stakeholders in local agrifood sector are:

- food processing companies
- agricultural producers (primary production)
- wood processing companies
- plant oil producing bio-refineries
- greenhouse owners/producers of vegetables and fruits
- textile/clothes producing firms

Currently the economic limitations faced by agro-industrial are the energy costs, the costs of inputs (fuel for machineries, mineral fertilisers, plant protection products, seeds, forage for livestock feeding, certifications, etc) and the insufficiently qualified labour. The most important activities in this sector are canning industry, milk processing, vines production, honey production, cigarette production, tobacco processing, mineral water bottling, beer production and soft drink production.

In Plovdiv region forests are an important biomass source, in fact they occupy more than a quarter of the region area (151 915.9 ha). Bio-waste amounts to up to 50% of the wood harvested in the forest holdings. Residual lignocellulose products represent a huge raw material source for industry and energy sectors. The main uses of forestry biomass are construction (70% in percentage of the produces wood in the region), shredded paper (10%), chipboards (15%), cellulose (5%). Forest sector is mostly dominated by state-owned enterprises. About 5% of the total population of this region is employed in this sector. The share of forested land in the district has increased over the last 10 years by 3.93%. The main factors related to expansion of exports in this sector are the increase in forest areas and the increase in the production of forest products.

The average size of holdings raising cattle is 33 animals, and those raising sheep and goats and 104 animals. In Plovdiv region larger farms are concentrated, an average of 134 ruminants per farm are raised here, which is above the national average. The main destination of the cattle are meat and milk production.

Services contribute more than a half to the regional added value (about 50%), while agricultural accounts for only a small part (about 14%). In Plovdiv region the main industries are the perfumery and cosmetics, chemical, fur and leather industry and textile and knitwear. The major industrial centres in this area are Plovdiv, Assenovgrad, Karlovo, Stamboliyski, Parvomay, Sopot, and Laki (mining industry).

[3] Boshnakova-Petrova M., 2020 Agricultural Census Confirms Farm Consolidation and Growth, 2020 – available at https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=2020%20Agricultural%20Census%20Confirms%20Farm%20Consolidation%20and%20Growth_Sofia_Bulgaria_05-13-2021.pdf.

In Plovdiv region are produced the following type of wastes/side-products/residues:

- residual plant biomass from agricultural cropping (straw, hey, tree branches, residual fruits and vegetables, etc.)
- residuals from manure or compost collected and processed from the animal husbandry farms/ cooperatives
- residual biomass from the slaughterhouses and meat factories
- residual side-streams from food processing e.g. milk and meat, fruits and vegetables, grain, sunflower oil refineries, essential oils refineries, greenhouses, etc.
- organic residuals from the biogas production (after composting)

The development of Bio-based industry in Bulgaria is in its initial stage, so this country belongs to the "modest innovators", because it is well below EU average. This sector in Bulgaria depends on the usage of efficient technologies for direct biomass combustion, the implementation of energy production technologies, the availability of infrastructure allowing the usage of different types of biomass and the development of the biomass market in the country. Companies are lagging behind in bio-based research and development, this is mainly due to the poor connection between them and research institutes and universities.

Competitive Bulgarian bio-based products for the market are bio-based production of herbal pharmaceutical products, other oil products for plant cosmetics, pharmaceuticals, timber houses, furniture, bio-oils, pellet production and textiles.

The main biobased materials, side-products, waste or residues used as raw materials in the productive process are materials form:

- agriculture: plants and animals, and their residues during growing, breeding, harvesting, food processing, etc.
- agriculture: (plant animals, microorganisms) used in pharmaceutical and cosmetic industry.
- wood origin
- wild plant natural products

These raw materials are obtained from agricultural areas, including non-cultivated land (e.g., pastures, meadows, abandoned land) and from forest areas.

The 3 bio-based solutions with more relevance in Plovdiv region are:

- large-scale composting of the organic residues from plant and animal origin generated by agriculture
- large-scale production of bioenergy i.e., biomethane from biogas installations
- production of pellets and other materials to replace diesel and other fossil fuels used in energy reactors.

Instead, bio-based solutions in Plovdiv region with a high deployment potential that need support to unlock their potential are:

- large-scale cooperative of grape growers, vineyards, wine production, composting of the organic residues from grapevines and wine-making origin
- large-scale cooperative production of medicinal plants and herbs (using results from novel R&D methods) and oil extraction.
- production of pellets (from wood chips or crop residues) and other materials to replace diesel and other fossil fuels used in energy reactors.

In the Municipality of Plovdiv there is a project which aims to improve the socio-economic inclusion of vulnerable groups through education, employment and health. This project aims to use the subsidized employment to increase the access to the market and to reduce the poverty for minority groups. In addition, dedicated training courses will improve the motivation and professional skills of these target groups. Another important objective is the inclusion of children from ethnic minorities increasing the participation in activities related to education, culture and sport. Also in this framework, there is also another project (Youth center Plovdiv) which aims to expand the territorial scope of the activities of the Youth center Plovdiv and to increase the activities.

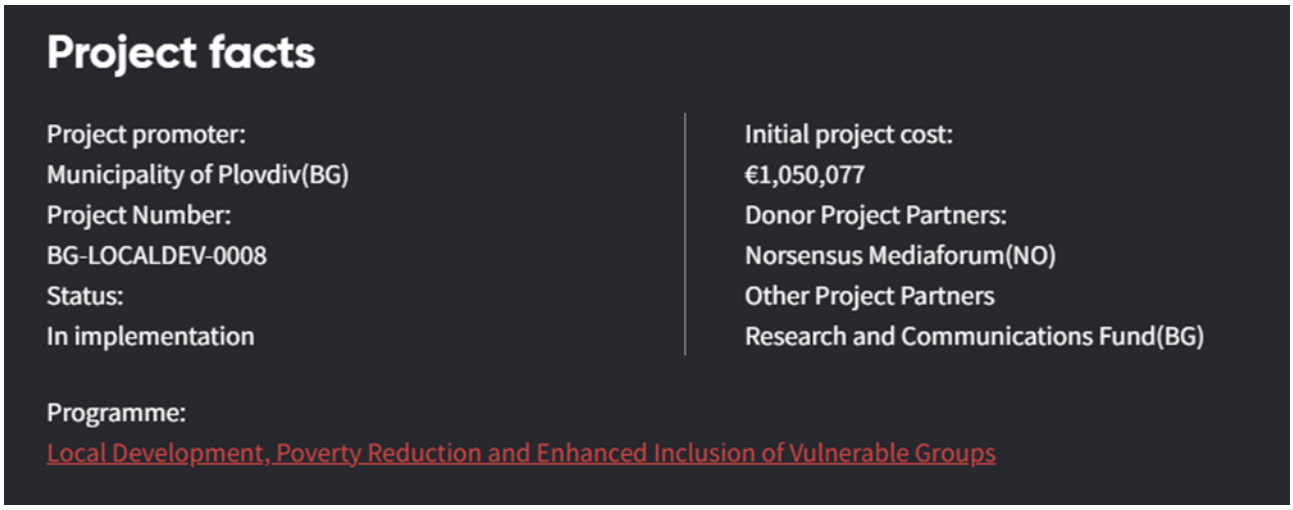

Figure 2: Youth Center Plovdiv

Source: https://eeagrants.org/archive/2014-2021/projects/BG-LOCALDEV-0008

3.4. Slovakia – the Nitra Self-Governing Region

Agriculture and Food Production

Slovakia is well positioned for the development of agricultural and food production[4], highlighted by its extensive agricultural land area of 2,385 thousand hectares (NPPC - VÚEPP 2019), representing 49% of the country's territory and equivalent to 0.44 hectares per capita, surpassing the EU average of 0.34 hectares per capita. Of the total agricultural land, primary agricultural land, specifically arable land, covers 1,400 thousand hectares. However, a major challenge lies in the extreme fragmentation of land ownership, with only 12% consolidated over the past 30 years. Land consolidation is projected to take another 30 years, which is deemed excessively long according to estimates by the Ministry of Agriculture Development and Rural Affairs.

Regarding water resources, the Slovak Republic has ample water supplies, including drinking water. The country has water reservoirs covering an area of 95 thousand m3 and a volume of 1.9 billion m3, along with rivers that serve as significant water sources for agricultural needs. Given the challenges of climate change and insufficient rainfall, realizing the full potential of water resources for agriculture requires substantial investments in irrigation systems. The necessary financial resources for these investments need to be generated gradually. An audit of the existing irrigation facilities, followed by a revitalization and investment plan, will determine the required investment resources.

Slovak agriculture is characterized by low efficiency and persistently low added value. Crop production specifically exhibits low financial returns per hectare due to an excessive focus on cereal and oilseed cultivation, which are primarily exported without further processing or added value.

Development of the food industry

A persistent and growing issue in the country is the continuous increase in the negative balance between food imports and exports. However, the Slovak Republic has all the necessary conditions to achieve self-sufficiency in food production within its region. The key lies in processing domestic agricultural production into food within the country and promoting its sale.

Since 2012, the negative balance of food exports and imports has been consistently rising, from EUR 370 thousand in 2012 to EUR 1,648 thousand in 2018. This signifies a nearly fivefold increase in the negative balance over the past seven years. Such a trend causes indirect harm to the national economy, hampers GDP growth, and burdens the Slovak consumer by supporting job creation abroad.

Although it is not feasible to present all the necessary measures for the long-term development of food production within the proposed strategy, we will highlight the most significant ones. The NSC will take the initiative to actively support these measures.

[4] National Regional Development Strategy of the Slovak Republic:
https://trimis.ec.europa.eu/sites/default/files/project/documents/national_regional_development_strategy.pdf

Development and approval of the National Strategy for Increasing Domestic Food Production

- Gradually increasing food self-sufficiency and reducing food imports from the temperate zone. Identifying food production as a matter of national interest.
- Establishing a working group dedicated to implementing the National Food Strategy.
- Developing and approving a long-term investment plan for selected sectors of the food industry, along with quantifying the necessary financial resources.
- Coordinating the Common Agricultural Policy (CAP) and the national subsidy system to stimulate the business sector.
- Generating investment and guarantee financing mechanisms required for the food industry's development.
- Establishing a competitive food production base that includes higher value-added food production and organic food.

The Slovak food industry currently does not achieve self-sufficiency in the following commodities:

- Cereal processing, such as flour milling, compound feed production, barley malt, etc.
- Oil production and oilseed processing, not limited to bioethanol.
- Development of potato production and processing.
- Cultivation of temperate fruits and vegetables.
- Milk production.
- Production of dairy products, including butter, milk fat products, cheese, sour milk products, and desserts.
- Livestock production, encompassing pigs, cattle (including free-range cattle), poultry, and eggs.

These commodities signify deficits in agricultural and food production. To determine and prioritize individual sectors within the framework of the national strategy for increasing domestic food production, it is essential to evaluate their overall development potential and the status of individual businesses. This includes implementing the "Entrepreneurial Discovery Process" through Business Process Analysis and defining incentive measures, along with quantifying financial resources. It is not feasible to support all sectors simultaneously and with equal intensity.

In updating the NSK's innovation strategy, it is evident that the core focus will revolve around innovation in agriculture and the development of food production. The aim is to generate innovative solutions not only in research, development, and production processes but also in business model innovation and distribution logistics models beyond traditional retail chains.

SMART SPECIALISATION STRATEGY

The Slovak economy is experiencing a new wave of structural change with the emergence of the bioeconomy alongside the rapidly growing information and communication technology (ICT) industry[5]. Slovakia has great

[5] DRAFT RESEARCH AND INNOVATION STRATEGY FOR SMART SPECIALISATION OF THE SLOVAK REPUBLIC 2021-2027: https://mirri.gov.sk/wp-content/uploads/2018/10/Research-and-innovation-strategy-for-smart-specialisation-of-the-Slovak-Republic-2021-2027.pdf

potential for growth in the bioeconomy sector. In 2016, the turnover of the automotive industry was EUR 26.5 billion, whereas the bioeconomy achieved EUR 11.1 billion, representing only 43% of the automotive industry's turnover. While the necessary resources such as land, water, and energy are available in Slovakia, there are challenges related to exporting raw materials and the low-added value in key sectors of the bioeconomy, particularly agriculture and the food industry.

Consultations with bioeconomy experts indicate significant potential for the sector, with the possibility of reaching two-thirds of the automotive industry's turnover within a decade and potentially matching it.

The bioeconomy is defined by the European Commission's Joint Undertaking (JU) and the Bio-based Industries Consortium (BIC), which outline its main areas and their interconnections. Agriculture and forestry serve as the foundation of the bioeconomy. While Slovakia has a slightly above-average agricultural and forest land area relative to its surface area, countries like Scandinavia have significantly larger forest areas, and Ukraine possesses an order of magnitude larger arable land area, which gives them a competitive advantage in terms of reducing unit costs compared to Slovakia.

Innovation potential of the regions of the SR

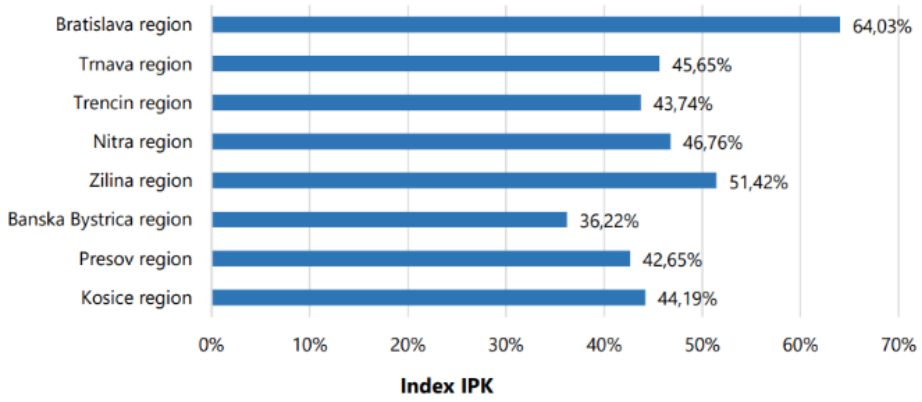

Figure 3: Index IPX

Source: ERA portal Slovakia

Table 9: Research and development expenditure by source of funding in thous. EUR

Funding Source	**2015**	**2016**	**2017**	**2018**	**2019**
Total R&D expenditure in the SR	927 272	640 835	748 955	750 947	776 590
Expenditure from state and public sources	296 133	262 670	265 909	285 431	314 158
Expenditure from university sources	30 208	12 443	12 463	11 612	13 713
Total expenditure from business sources	232 349	296 210	367 221	366 814	363 102
Expenditure from private non-profit org.	2 940	902	1 301	1 889	2 262
Expenditure from foreign sources	365 642	68 609	102 913	84 351	83 355

Source: Statistical Office of the Slovak Republik

3.5. Slovenia – whole country

Exports are a main part of the Slovenian economy. The main products exported by Slovenia are medical and pharmaceutical products (10 %), electrical machinery (9.9 %) and general industrial machinery (5.4 %). The most important countries for exports are Germany, Italy, Croatia and Austria.

The agriculture sector contributes only in a small part to Slovenia's Gross value added (GVA), in fact due to the small dimension of the Slovenian farms that are also not specialised, agricultural sector needs a structural change. In addition, only 5% of the farm owners are under 35 years, and most of the agricultural land is located in areas with natural or other restrictions. Agriculture sector covers only 6% of total employment in the country[6].

On the contrary, industrial sector has an important role in the economy of this country (approximately 40 % of the GVA). In 2017 there were 733 food processing enterprises, and this value has been growing during the last years. These companies generated an added value of around 499 million euros and employed about 13 000 people. Most of these companies have micro dimension, but despite large companies are only the 2% of this sector, they represent 53% of the added value. The main activities carried out in this sector are manufacture of bread, manufacture of fresh pastry goods and cake, production of meat and poultry meat products, processing and preserving of meat and manufacture of beer.

In Slovenia there are 789 enterprises active in the agrifood industries, the following are the main ones[7]:

- processing of meat and production of meat products (100 enterprises)
- manufacture of bakery and farinaceous products (336 enterprises)
- manufacture of dairy products (29 enterprises)
- processing and preserving of fruit and vegetables (42 enterprises)
- manufacture of other food products (134 enterprises)
- manufacture of wine from grape (33 enterprises)
- manufacture of beer (40 enterprises)
- manufacture of soft drinks and production of mineral waters and other bottled waters (21 enterprises)

In this sector are produced mainly meat products (712.2 million EUR turnover), dairy products (407.3 million EUR turnover), bakery and farinaceous products (378 million EUR turnover), other food products (361 million EUR turnover) and beer (170.7 million EUR turnover).

The main economic limitations faced by the agroindustry in Slovenia are[8]:

- Fluctuations in agricultural product and energy prices

[6] Statistical Office of the Republic of Slovenia, https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/0301975S.px/

[7] Data for 2021, Poročilo o stanju kmetijstva, živilstva, gozdarstva in ribištva, https://www.kis.si/f/docs/Porocila_o_stanju_v_kmetijstvu/ZP_2021_splosno__priloge_6.9.2022.pdf.

[8] Common Agricultural Policy Strategic Plan 2023-2027 for Slovenia, https://skp.si/wp-content/uploads/2022/11/SN-SKP_izpis-iz-SFC-7.11.2022.docx, p. 39, 90, 92 and 95.

- Limited access to capital
- Low self-sufficiency in agricultural products
- The scale and structure of organic production does not match demand
- Negative agrifood trade balance and low value added of agrifood exports
- Lower productivity of agrifood industries relative to other manufacturing activities

In agroindustry are produced wastes related to the food processing such as meat, milk, fruits, vegetables, bakery and confectionery products, alcoholic and non-alcoholic beverages industry. This sector produces 30 000 t annually of side streams in the food processing industry, which is classified as waste and 130 000 t annually of discarded food. These wastes are mainly used for biogas, except for waste edible oils, where the main method of processing is refining, or other methods of reuse and by-products of animals that are processed into various products with added value[9].

The main stakeholders in agrifood sector are:

- Chamber of Agricultural and Food Enterprises within the Chamber of Commerce and Industry of Slovenia
- Chamber of Agriculture and Forestry of Slovenia
- Cooperative Association of Slovenia
- Farmers' Union of Slovenia
- Perutnina Ptuj d.o.o. (company)
- Ljubljanske mlekarne d.o.o. (company)
- Atlantic Droga Kolinska d.o.o. (company)
- Pivovarna Laško Union d.o.o. (company)
- Žito d.o.o. (company)
- Celjske mesnine d.o.o. (company)
- Incom d.o.o. (company)
- Jata Emona d.o.o. (company)
- Panvita MIR d.d. (company)
- Mlekarna Celeia, d.o.o. (company)
- Mlinotest d.d. (company)
- Pekarna Pečjak d.o.o. (company)
- Fructal d.o.o. (company)

In order to improve the cost efficiency of Slovenia agri-food processing companies, it is important to generate yield from the waste streams derived from food and fruit processing. Although, in general, industries in this sector adapt quickly to technological development, there are still sub-sectors that have problems to do so, e.g. brewing industry, dairy industry and flour makers/bakers.

[9] Juvančič L., Gasan Osojnik Črnivec I., et al., Strategic Concept Paper for Bioeconomy: Slovenia, BIOEAST, 2023 – available at https://www.daes.si/storage/post-content/eRZ8nYZHIrhR7z0GVyCfw5Xz2HGQ2WLOdKUoFbov.pdf.

Table 10: Main crops in Slovenia: surface in hectares of percentage of the cultivable area occupied by each crop

Product	Area	Percentage
Grain maize and corn cob mix	41 402 ha	8.6%
Green maize	29 663 ha	6.2%
Wheat and spelt	26 785 ha	5.6%
Barley	21 863 ha	4.6%
Grasses, grass mixture and grass clover mixture (Grass-clover mixtures)	16 234 ha	3.4%
Grasses, grass mixtures and grass-clover mixtures (Grasses, including mixtures)	11 694 ha	2.4%
Triticale	5 152 ha	1.1%
Pumpkins for oil	4 491 ha	0.9%
Clover	4 086 ha	0.9%
Lucerne	3 949 ha	0.8 %
Rape and turnip rape	2 806 ha	0.6%
Potatoes	2 734 ha	0.6%
Hops	1 535 ha	0.3%
Oats	1 195 ha	0.2%

Source: Data for 2021, Statistical Office of the Republic of Slovenia, https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/H200S.px/

As reported in the table above, most of cultivations in Slovenia are related to grain maize and corn cob mix. After these, there are plants wheat and spelt and barley which account for an important part of this sector.

In Slovenia the production of crops for food and feed uses is about 8.2 million ton. This value allows the Slovenia production to stay in the average position at EU level. Crop production in 2017 accounted for 50% of the agricultural turnover, meanwhile livestock and agricultural services accounted for the remain 48% and 2% respectively.

To support this sector in Slovenia there are both measures financed by the EU's common budget and financed exclusively from the national budget. The amount of the national envelope was slightly reduced compared to the previous years, amounting to 131.5 million EUR.

Payments for agriculture from the national budget amount to 402 million EUR in 2021, an increase of almost 3% compared to 2020 due to the increased volume of national funding for various compensation and other exceptional payments. Due to the increase in the volume of payments from the national budget, EU co-financing of agriculture has decreased markedly, to 65% in 2021 (last 5-year average: 71%)[10] [11].

[10] Data for 2021, Poročilo o stanju kmetijstva, živilstva, gozdarstva in ribištva, https://www.kis.si/f/docs/Porocila_o_stanju_v_kmetijstvu/ZP_2021_splosno__priloge_6.9.2022.pdf.

[11] Common Agricultural Policy Strategic Plan 2023-2027 for Slovenia, https://skp.si/wp-content/uploads/2022/11/SN-SKP_izpis-iz-SFC-7.11.2022.docx, p. 79.

Following the main measures:

- market measures and direct support to producers (about 189 million EUR)
- rural development measures and agricultural structural policy (about 165 million EUR)
- funding for general services to agriculture remained relatively small (about 46 million EUR)

The prices of agricultural products in Slovenia are particularly volatile due to the presence of larger neighbouring markets. Fluctuations in production volumes and prices can cause problems for farmers, especially about uncertainty about revenues. The share of employment in this sector has declined in recent years. Due to fragmentation and limited access to agricultural territories, net value added per work unit in Slovenia is below the European average.

To increase agricultural production while ensuring sustainability, agriculture must use resources efficiently to reduce losses and waste. In addition, it is necessary to stimulate access to the sector for young people, to reduce the average age of business owners[12].

Residual biomass production registered in Slovenia is at the lowest level in the EU, with a residue production of about 700 kt. In this country, 0.7 million tonnes of residues are produced per year, and the main sources are cereals. Following are the amounts of residual biomass produced for the most relevant crops[13]:

- 83 000 t of vegetable residual biomass
- 20 000 t of fruit residual biomass
- 300 000 t of dry matter of straw
- 250 000 t of dry matter of corn stems
- 100 000 t of dry matter of hops, the remains of vegetables, oilseeds and root crops
- 30 000 t of dry matter produced by the green cuttings of vines and fruit plants

The main uses of forestry biomass in Slovenia are[14][15]:

- Roundwood: 3 815 000 m^3
- Sawlogs and veneer logs: 1 977 000 m^3
- Firewood: 1 115 000 m^3
- Pulpwood, round and split: 673 000 m^3
- Other industrial roundwood: 50 000 m^3

Following are the main stakeholders involved in the forest biomass production:

[12] Common Agricultural Policy Strategic Plan 2023-2027 for Slovenia, https://skp.si/wp-content/uploads/2022/11/SN-SKP_izpis-iz-SFC-7.11.2022.docx, p. 75, 98, 127-128, 217-218, 239.
[13] Juvančič L., Gasan Osojnik Črnivec I., et al., Strategic Concept Paper for Bioeconomy: Slovenia, BIOEAST, 2023 – available at https://www.daes.si/storage/post-content/eRZ8nYZHIrhR7z0GVyCfw5Xz2HGQ2WLOdKUoFbov.pdf.
[14] Data for 2021, Statistical Office of the Republic of Slovenia, https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/1673145S.px.
[15] Juvančič L., Gasan Osojnik Črnivec I., et al., Strategic Concept Paper for Bioeconomy: Slovenia, BIOEAST, 2023 – available at https://www.daes.si/storage/post-content/eRZ8nYZHIrhR7z0GVyCfw5Xz2HGQ2WLOdKUoFbov.pdf.

- Slovenian Forest Service
- Slovenian Forestry Institute
- Forest Owners Association of Slovenia
- Chamber of Agriculture and Forestry of Slovenia
- Wood and Furniture Industry Association within the Chamber of Commerce and Industry of Slovenia
- Association of the Paper and Paper Converting Industry within the Chamber of Commerce and Industry of Slovenia
- Slovenski državni gozdovi d.o.o. (company that manages the state forests)
- Metropolitana d.o.o. (company that manages the forests of the Archdiocese of Ljubljana)
- Soško gozdo gospodarstvo Tolmin d.o.o. (forestry company)
- Gozdno gospodarstvo Bled d.o.o. (forestry company)
- Gozdno gospodarstvo Novo mesto d.d. (foresty company)
- Lesoteka, d.o.o. (forestry company)
- Gozdarstvo Grča d.o.o. (foresty company)

The manufacture of dairy products and agricultural and forestry machinery industry in Slovenia are important sectors in term of exports. As for the dairy sector, the production of animal oils, fats, bakery products, flour products and beverages are the areas that have had the fastest growing growth. In addition, the production of a different agricultural commodities such as cereals oil plants, potatoes, hops, vegetables, fruit, beef, poultry, sheep and goats, milk and honey have also grown.

Among EU countries, Slovenia is behind only Finland and Sweden in term of relative forest coverage. Typically, in Slovenia there are forests of beech, fir-beech and beech-oak sites which have a relatively high production capacity. Despite the importance of forestry has increased during the last 20 years in this country due to the increase in the value added generated by this sector, the number of employees has reduced due to the refurbishment in the forestry management. Wood processing and furniture industry have the highest value added from exploiting wood biomass.

Sector such as builders' joinery and carpentry of wood and various building materials made of wood have a great potential in Slovenia due to the competitive prices for exports. In specific, the sectors that have shown competitiveness advantages in exports are the manufacture of furniture and the manufacture of electrical equipment. Other subsectors with a highly competitive advantage in term of export are:

- manufacture of other builders' carpentry and joinery
- manufacture of other products of wood manufacture of articles of cork, straw and plaiting materials
- forestry, logging and related service activities

Generally, for wood industry is expected a growth by 5.89% of GDP in the next decade, with a consequently increase in the employees which is expected to achieve 2 608 people and an increase in sales and productively respectively of 66% and 9.8%. Wood processing sector can represent a great opportunity for Slovenia due to the trend of exporting wood and subsequentially buying back products, e.g. plywood.

Hardwood mainly is used as firewood (55 %), for pulpwood and panel wood (24%) and roundwood (19%). The largest domestic consumer of roundwood is the sawn wood industry (1.74 million m^3 in 2021), followed by the composite wood, pulp and chemical industries with a total processing volume of 0.513 million m^3. A large consumer of roundwood is the household sector, which consumes over 1 million m^3 of firewood per year. With an annual export volume of 3 million m^3, Slovenia is a strong exporter of unprocessed roundwood, especially in the category of coniferous roundwood, which amounted to 1.35 million m^3 in 2021[16] [17].

Green technologies and processes, sustainable energy and secondary raw materials are increasingly becoming very important sectors for Slovenia. In fact, on a total R&D investment of EUR 139 million, about 90% of this amount is made in the field green technologies and processes. The growth of this sector will continue in the period 2021-2027, when are expected:

- a growth in revenue of 3.8%
- an increase in exports of 3.7%
- a growth in added value of 3.4%
- an increase in employment of 0.9%
- a rise in labour productivity of 2.4%
- an increase in R&D investment of 4.1%

Other sectors for which a strong growth is expected in the coming years are waste collection and waste treatment and disposal which have registered high growth rates in the last years, and the manufacture of paper and paper products which have obtained a competitive advantage in technology and exports. In addition, also for smart buildings and homes market, including the wood chain products is expected a grow between 10% and 23%.

The easter region of Slovenia is less developed and it is mainly characterised by agriculture activities, but nevertheless it is important for the energy supply of the country, in fact a large part of Slovenia's energy infrastructure and the only nuclear power plant of the country are located here. With regard to energy supply, the priority in Slovenia is to increase the production of renewable energy by replacing obsolete technologies with greener and more efficient ones for the use of renewable sources. Currently in Slovenia renewable energy accounts for about 16% of the total, and wood and its byproducts are the main renewable energy source used (about 52%), followed by hydro energy (about 30%). If the process of implementing cutting edge technologies continues in the coming years, in this sector it will be possible to extract almost all the added value from the products and then burn what remains and use the heat and energy generated. Increasing the potential in terms of energy generated, Slovenia wood could power several sectors such as pulp & paper sector, chemical industry, civil engineering sector (eco- bio-based material production and construction) etc. Increasing the usage of renewable sources will permit Slovenia to reduce dependency on imported sources and to increase energy security. Currently, there are no lignocellulosic bio-refineries in

[16] Data for 2021, Statistical Office of the Republic of Slovenia, https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/1673145S.px.

[17] Juvančič L., Gasan Osojnik Črnivec I., et al., Strategic Concept Paper for Bioeconomy: Slovenia, BIOEAST, 2023 – available at https://www.daes.si/storage/post-content/eRZ8nYZHIrhR7z0GVyCfw5Xz2HGQ2WLOdKUoFbov.pdf.

Slovenia that would provide the most technologically, economically, and environmentally prospective exploitation model of residual biomass utilization.

Biogas production in Slovenia is growing lower than expected, both in energy and transport sector. The main sources of biogas production in this country are agricultural waste, organic waste in municipal landfills, biodegradable waste from food processing industry, waste from public utilities and organic kitchen waste. In Slovenia biomass is used for individual heating and especially in small cities and rural areas. The main problem is the use of biomass in inefficient individual heating systems. In this country there are only a few renewable energy resources driven by small-scale district heating network, but despite this the development of this solution is a part of the Slovenian national energy plans and strategies. The main barriers to the development of this solutions are that citizens have low awareness of positive impacts of centralised small-scale DH and legislation for above 1 MW district heating networks can be improved.

In Slovenia, wood is the most important renewable energy, in fact in 2019 this source represented 48% of the country's energy mix. In 2020, the primary energy production from the biogas in Slovenia amounted to 27 metric ktons of oil (equivalent). Besides wood, less than a ton of biomaterials or biochemical are produced.

Also due to the high number of infrastructure dedicated Slovenia is one of the countries with the highest percentage of separately collected waste and management of recycling. In fact, in 2016 there were about 400 facilities for waste recycling, about 200 facilities for backfilling and 10 facilities for waste energy recovery in Slovenia.

In order to develop a large-scale bio-based production chains it is necessary to transport a large volume of materials, such as the supply of biomass and the export of (intermediate) products. To do this economically, it is possible to use waterways, such as the port of Koper which is the only Slovenian port which handles cargo and in addition it is a part of the Trans-European Transport Network (TEN-T).

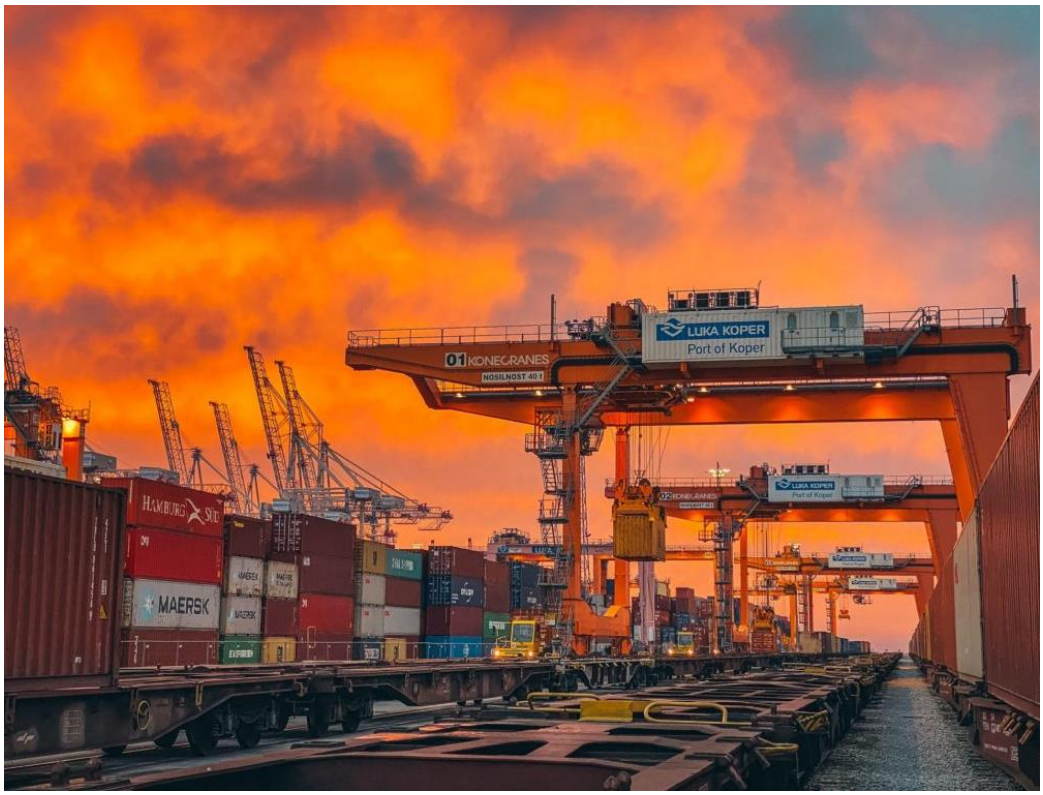

Figure 4: Port of Koper

Source: https://metrans.eu/notice-from-the-port-of-koper/

This infrastructure is central for transport and logistics activities, both at national and regional level. For this reason and because its strategic position is considered favourable for supply market in central and Eastern Europe this is one of the most important connecting transport platforms in Slovenia.

3.6. Croatia – region Adriatic Croatia

The main economic activity in the area are wholesale and retail trade, transport, accommodation and food service activities, information and communication.

Agriculture and food

The main crops in the area are:

Corn is the most dominant crop in the Republic of Croatia, based on the agricultural area utilized. It accounts for about 25% of the total agricultural area in the country. Other important crops in Croatia include wheat, barley, oats, and soybeans. Sunflower and rapeseed are also significant oil crops grown in Croatia. Additionally, Croatia is known for its production of fruits such as apples, plums, and grapes, as well as vegetables such as tomatoes, peppers, and onions.

The Adriatic region has a diverse agriculture industry, but some of the main crops grown in this area include:

Olives - Adriatic Croatia is home to many olive groves and produces high-quality extra virgin olive oil; Grapes - Croatia is known for its wine production, and the Adriatic region is no exception. Some popular grape varieties grown in this area include Plavac Mali, Teran, and Malvazija; Citrus fruits - The coastal climate in Adriatic Croatia is ideal for growing citrus fruits such as oranges, lemons, and mandarins; Figs - Figs are a popular crop in this region and are often used in local dishes and desserts; Almonds - Almond trees are commonly found in the Adriatic region and produce a nut that is used in a variety of sweet and savory dishes; Lavender - The islands of Hvar and Vis are known for their lavender production, which is used in the production of essential oils, perfumes, and soaps; Vegetables - Adriatic Croatia produces a range of vegetables, including tomatoes, peppers, zucchini, and eggplant; Medicinal herbs - The region is also known for its production of medicinal herbs such as sage, rosemary, and thyme.

For Adriatic Croatia:

Fruits: mandarins 2044 ha, cherries 1042 ha, plums 670, figs 570 ha, peach and nectarines 315 ha, apple 284 ha, walnut 201 ha, hazelnuts 148 ha. Pear, apricot, strawberries, oranges, lemon each <100 ha; Grapes 10 227ha; Olives 19 940 ha; Vegetables: white and red cabbage 277 ha; Field crops: Barley 2139 ha, potato 1813, corn 1638 ha, wheat 1272 ha, oats 1031 ha, aromatic, spicy and medicinal herbs 925. Cereals for the production of grain (including seed) - 38.51% of cultivable area; Plants harvested green from arable land – 36.30% of cultivable area; Root crops – 7.55% of cultivable area; Fresh vegetables (including melons and strawberries) - 6.76% of cultivable area; Industrial crops – 2.86% of cultivable area.

Agricultural supply chain includes:

Agricultural input companies and retailers (seed and fertilizer companies – Sjeme d.o.o. Split, Vrtni centar Viškovo, Venci d.o.o, Polja Bure d.o.o etc); Farmers and farming industries (family farm, small, medium and large enterprises..); Agricultural credit institutions (e.g. Center for Agriculture and Rural Development of the Primorje - Gorski Kotar County)

Crop consultants and advisors (Directorate for Professional Support for Agricultural Development, EUROKONZALTING); Aggregators (AGRICULTURAL COOPERATIVE SVIČRE, CROATIAN PROSCIUTTO CLUSTER, Agris cluster...); Government (Ministry of Agriculture - Administration for Agricultural Land, Plant Production and Market).

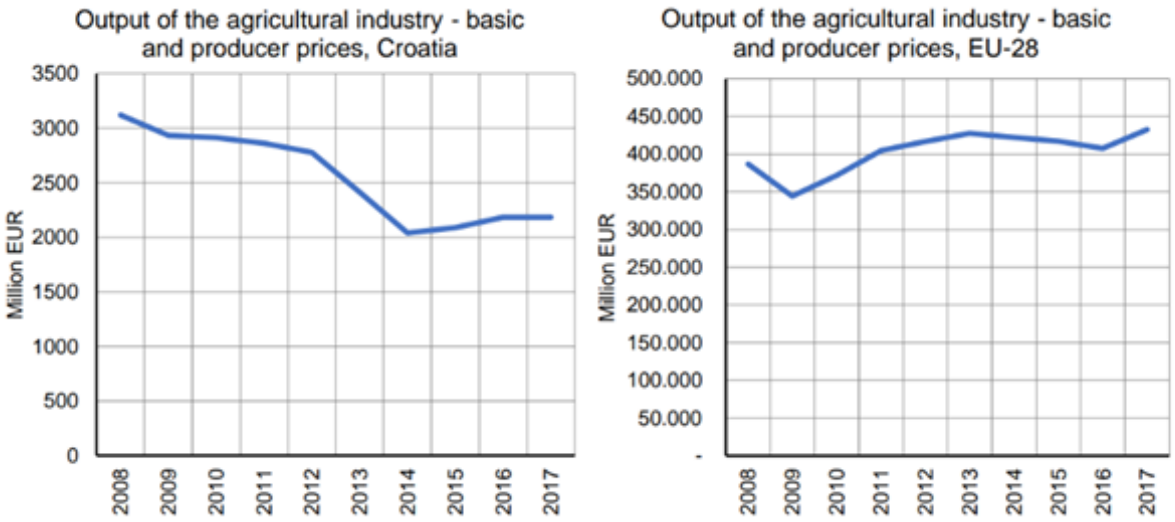

Figure 5: Output of the agricultural industry – Croatia / EU-28

Source: Eurostat (2018)

Wood processing and furniture industry

Charcoal, wood chips, particles and residues, wood pellets, sawn wood, wood-based panels, pulp wood, paper and paperboard, briquettes. Out of the total amount of industrial wood and fuelwood harvested almost 50% was allocated for households while remaining 50% was allocated for other energy purposes (cogeneration of electricity and heat, pellet, briquette and charcoal production), industry (paper, plywood, furniture…) and export.

Food Industry - Mariculture[18]

At the moment, Croatia does not have a national nor any regional bioeconomy or bioeconomy relevant strategy. As a country with moderate regional strategic action to deploy bioeconomy, under BIOEAST Initiative is in the process of developing their first national circular bioeconomy strategy.

[18] Blue Economy and Sustainable Development: Croatia Case: https://www.croris.hr/crosbi/publikacija/prilog-skup/650256

Table 11: Mariculture Production, By Species (2008-2017)

SPECIES	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
European Seabass	2 500	2 800	2 800	2 755	2 453	2 896	3 215	4 075	5 310	5 616
Gilthead Seabream	2 000	2 200	2 400	1 719	2 173	2 978	3 655	4 488	4 101	4 830
Atlantic Bluefin Tuna	3 711	4 200	3 592	3 223	1 907	2 616	2 224	2 603	2 934	2 162
Meagre			2	39	24	44	60	67	125	253
Turbot							1	7	0,5	
Common Dentex					0,037	6	40	4	1	
Red Porgy							40			
Sharpsnout Seabream			0,65							
Sea Trout						4	13			
TOTAL	**8 211**	**9 200**	**8 794**	**7 756**	**6 557**	**8 474**	**9 247**	**11 244**	**12 471**	**12 861**

Source: Croatia Ministry of Agriculture

Biobased products:

- Certified biodegradable, compostable thermoplastics from bio-mi
- Processing of LDPE and HDPE materials, bio-polymers, packaging and production of bio-materials by mi-plast
- Development of environment-friendly coating products with bio-based basis by Hempel
- Biodiesel fuel by ADRIATIC BIODIZEL d.o.o. (the only biodiesel factory from rapeseed and waste edible oils in Croatia)
- Bioenergy: Biomass power plants (7)

One published strategy with minimum bioeconomy content for one NUTS 3 county (Split-Dalmatian county) was identified - Action plan of the circular economy of SDŽ as part of Circe 2020.

Despite its great potential for a sustainable and circular bioeconomy, Adriatic Croatia lacks strategic integration and cross-sectoral interaction. It is precisely the connection of different sectors, such as bioeconomy and tourism, that is seen as a powerful driver of rural and coastal areas. Their development and mobilization of bio-resources aims to positively influence the unfavourable trend of depopulation of the rural Adriatic, which, along with the poverty of the region, stands out as one of the main problems.

Smart Specialisation

Croatia has one of the highest numbers of tertiary education institutions per capita in the EU and above average numbers of doctorate graduates, with excellence niches in Information and Communications Technology (ICT), biomedical and natural sciences[19]. A lack of coordination, management and reform in

[19] Smart Specialisation Platform Croatia: https://s3platform.jrc.ec.europa.eu/croatia

research and innovation policies and institutions as well as low levels of science-business cooperation negatively affects the quality of public research and acts as a barrier to innovation.

Development of the national S3 in Croatia came at a time of intensive national reform and policy change following accession to the EU. The first step in the entrepreneurial discovery process was the establishment of twelve competitiveness clusters in specific sectors of the Croatian economy (food, wood, pharmacy, textiles, construction, electronics, machinery, defence, ICT, chemicals, maritime industry and creative services). A S3-Interministerial Steering Group (ISG) and S3-Interministerial Working Group (IWG) represent all relevant government institutions and are facilitated by a Partnership Consultation Group (PCG), an inter-ministerial National Innovation Council and Thematic Innovation

3.7. Hungary – region North-Hungary

The characteristics of the Hungarian territory are favourable to the development of the agricultural, for this reason this sector plays an important role in the national economy. Hungary in fact has a favourable position and environmental conditions in terms of climate, soil quality and water availability. Hungary also has a large agricultural area (1 300 600 ha), more agricultural area per capita and a high agricultural income compared to the EU average. Despite this, the size of Hungarian companies operating in this sector is lower than the European average. In this country above 30.5% of the population lives in rural areas. In the North Hungary region, the quality of arable land is affected by lowering of the water table, intensive agricultural production, excessive pesticide use, soil erosion, deforestation, and construction. The production of crops for food and feed uses is in the average position at EU level. The most important crops are cereals, crop harvested green, sugar and starchy crops and oil crops. Employees in this sector are 4.8% of the total. Agricultural sector is focused on major field crops and on the production of fruit and vegetables. Hungary wants to double organic farming by 2027.

Around 38% of the rural development budget is allocated to agri-environmental intervention, 8% to the development of organic farming and 5% to the protection of natural sites. Generational renewal, which can be achieved by facilitating market access for young farmers, is an important factor for the further development of this sector. The Hungarian agricultural sector, in fact, is rich in opportunities for local communities, and these must also be exploited by the new generations.

The economy of rural areas in Hungary is supported at national level to create a sustainable development path that allows to exploit the opportunities offered by the new technologies. In addition, there is also an interest in making agricultural production a profitable and socially recognised activity. The application of innovative agricultural technologies and competitive solutions can be important steps to increase the volume of export and the competitiveness of this sector.

In Hungary there are about 8 500 agricultural cooperatives cultivating 40% of the available agricultural land. There are about 450 000 individual farmers who usually have their own agricultural fields. Most of the farmer organizations are exclusively engaged in crop production. Given the large number of activities carried out in the agricultural sector, Hungary has great potential for the development of residual biomass from arable crops.

In Hungary in addition to agriculture, feed manufacturing and livestock farming are also important sectors. Most of the farms in this country produce livestock such as poultry, pigs, sheep and cattle. The pig and poultry sector are subsidized from national resources.

In the document published under the auspices of the Hungarian Ministry of Agriculture, there is a strategic vision and clear targets for the development of organic agriculture in Hungary by 2027. This plan analyses the development opportunities of organic farming and envisages the creation of a support system which allows the organic farmers to have financial stability and professional success. The main objective of this plan is to increase the size of organic farming in Hungary so that at least 10% of the agricultural area is organic cultivation. Some of the target reported in the documents are:

- an increase to 5% in the share of domestic organic food as a proportion of total Hungarian food market turnover
- a doubling of the average domestic consumption of organic products per capita
- an increase in the share of local organic products in public catering to 20%

If these targets are achieved, the number of local farms processing organic products and the amount of biological raw material produced will double by 2027.

To increase the promotion of organic farming in Hungary, the new National Action Plan sets foreseen several tasks in the period from 2022 to 2027, grouped around seven key action areas:

- coordination of local cap support instruments for the development of organic farming;
- stimulate the production of organic food
- develop organic value chains and green public procurement
- formulate information and promotion campaigns;
- meeting the special mechanization needs of organic farming
- safeguarding and strengthening training and education in organic farming
- establishing and expanding the advisory and expert network in organic farming,
- development of professional advisory system
- strengthening hungarian research, development, and innovation (rdi) on organic farming

Forest area in the region covers about 399 000 ha, that is the 29.7% of the total area. The main uses of forestry biomass are firewood (53%), logwood (20%), paper wood (16%) and other industrial wood (11%). In Hungary, due to afforestation, the forest area in this country has increased in recent years. In this country there are mainly acacia and oak forests. The amount of live wood in forests exceeds 360 million m^3 gross, with a trend that has continued to grow in recent years.

Most of the forests are owned by the state (59%), while the others are privately owned (40%) and municipalities (1%). The stakeholders involved in the forest biomass production are state-owned and private companies. For a future development of the forest sector in Nord Hungary the following actions need to be taken:

- increase in forest area
- preserve biodiversity
- protect water resources
- maintain soil quality
- promote wood processing and utilization, such as in the production of wood-based products, furniture, and energy

There are 5 636 livestock farms in this region, covering 79 111 ha. Cattle is destined above all for milking cows and meat cattle. The main stakeholders involved in this sector are private entities such as companies and individual producers. To foresee a future development in this sector the following points must be made:

- increase in animal welfare
- rise in organic farming
- development of new technologies

- focus on sustainable farming
- export growth

The food industry plays an important role in national economy; in fact, it is the third largest sector, it has a production value of around 2 600 billion HUF and in 2017 represented about 1,9% of the GDP. Despite in the past Hungarian agricultural and agri-food sector had not only a huge importance at national level, but also at European level, today the situation has changed, and Hungary is more dependent on foreign trade. In food industry, the most important sub-sectors are:

- meat processing and preserving
- beverages
- pet food and feed production
- milk processing
- dairy products
- fruit and vegetable processing and preserving

In the region there are 13 000 agrifood industries, that produce mainly meat, dairy, frozen foods, condiments, beer and beverages. The percentage of employment in this sector in about 6.5% of the total. In this sector there are several issues such as salary prices, lack of capital, administrative loads, supply chain problems that need to be solved to create the basis for future development. Other points to consider for a future growth are increasing exports, technological advancements, increasing demand for healthy and organic food, growing demand for convenience food, developing sustainable production practices.

This sector produces 3 000 000 tons of wastes or residues in all Hungary, mainly organic waste, packaging, wastewater, chemicals, by-products. The main stakeholders of the local agrifood industry are Pick Szeged (in Salgótarján), Nestlé, Balaton Hús, Fornetti Ltd., Friesland, Hell Energy, Borsodi Északi Ásványvíz, Gyulai Hús, Coca-Cola, Euro Pék, Magyar Hús, Dr Oetker, Sága, Bonafarm-Bábolna, Sole-Mizo.

The main part of energy produced in this country come from non-renewable sources, mainly coal, gasoline and natural gas. Only 12% of the total energy produced come from renewable sources. The most used renewable source in Hungary is solar power. The energy sector employs around 26 000 people across the country. Due to the degradation of the deep coal mining, Hungary depends on natural gas for its energy production. Despite this, recently some thermal power plants have been converted to large biomass firing which become from the forestry resources. There are three wood species utilized for energy purposes in this country: acacia, willow and poplar. Hungary is a country with higher livestock densities so it should support the biogas investments. In Hungary a lot of investments have been made in recycling waste. In 2020, 3.5% of the total electric energy consumption in this country was based on biomass.

Figure 6: Acacia trees in Hungary

Source: https://adventureinhungary.wordpress.com/tag/acacia/

In Hungary there are above 5 129 biobased industries active mainly in the pastures, crops, forage, industrial plants and fruits. Between them, the more relevant in terms of revenue and role to meet the government strategic objectives are the industries that deal with pastures, crops and forage.

In this region, the biobased solutions with high potential for deployment are biogas production, waste management, organic animal husbandry, biobased construction.

3.8. Romania – West region

In the strategy of the European Union through the Common Agricultural Policy (CAP), a sustainable development of rural areas is desired through several long-term objectives. Through these objectives, a competitive agriculture is desired with a balanced development of rural economies and communities, including the creation and maintenance of jobs in the rural environment. (https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/rural-development).

The European Network for Rural Development (ERDN) supports the implementation of rural development programs through a bottom-up approach, where farmers and other rural economic actors come together to act together under different organizational forms. For the future, the European Union will include rural development in national strategic plans starting from 2023. Through these actions, the rural economy will become responsive to challenges such as climate change or generational renewal, but at the same time continue to support European farmers in an agricultural sector sustainable and competitive.

Figure 7: West Region in Romania

Energy Sector

In Romania's Energy Strategy for the period 2016-2030, the promotion of renewable energy sources[20] was taken into account, among them is the use of biomass for the production of electricity, which is why biomass

[20] UE objectives on decarbonization: https://www.europarl.europa.eu/news/it/headlines/society/20180305STO99003/ridurre-le-emissioni-di-anidride-carbonica-obiettivi-e-azioni-dell-ue

currently contributes approximately to 14% of the world's primary energy consumption (http://add-energy.ro/care-este-potentialul-de-biomasa-al-romaniei-si-ce-planuri-sunt-pentru-acest-sector-afla-acum).

Also by Decision no. 1844 of 2005 regarding the promotion of the use of biofuels and other renewable fuels for transport defines biomass as a biodegradable fraction of products, waste and residues from agriculture, forestry and related industries. The analysis of the "Roadmap for renewable energy" regulated by the European Union through Directive 2009/28/EC of the European Parliament reveals the objective premise that a percentage of 20% of global energy should be provided from renewable sources, especially in sensitive areas as providing transport in large urban agglomerations.

These European goals that proposed a reduction in dependence on fossil fuels are associated with an increase in the use of new technologies in the field of energy, which generates a positive socio-economic impact in the EU states. The member states of the European Union thus took on the task of creating and applying instruments to improve energy efficiency, in particular the economic levers that would ensure a minimum of 10% of the energy used in the transport sector from renewable sources.

Also, through Law 220/2008 on the promotion of energy production from renewable sources in Romania, premises for sustainable development are ensured at the local and regional level, especially the creation of new jobs related to the exploitation of renewable energy sources (https://www.academia.edu).

The current socio-economic context of the impact of energy production from biomass must be analyzed starting from the current moment when biomass provides about 5% of the total energy consumption at the European level. In addition to the production of energy, biomass is also produced for the production of heat in cogeneration plants, as well as a raw material in the production of biofuels (https://revista.newprojects.org/?p=1160). In other words, the use of biomass as a raw material can play an important role in creating a new industry based on this raw material provided by the agri-food sector in Romania.

This is how the national plans appeared, where along with the use of biofuels for the field of transport, the use of biomass sources for energy production also appears. In Romania, the promotion of electricity from renewable sources is stipulated by Law no. 220/2008, defining alongside established sources (hydro, wind, solar energy, etc.) and the energy produced from biomass as follows:

- biomass from biological waste (electricity production in cogeneration);
- biomass (regardless of the form of aggregation) from energy crops (exclusive production of electricity);

In Romania, there is the possibility to reduce greenhouse gas emissions by 80% in the industrial sector, by 60% in the transport sector, and the agricultural sector by approximately 40% by 2050 (https://www. europarl.europa.eu/news/ro /headlines/society/20180305STO99003/reducerea-emisiilor- de-co2-obiective-si-masuri-ue).

One of the possibilities to reduce CO2 emissions in the atmosphere is the use of modern technologies for obtaining energy, mainly renewable energy sources, including biomass. The use of biomass for the purpose of energy production is supported, in addition to arguments related to environmental protection, especially

by socio-economic considerations. Areas with good favorability for the cultivation of energy crops are considered to be positively correlated with the stabilization of the labor force of farmers. One of the arguments is given by the opportunity to capitalize on uncultivated land due to agricultural overproduction, degraded land, etc.

Biomass in biorefineries

In 2021, OMV Petrom invested approximately 21 million euros in the Petrobrazi refinery in Romania to increase its capacity to replace fossil fuels with biofuels. Currently OMV Petrom, the largest energy company in Southeast Europe, supplies fuels with a biofuel content of 6.5% in diesel and 8% in gasoline. Following the investment, Petrobrazi has increased the biofuel substitution capacity from 200 kilotons to over 350 kilotons of biofuels per year. OMV aims to reduce carbon emissions by 27% by 2025 compared to 2010. Through sustained investments, OMV Petrom has already reduced the carbon emissions of its operations by 22% in 2019 compared to 2010. Petrobrazi has a total processing capacity of crude oil of 4.5 million tons per year and, since 2005, OMV Petrom has invested approximately 1.8 billion euros in the refinery.

Probably the most publicized achievement in the field of biorefineries in Europe and in the world is the *first commercial-scale plant for the production of cellulosic ethanol in Europe*, which will be completed by the Swiss company Clariant, in ***south-west Romania***.

Figure 8: Biorefinery in Podari, Dolj county– constructed in october 2021

(Source: *Clariant Specialty Chemicals/Clariant News*)

In Podari, Dolj county, Clariant, one of the main manufacturers of specialty chemicals, is committed to providing innovative answers to today's global challenges, such as zero-emission mobility. The innovative solution developed by the company transforms agricultural residues such as wheat straw, corn stalk or sorghum bagasse into ligno-cellulosic ethanol, or second generation biofuel. The plant in Podari will process over 250,000 tons of wheat straw, from local farmers, to produce 50,000 tons of cellulosic ethanol.

Building the factory in a predominantly rural area will create more than 400 green jobs – 100 of them inside the factory and a further 300 in related services within the raw material supply chain. This technology harnesses the full potential of plants by using residual biomass.

Processing biomass through biorefining is a smart approach to harnessing bioresources and is done with a much higher degree of sustainability than biomass harnessing through combustion. Through biorefining, biomass serves as a raw material to deliver to the market a varied range of consumer products, which have the advantage of being of non-fossil origin, produced from renewable sources and are considered bio-products. For example, bio-ethanol used as a biofuel comes from biomass (by fermentation of carbohydrates), unlike synthetic ethanol produced in refineries and which comes from petroleum, or bio-asphalt is produced with lignin from lignocellulosic biomass, unlike asphalt produced with petroleum bitumen.

The access of these innovative technologies to the market requires a stable legislative framework, an additional reason to review the Romanian legislation in the field of clean energy and especially energy from bioresources. Where can the biomass used in Romania as a feedstock in biorefineries come from? In this sense, two main approaches can be established:

A. Biomass from energy crops specifically intended for processing to obtain energy and non-food products, for example: corn for the production of bioethanol, rapeseed for the production of biodiesel, energy willow for the production of solid biofuel, etc.

B. Residual biomass that comes from economic activities in which it is used as a raw material, for example: plant residues resulting from the harvesting of the main agricultural products (straw, cobs, stalks, etc.); lignocellulosic residues from forestry and wood processing; by-products and residues from the food industry (fruit pulp, beet pulp, bagasse, whey, animal fats, brewer's yeast, sludge from sewage treatment plants from the food industry, etc.).

Approach (B) is considered highly sustainable, being ideal for building a circular (bio)economy, smart waste management, reducing carbon emissions and environmental impact. However, the availability of these resources in sufficient quantity to build an integrated value chain, which would provide products at the level of market demand, is put under the sign of uncertainty in most of the studies carried out to date (Scarlat 2011, Vintilă 2012, Neo 2013).

That is why, most of the time, there is a need to supplement raw materials originating as residual biomass from different sectors of the economy with biomass produced specifically for the production of bioenergy/biorefinery.

Thus, approach (A) is generally needed, which involves the use of agricultural areas to obtain biomass. In this case, it is currently recommended to primarily use agricultural land which it is not recommended to grow crops for food or feed. There are agricultural lands, which, although they are classified in higher creditworthiness classes, may contain pollutants that are found in the food products obtained in these areas.

Examples in this regard are the polluted areas in Romania (Moldova Nouă, Copșa Mică, Baia Mare, Zlatna, etc.). If we refer only to the polluted area Copșa Mică, the total surface where the content of pollutants in the soil (0-20 cm) exceeds the alert thresholds for the safe use of agricultural land, according to Vrînceanu (2009), Lacatusu (2010), are: 7040 ha - for zinc (soil content exceeding 300 mg/kg); 10320 ha - for cadmium (content in soil higher than 3 mg/kg); 22565 ha - for lead (content in soil higher than 50 mg / kg).

Circular bioeconomy is meant to be one of the tools needed by today's society to improve food security and decrease pollution and impact of human activities on the environment. The European Commission has recently set new maximum levels for Cd and Pb in a range of food products to improve public health protection, with these measures entering into force from ***Aug. 30th 2021***. Such *actions aim to further reduce the presence of carcinogenic contaminants in food and make healthy food more accessible* — a key aim of **Europe's Beating Cancer Plan**. Examples of these thresholds include 0.030 milligram per kilogram wet weight (ppm WT) for Cd and 0.10 ppm WT for Pb in stem vegetables; 0.10 ppm WT for Cd and 0.10 ppm WT for Pb in root and tuber vegetables (EU Regulations / 2021). In the case study area, the daily TM intake rates via local vegetable consumption are well above these values, more precisely 2 to 4 times higher for Pb and 5 to 10 times higher for Cd; yielding potential adverse public health effects. Even after 10 years of ceasing production of the nonferrous smelter (production was ceased in 2009), the HM contents in the soil and plants are high inside the polluted area. Such soils, or those with various other components that can be absorbed by crop plants and endanger public health, are recommended for use in the production of non-food crops, ideal for obtaining biomass to be used as a raw material in biorefinery.

3.9. Czechia -region BIOEAST

Czech Republic is a medium sized country in the EU with more than 10 million inhabitants. Regarding national economic condition, the average level of income is below the EU average and the of exports expressed in €/capita is still relatively low.

Table 12: Main characteristics of Czech Republic

Category	Value	Unit
Population	10.6	million (2021)
Area (total)	8	million ha (2021)
% population in urban areas	25.0	% of total population (2021)
% territory predominantly rural	36.8	% of total territory (2021)
% territory predominantly urban	14.5	% of total territory (2021)
Agricultural Area	3.5	million ha (2018)
Forest area	2.67	million ha (2018)
Population density	135	n°/km² (2018)
Agricultural Area per capita	0.33	ha/capita (2018)
Forest area per capita	0.27	ha/capita (2018)
GDP/capita	19 397	at current prices in 2018
	27 483	GDP at purchasing power in 2018
GVA by Agriculture, forestry and fishing	2.2	% of total GVA (2018)

Dettenhofer M., D.2.1 Country report: Czech Republic, Celebio, available at: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.2.1_Biobased-Economy-Business-Opprotunities-in-CZ.pdf

The agricultural sector is well developed in the Czech Republic due to the large size of the country that is optimal for supporting agricultural practices on an industrial scale. All this leads to increased short- term yield of crops and long-term poor land management.

The percentage of agricultural employment in 2019 and the agricultural area per capita are like the European average. Despite this, agricultural workers are not heavily represented. Agricultural land makes up more than half (about 50.2%) of the territory of the Moravian-Silesian Region. Crop (59%) and livestock (41%) production are also like the European average. The Czech Republic has a crop production for food and feed uses of 11.3 Mt, which allows this country to be in an average position at EU level. Instead, permanent crops cover a relatively small percentage of the cultivated area, particularly compared to most EU countries. Cereals represent most of the agricultural production in the Czech Republic. Although this data is in line with

the European level, the Czech Republic lacks an overall strategy to evolve Bioeconomy in a sustainable direction.

About 60% of agricultural land is covered by cereals with wheat and barley as the main crop types. Cereal straw is the most abundant source of residual biomass covering more than 65% of the primary residual production, the rest being oil crops straw. In this country the consumption of sunflower mainly as a vegetable oil is abundant, but despite this most of it is imported and sunflower production constitutes less than 1% (less than 47 Kton) of the overall agricultural production. Potatoes and sugar beet are the most common sugar crops. The area under sugar beet and potatoes accounts for about 5% of the total agricultural area in the Czech Republic, but due to its high yield the harvest is significant. Sugar crops are less relevant in terms of their post-harvest residues production. Sugar beet is mainly used as a raw material in the sugar processing industry or as a feedstock in ethanol production. The main stakeholders involved in the crops production are cooperatives and farmers.

In the Czech Republic the current soil situation is not very good, because heavy industry and mining have had a negative effect on soil quality. To improve this situation, there are many projects that aim to improve soil quality with compost[21].

The Czech Republic is a landlocked country, so aquaculture is mainly carried out in ponds, in fact 90% of total fish production is produced here. In 2018, imports of fish and fishery products were valued at USD 362 million, while exports were valued at USD 204 million. In this country recreational fisheries, aquaculture and inland commercial fisheries are organized. In the Czech Republic there are more than 2 thousand fishing grounds with a total area of almost 42 thousand ha.

The Czech Republic is in a good position compared to most EU countries in terms of residual biomass production. Below are the main data about this sector in this country:

- 12.1 Mton of residues are produced per year and the main sources are cereals and oil crops
- primary residues are the most abundant residual source of biomass
- cereals and oilseeds straw are contributing the most to the overall residual production
- wheat straw is the most common type of primary residues
- rapeseed has one of the highest residues yields per ha of crop produced
- rapeseed straw is the second most abundant source of primary residues
- sugar crops are less relevant in terms of their post-harvest residues production.
- crops other than cereals and rapeseed are generally less relevant in their primary residue production.

In terms of the secondary residues, cereal, oil and sugar processing industries are the most relevant sectors.

Given the importance of agricultural sector the residual biomass potential from arable crops is huge. The low market penetration of organic products may be an opportunity when demand increases in the coming years. Realizing the transition to a more efficient use of biomass will require a new mind-set toward long-term environmental and social sustainability and more emphasis on economic prosperity. Most of the biomass is

[21] Hofman V., Voltr V., et al., SITUAČNÍ A VÝHLEDOVÁ ZPRÁVA PŮDA – available at https://eagri.cz/public/web/file/697802/Puda_2021_Web.pdf.

used in animal food production. However, the development of this sector is quite uncertain, because how much crop residue can be removed sustainably depends on several factors.

The main subsector in Czech process industries is food and beverage, which represent 2.7% of the GDP. The main resources used in this sector are agricultural products, forest and water management products and imported raw materials. The main branches of food and beverage industry are processing meat and meat products, processing fruit and vegetables, dairy industry, processing meat and meat products, production of flour and starch products, production of beverages, beer making and wine making.

In the Czech Republic there are several agrifood industries active in the production of dairy products, treatment of milk, processing and canning of meat and meat product, bakery, confectionery and other flour products, sugar from sugar beet, canning of fruits and vegetables, mill and starch products.

Table 13: Average production in the main agrifood industries in Czech Republic

Product	**Quantity**
Milk	181,1 mil. L
Livestock for slaughter - Cattle	9544 tonnes of live weight
Pigs	5687 tonnes of live weight
Meat production in terms of carcass weight - Beef	2989 tonnes
Veal	7 tonnes
pig meat	14 256 tonnes
Production of poultry for slaughter	7089 tonnes of live weight
Production of eggs for consumption	18.2 mill pieces

Source: https://www.czso.cz/csu/czso/11-zemedelstvi-rumfyzqa27 and https://www.mjm.cz/skrobarna-lihovar-mlyn

The main stakeholders of agrifood sectors are:

- Milk and milk products: EKOMILK a.s., MILKEFFEKT, a.s., Mlékárna Kunín, s.r.o.
- Meat and meat products: SLAUGHTERHOUSE - KURKA s.r.o., TÚŠÍNSKÉ JATKY HOLDING, S.R.O., PENSAM s.r.o.
- Bakery and confectionery products: Opava is home to the largest and most modern biscuit factory of Mondelēz International in Europe.
- Production of sugar from sugar beet: Moravskoslezské cukrovary s.r.o. - spin-off plant Opava
- Processing and canning of fruits and vegetables: Beskyd Fryčovice, a.s.
- Production of mill and starch products, distillery: MJM agro, a.s.

Forestry in Czechia Republic has faced several challenges in recent years, in particular the effects of climate change and effects of the unbalanced forestry cover formation in the past. Despite that, sustainable forest management has become a strategy and objective of forestry policy in this country, in order to:

- preserve and appropriate development of forest resources
- preserve the health and vitality of forest ecosystems
- preserve and promoting forest production functions
- preserve, protect, and appropriately enhance the biological diversity of forest ecosystems
- preserve and appropriately improve the protective functions of the forest
- preserve other social and economic functions of the forest.

Most of the forests in the Moravia-Slesia region are owned by the state (approximately 75.8%), managed mainly by Lesy České republiky, s.p. The state participates in the production of forest biomass, specifically the enterprise Lesy České republiky, s.p[22].

In the Moravian-Silesian region, wood was most often obtained as part of random harvesting due to damage by insects, especially bark beetles. This logging accounted for 35.6% of the total processed incidental logging in the region. Only a slightly lower share (35.5%) of accidental wood extraction was caused by natural causes[23].

Czech Republic has a low relative timber consumption, due to insufficient timber-processing capacities and low customer demand. This results in the export of raw wood higher than imports.

Waste can be an important source of biomass for this country, especially by using currently wasted plant foods. In the Czech Republic, municipalities manage the collection of waste that will then go to landfill or be incinerated (especially for domestic and restaurants waste).

Table 14: Current waste treatment and potential estimates for Czech Republic

Region	Total sludge production	Agricultural use	Composting	Landfilling	Incinerating	Other
Czech Republic	202 358	88 883	64 515	17 728	19 440	11 792

Dettenhofer M., D.2.1 Country report: Czech Republic, Celebio, available at: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.2.1_Biobased-Economy-Business-Opprotunities-in-CZ.pdf

Czech gross electricity production reached 87 TWh (terawatt-hours), while domestic consumption was around 74 TWh. Czech Republic is the ninth largest electricity exporter in the world and the third largest in the EU. The country's surplus of 13 TWh was exported to neighbouring countries.

Heat is produced mainly by the combustion of brown coal (43.3%) or natural gas (30.1%). In addition, brown coal is the main fuel used for domestic boilers and small heat generation systems. Wind power is the main source of renewable energy used in this country.

[22] ZÁKLADNÍ INFORMACE A LEGISLATIVA – LESY – available at https://www.msk.cz/cs/temata/zivotni_prostredi/zakladni-informace-a-legislativa-_-lesy-1286/.
[23] Lesy České republiky, Moravskoslezský kraj – available at https://lesycr.cz/media/kurovec-caste-dotazy/moravskoslezsky-kraj/.

In the coming years, the demand for biomass as a heating source is expected to increase due to the conversion to more renewable energy sources and the reduction of dependence on coal.

To reduce the use of coal in power plants and continue to have a central position in electricity export, the Czech Republic wants to expand the production of nuclear and renewable energy. In the coming years there will be several investments to give more opportunities to innovative technologies and smart solutions.

Table 15: Czech Republic and EU Energy Profile

Category	Czech Republic	EU average	Unit	Assessment	Similar countries
Energy					
Primary energy consumption	3.86 (2015)	3.22	Toe/capita (2012)	Medium	ES, FR, PL, SI, SK, ME
Energy dependence	35% (2016)	55.4	%	Medium	
Renewable energy share	14.9% (2016)	17.9	%	Medium	
GHG emissions	12.2 (2017)	9.47	Ton CO_2eq/capita	Medium	
Renewable energy (RE)					
Bioenergy in RE	88%	69%	%	Medium	FR, SI

Dettenhofer M., D.2.1 Country report: Czech Republic, Celebio, available at: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.2.1_Biobased-Economy-Business-Opprotunities-in-CZ.pdf

The renewable energy sector in this region may experience significant growth in the coming years. The main factors that will drive this growth are[24]:

- wind energy: the peaks of Hrubé Jeseník, Nízké Jeseník, Zlatohorská vrchovina and Hanušovická vrchovina in the Moravian-Silesian region are the most suitable places for the installation of wind power plants because they have the highest average wind speed.
- solar energy: to exploit the potential of solar energy it will be necessary to install PV panels in brownfields and reclaimed mining areas, where it can reach several hundred MWp, on the roofs of family and apartment buildings, on public administration buildings and on industrial and agricultural buildings.
- waste heat: in the Moravian-Silesian region there are heat sources (biogas stations, industrial operations, an incinerator for hazardous waste in Ostrava and a plant to produce cogeneration of electricity and heat) that are currently blocked because no use has been found or the necessary agreements have not been reached between the heat producer and the customer.

Due to its mountainous relief, the Moravian-Silesian Region has a significant share of ecologically managed land. Permanent grasslands predominate here, which are used mainly in the organic farming regime for

[24] Máček R.,Henelová V., MORAVSKOSLEZSKÝ KRAJ ÚZEMNÍ ENERGETICKÁ KONCEPCE MORAVSKOSLEZSKÉHO KRAJE NA OBDOBÍ 2020 – 2044, 2020 – available at https://portal.cenia.cz/eiasea/download/U0VBX01TSzAyN0tfbmF2cmhfODUxMTc0MjIyMDkzNjkxNjgyMC5wZGY/MSK027K_navrh.pdf.

cattle, sheep, goats and horses, and organic fruit. The Moravian-Silesian region in 2021 was one of the regions with the highest number of eco-farms, 433 out of a total of 4 794. 65 organic food producers out of a national total of 944 were based in the Moravian-Silesian Region in 2021[25].

Among the industries previously mentioned, organic agriculture and organic animal husbandry, process of wood into pulp and production of wood pellets from wood and wood biomass are the more relevant in terms of revenues and role to meet the government strategic objectives.

The main biobased industries in Czech Republic are:

- organic agriculture and organic animal husbandry (milk and dairy products, bread, spices, flour, pasta, eggs, chicken, pork and beef, fruit, vegetables, dried fruit)
- processing of biodegradable waste, sewage sludge, including animal by-products: compost, biofuels, fertilizer
- energy use of biomass (bioenergy)
- biogas stations (biogas, fertilizer, compost)
- processing of wood into pulp (pulp, biorefinery products, energy)
- production of woolen blankets and other bedding (woolen blankets and other bedding)
- production of wood pellets from wood and wood biomass (biofuel)
- production of natural cosmetics, oils and ointments (herbal ointments, oils from herbs and plant extracts, creams)
- production of stone wool (insulating materials)
- production of medicines and supplements

The main type of biobased materials, side-products, waste or residues used as raw materials in the productive process are:

- wood, wood chips, wood biomass (processing of wood into pulp, wood pellets)
- sheep's wool (production of wool blankets and other bedding)
- herbs, seeds and nuts (production of natural cosmetics, oils and ointments, medicines)
- farm fertilizers (organic agriculture)
- natural stone - basalt, possibly gabbro or diabase (stone wool production)
- plant biomass, slurry (biogas stations)
- cellulose leachates (production of energy and heat)

[25] Čermáková E., Grešlová P., et al., Zpráva o životním prostředí v Moravskoslezském kraji, 2021 – available at https://www.cenia.cz/wp-content/uploads/2023/02/Kraje_MORAVSKOSLEZSKY_2021.pdf.

3.10. Netherlands – region Apeldoorn

Largely present in Apeldoorn are the food industry (slaughterhouses and calf farms) and paper mills. Both are intensive industries regarding biobased products. Potentials are the protein transition (from animal protein to plant-based), digitisation and scarcity of raw materials (wood, water, etc.) and also the need for more sustainable solutions (e.g. no bleaching, more recyclable, other food like seaweed).

	2022*			
Arable crops	Area under cultivation	Harvested area	Gross yield per ha	Gross yield, total
	ha		1 000 kg	
Wheat (total)	6,321	6,242	8.7	54,209
Wheat, winter	5,120	5,053	9.2	46,286
Wheat, spring	1,201	1,189	6.7	7,923
Barley, winter	841	841	7.9	6,640
Barley, spring	1,658	1,617	6.3	10,128
Rye	332	332	4.5	1,483
Oats	158	158	6.1	962
Triticale	339	336	4.2	1,424
Grain maize	2,269	2,269	14.1	31,891
Green maize	34,419	34,299	42.4	1,455,936
Maize, corn cob mix	1,142	1,142	11.1	12,684
Kidney beans	3	3	2.3	6
Turnip rape (total)	267	267	4.8	1,294
Fibre flax	9	9	5.2	45
Linseed	9	9	1.0	9
Chicory	40	40	43.4	1,754
Hemp	29	29	8.4	242
Potatoes (total)	6,301	6,295	40.5	254,819
Ware potatoes (total)	3,588	3,583	43.2	154,726
Ware potatoes on clay soil	.			
Ware potatoes on sandy or peat soil	.			
Seed potatoes (total)	1,710	1,710	34.9	59,702
Seed potatoes on clay soil	.			
Seed potatoes on sandy or peat soil	.			
Starch potatoes	1,002	1,002	40.3	40,391
Sugar beet	3,035	3,035	75.9	230,325
Seed onions (total)	541	532	42.1	22,420
Seed onions: yellow	418	410	42.8	17,548
Seed onion: red	123	123	39.8	4,871
Seed onions (exc. loss)	.			
Onion sets (2nd year)	51	51	39.9	2,050

Figure 9: Crops within the Region Apeldoorn
Source: CBS

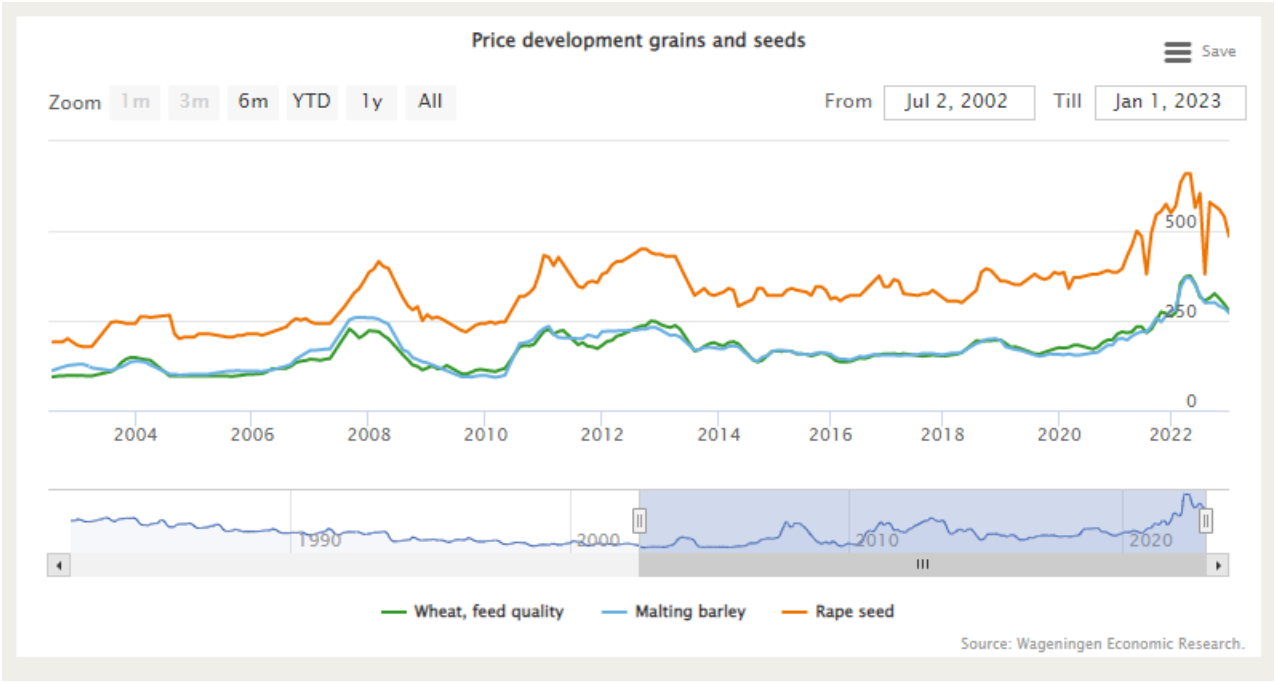

Figure 10: Price Development grains and seeds

Source: https://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2272&indicatorID=2046 (more information on dutch webpage)

Regarding the strategy for circular bioeconomy the focus is on high circularity in terms of prevention, creating biogas and compost. Attero is a large composting and biogas production facility. Recycle stations may be seen as a hub collecting products that can directly be used in the thrift shop or recycled. At the thrift shop they have several facilities such as a repair café, a sewing workshop, wood workshop and a laundry. At CODA (culture centre) they offer workshops in their Experience Lab such as Fixing Fashion, Plastic Recycling and a Bio design Lab[26].

Also, the Region has specialization within the construction field. The housing sector is about new homes to be built to provide the desired housing stock and about renovation, repurposing and demolition of existing homes. The net planned capacity for housing in Gelderland until 2030 is approximately 74,000 homes. It is expected that 76,567 new homes will be built and 2,754 will be demolished. Data on the extent of the maintenance and renovation task of homes are not readily available and have therefore not been further inventoried.

The planned new construction and the energy-neutral and climate-proof existing homes are accompanied by a high demand for materials. By weight, they are mainly stony building materials such as concrete and brick.

[26] CODA Experience Lab: https://www.coda-apeldoorn.nl/nl/locations/experiencelab

Part of this demand can be met by a (more) high-quality reuse of stony materials released during demolition. Another option is to use alternative biobased raw materials, such as: wood, flax and miscanthus.

Demographic developments such as the aging population and the growth of single-person households are creating an increasing need for homes that can easily be adapted, split or merged. Temporary homes and circular housing concepts can contribute to making these transitions and provide temporary housing during renovation/transformation. Flexible homes thus prevent the (early) demolition of no longer suitable homes in the long term.

Living Lab and knowledge center 'Circular and biobased construction: the knowledge center is being built with materials and products from the dismantling of old buildings in the region in combination with biobased materials. A project is starting in the Achterhoek to store demolition waste from social real estate that is released for 5 years in a materials marketplace to be processed as recyclate through circular procurement.

About the repurposing existing real estate this may concern a variety of buildings that are no longer necessary or suitable for their original function: such as office buildings and schools that are being made suitable for a residential function. Repurposing prevents demolition and saves on raw materials.

For the plastic industry The plastics industry in Gelderland annually produces 553 kton of products, with the following major subsectors: the manufacture of plastic sheets, foil, tubes and profiles (280 kton/year), the manufacture of plastic packaging materials (110 kton/year) and the manufacture of other plastic products (150 kton/year). The input for the plastics industry consists of semi-finished products, primary granulate (fossil, biobased) and recyclate.

Regarding the plastic industry there are no producers of primary plastic granulate in the province of Gelderland. There are, however, various producers of regranulate such as Rymoplast. Regranulate is made here from plastic waste streams, a raw material for new products.

Three options have been distinguished for a more circular plastics industry.

1. Better separation and production of plastic regranulate: the majority (83-85%) of discarded plastic products are incinerated. Primary granulate can be replaced by processing plastic products into plastic regranulate. There are many types of plastics on the market and a mix of different plastics is released after use. To be able to reuse the plastics, separation of the different types is necessary.

2. Production of recycled products: in addition to the supply of regranulate, the demand for recycled plastics can also increase. By making more semi-manufactures and end products from regranulate or other forms of discarded plastic, a market for discarded plastics is created. And the demand for primary raw materials is falling.

3. Use of biobased raw materials for plastic products: fiber-rich crops (such as flax and hemp) and in particular residual flows from carbohydrate-rich crops (such as maize, wheat, sugar beet and starch potatoes) can be used for the production of chemical substances and biobased materials. Biobased raw materials thus replace fossil raw materials in production.

3.11. Germany – region Baden-Württemberg

Germany is one of the main agricultural producers in the EU. In this country agricultural production is concentrated in a specific region according to the type of activity. The Northern federal States have a high density of livestock farms, while in Baden-Württemberg arable crops are more dominant and in the southern regions (Baden- Württemberg and Bavaria) there are above all small-sized farms.

The bioeconomy is financed by the federal state and political support from the Federal Government. The Baden-Württemberg region, realizing the potential of a sustainable and circular economy, was one of the first regions in 2013 to have created a bioeconomy research strategy and a federal state research program. In addition, in 2019 this region adopted a state strategy for a sustainable bioeconomy. Between 2020 – 2024, 50 million euros has been allocated for the implementation of this strategy, to promote the transformation towards an efficiency and sustainable economy based on renewable energy and biological resources.

The application of this strategy will achieve the following objectives:

- use of renewable and recyclable row materials sources, and a consequently reduction of greenhouse gas emission
- this region will become a pioneer state for sustainable and circular economy organization
- strengthening rural areas based on innovative bioeconomy solutions. This point will increase regional added value and create jobs.

With this plan, sustainable management of the regional economy based on biological resources will be created in the Baden-Württemberg region.

The government of Baden-Württemberg has identified the main opportunities offered by the bioeconomy in the following areas:

- environment: the sustainable use of renewable resources will allow to minimize the effects of climate change and to preserve the ecosystem
- economy: there are many economy opportunities that can be open, such as the creation of employment and investment
- social transformation: bioeconomy creates incentives for a transformation in the way citizens usually think, adopting circular approaches.

The strength of Baden Württemberg's bio-based industry is the well-established cluster landscape related to certain bio-based sectors such as food and feed, competitive high-tech products on the market.

The biobased industries located in this region are mainly active in the fields of agriculture, forestry, fishery and aquaculture, food, feed, biobased materials, bioenergy, conversion technologies, biotechnology, waste, etc. Two other opportunities in Baden-Württemberg are the bio-based textile and clothing sector, in fact cooperation and information events on these issues have already been held. There are already products on the market, such 100 % bio-based sustainable clothes, but they are a niche. Bio-based textiles may have opportunities in the high-tech automotive sectors.

In the table below are the main areas where Baden-Württemberg region can take advantage of opportunities offered by bioeconomy.

Table 16: Opportunities offered by bioeconomy in Baden-Württemberg region

Area	Measure
Linking sustainability and a bioeconomy	By implementing qualitative targets and quantifiable indicators for a sustainable bioeconomy, the government will measure the contribution that the sustainable circular bioeconomy will make.
The "sustainable bioeconomy" advisory board	A "Sustainable Bioeconomy" Advisory Board will be established. This entity will support the implementation and further development of the State Strategy for a Sustainable Bioeconomy.
Legal framework	The conditions that could inhibit or promote the development and dissemination of a sustainable circular bioeconomy and how they can be further developed will be analysed.
	The regional government will analyse the best methodologies for consulting the legal framework, authorisation processes and application procedures for biological solutions.
Cooperation at the state level and representation of regional bioeconomy areas at the federal and EU level	Baden-Württemberg will be active in exchanges with other regions to develop initiatives at the federal and EU levels.
Public procurement in Baden-Württemberg	Analysis of how sustainable circular bioeconomy can be included within the scope of public procurement.
Idea competitions for innovative bioeconomy solutions	Applications will be opened for idea competitions addressing current issues.
Sustainable generation and supply of biological resources	Baden-Württemberg will promote applied research and development on efficient generation and supply of regional biomass.
	The potential for sustainable useful biomass will be analysed using developing scenarios outlining future demand for regional biomass.
Food supply systems and food of the future	Promotion of applied research and development of consumer-oriented productions and process innovations along the value-added chain for food.
Digitalization in agriculture and forestry	The region will benefit from digital innovations to increase resource efficiency along the entire process chain and to promote innovative applications and business models.
Intelligent raw material and material flow management	The region will support innovation initiatives to efficient mobilization of regional biogenic.
Promoting the intelligent use of biological resources	The use of wood as a material will be promoted.
Further developing the number of biogas facilities	The number of biogas plants will increase to make them an essential element in bioeconomy-based value chain.

Source: State strategy for a sustainable bioeconomy Baden-Württemberg

The Baden-Württemberg region is a high-tech hub for the development of efficient, energy-saving and environmentally friendly technologies. Through its state strategy, this region wants to become a national and international leader for sustainable development of the bioeconomy both from a technological and social point of view.

The biotechnology sector is important for Baden-Württemberg, in fact here there are 156 biotech companies with 18 680 employees and taxable revenue of 5.03 billion euros in 2014 (including biopharmaceutical production). This sector is dominated by micro and small companies. Three of the largest European biotechnological production facilities are in this region, and in specific in the cities of Biberach, Laupheim and Ulm. In Germany, federal states have their own research and innovation strategies and programmes, which support the development at local level.

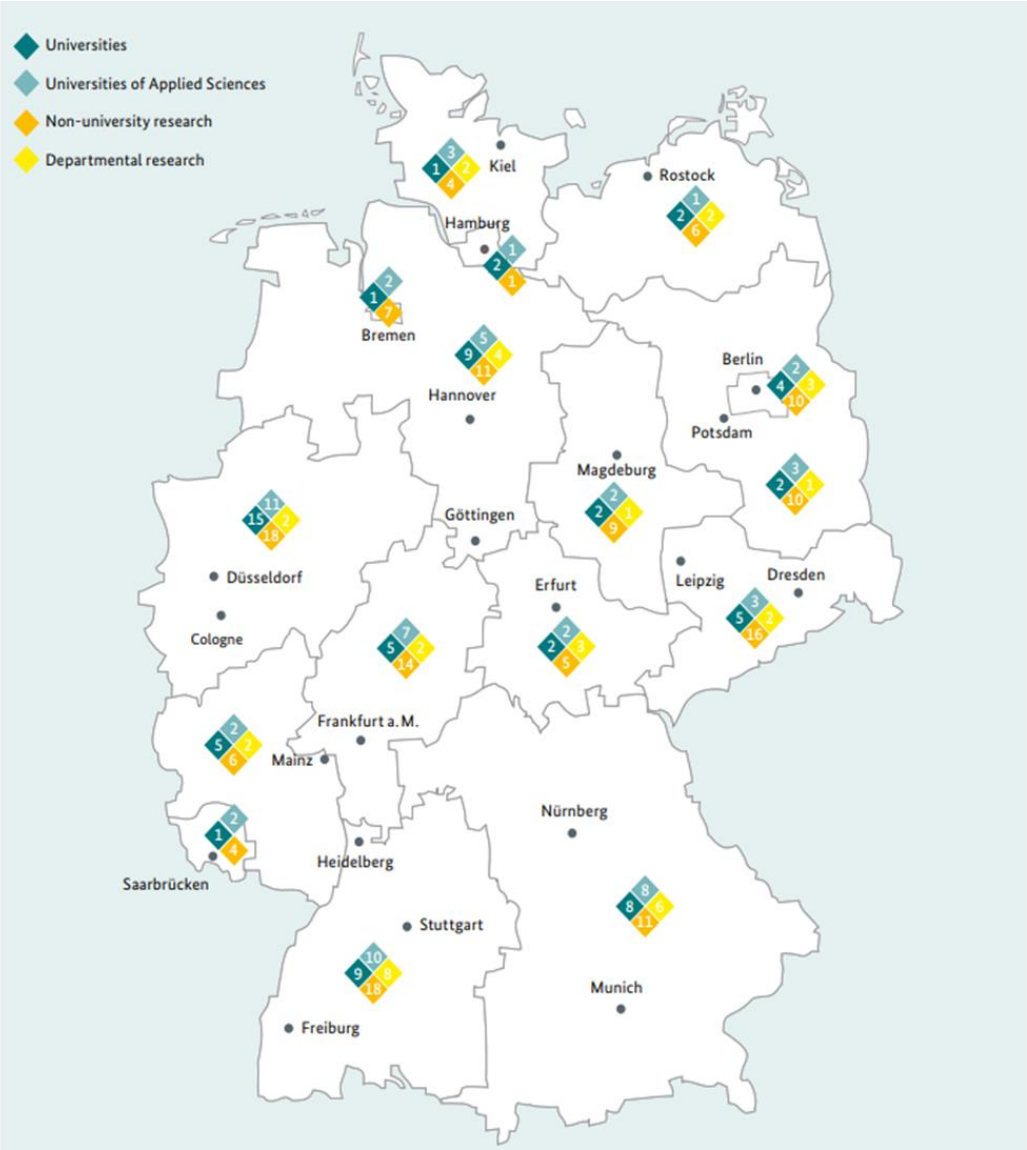

Figure 11: The bioeconomy research landscape in Germany

Source: Bioeconomy in Germany Opportunities for a bio-based and sustainable future, available at https://www.bmbf.de/SharedDocs/Publikationen/de/bmbf/FS/31106_Biooekonomie_in_Deutschland_en.pdf?__blob=publicationFile&v=5

To transform the current typology of economy into a sustainable bioeconomy, the role of regions as centre of economic and research activities is crucial. Regions can enable cooperative knowledge creation leads to innovations through research at company and academic level. Baden-Württemberg is an important region for innovation in both Germany and Europe, in fact it is the German region with the highest expenditure on research and development (EUR 28 billion). This is also Germany's leading region for patent applications with 133 patent applications per 100 000 inhabitants in 2018.

Researchers from Baden Württemberg are analysing the key issues in the transition to the bio-based economy:

- University of Hohenheim is analysing biomass production, biomass potentials, land use, land use changes and many other aspects associated with bio-based raw materials.
- Institute of Farm Management at the University of Hohenheim is analysing efficiency land use, material flows and production systems in the agrarian sector.
- Institute of Forest Utilisation and Work Science at the University of Freiburg is analysing how improve the industrial utilisation of forest wood products.
- Karlsruhe Institute of Technology (KIT) has developed a method known as "biomass steam processing" that enables the production of biochar from residual biomass.

Baden-Württemberg ranks fourth in Germany by value of agricultural production, but as one of Germany's hottest areas, it could feel the most from the effects of climate change. The land is used mainly as arable land and grassland. Vineyards, vegetables and fruit are the crops for which the greatest profit is expected. In this region, the second most important field crop is maize (in 2019, 192 800 ha of this product were cultivated). The main crops in the area are wheat (14%[27]), barley (9%) and maize (8%)[28]. Corn is usually used as a supplier of high-quality food and feed and as an important raw material for the technical-industrial sector. Corn starch is used for producing plastics, paper and cardboard, adhesives, packaging and insulating materials etc. The corn cob can be used in several applications such as sound carriers, floor coverings, hardboard, animal litter, polishing agents, oil binding agents etc.

The main stakeholders involved in crops production are[29]:

- individual farmers owning less than 5 ha: 15,7%
- individual farmers owning 5-10 ha: 17,9%
- individual farmers owning 10-20 ha: 20,6%
- individual farmers owning 20-50 ha: 22,2%

[27] Surface in hectares of percentage of the cultivable area occupied.
[28] Baden - Württemberg statistisches landesamt – available at https://www.statistik-bw.de/Landwirtschaft/Bodennutzung/LF-NutzngKultFrucht.jsp.
[29] https://www.statistik-bw.de/Landwirtschaft/Agrarstruktur/

- individual farmers owning over 50 ha: 23,6%

The agricultural land surface area in Baden-Württemberg is almost the same as many years ago, in fact in 1979 this area was 1.5 million hectare (ha) and until 2014 decreased only to 1.4 million ha, mainly because of the reduction of permanent pastures. For this reason, it seems to be difficult to have an enlarging of agricultural production land. The only possibility could be the use of new technologies and crop change to increase arable crops. In recent years these two solutions have increased arable production from 4.7 million tonnes to 5.3 million tonnes. Agriculture, forestry and fishery account for 1.1% of the total employment[30].

The high degree of innovation in the Baden Württemberg region and the state government's support programmes create opportunities for SMEs to develop new technologies for processing natural fibers applied in agriculture, food, cosmetics and chemical industry, biotechnology, construction, etc.

An important sector for Baden- Württemberg region is agrifood, which specializes in meat processing industry, dairy industry, bakery and confectionery industry and production of processed fruits and vegetables[31]. In 2021, 577 312 persons were employed in the agrifood industries. The main economic limitation faced in this sector are increasing of energy costs and changing consumption patterns (especially important for the meat and meat processing industry). The main stakeholders of agrifood industry in this region are[32]:

- Alpha-Protein GmbH
- Badische Peptide und Proteine (BPP) GmbH
- Better Food Consulting
- Fraunhofer-Institut für Grenzflächen- und Bioverfahrenstechnik IGB
- Geco-Gardens
- Hochschule Biberach
- IHK Rhein-Neckar
- Katz Biotech AG
- Kleinblatt GmbH
- Landwirtschaftliches Technologiezentrum Augustenberg (LTZ)
- ProteinDistillery GmbH
- Signature Products GmbH
- Spoontainable GmbH
- Steinbeis Europa Zentrum
- Universität Hohenheim
- Universität Stuttgart

[30] Baden - Württemberg statistisches landesamt,Er-werbs-tätige, Erwerbstätige am Arbeitsort im Bundesvergleich – available at https://www.statistik-bw.de/Arbeit/Erwerbstaetige/ET_wirtschSektoren.jsp#:~:text=So%20arbeiteten%202021%20in%20Berlin,knapp%2031%20%25%20im%20Produzierenden%20Gewerbe.

[31] Bundesministerium für Wirtschaft und Klimaschutz, Lebensmittelindustrie – available at https://www.bmwk.de/Redaktion/DE/Artikel/Branchenfokus/Industrie/branchenfokus-lebensmittelindustrie.html.

[32] Bioökonomie Baden – Württemberg – available at https://biooekonomie.baden-wuerttemberg.de/,Lde/Startseite/Akteure+in+BW/Online+Kompetenzatlas?search=true&umkreis=10&ort=&textsuche=&themen=Nahrungs-%20und%20Futtermittel&organizationType=.

- Food.net:z – Lebensmittel Netzwerk Rhein-Neckar e.V.

Baden Württemberg is the second largest region in Germany by forest extension, with about 1.4 million hectares of forest (38% of total land area)[33]. The strengths of this sector are the high-tech applications for forestry. Each year 11 million metric cube of timber are cut, and main user of this timber is the sawmill industry (65%) and log trade (18%). About 24% of this forest land is owned by the land of Baden-Württemberg, 40% by municipals and local authorities and the remaining part by privately owned[34]. 4 out of 11 million cubic meters of wood have been used for energy sector, resulting in a reduction in fossil fuels and CO_2 emissions. The main possibilities for an expansion of the forestry sector are sustainable economy and new applications of woody biomass in construction. The main stakeholder involved in the forest biomass production are owner of the forestland, sawmill industry, wood building and construction sector, etc. With the Biomass Action Plan, the state government aims to increase the share of wood in construction and the per capita consumption of sawn wood.

Bioenergy is an important resource for the economy of Baden-Württemberg, in fact it is the 2nd most important economic pillar for farmers. The importance of this sector is given by the attention that Baden-Württemberg has on this topic, in fact this region was the first in Germany to approve a law for heat utilization from bioenergy in the building sector in 2008. The long-term goal for the energy sector in this region is to increase primary energy from renewable up to 80% by 2050. In 2015, gross consumption of energy biogenic sources amounted to 5.65 % of net electricity consumption, 13 % of heat consumption and 4.8 % of fuel consumption. In Baden-Württemberg 8.2 % of the agricultural land is used for bioenergy. Since 2015 the biowaste are collected separately in this region to provide resources for a high value energetic and materials use. These resources can be exploited in several ways such as composting, fermentation, thermic use.

Stuttgart is the economic centre of the Baden-Württemberg region and is an engineering hub, with several leading global companies. In this region, the economy is more focused on the service sector than in other parts of Baden-Württemberg which instead focus on the productive industry. The most important sectors are automotive, mechanical engineering, and the creative industry.

Another important factor of Baden-Württemberg its location and infrastructures that make this region one of the most important transport hubs in both Germany and Europe. The infrastructures currently present are very efficient for several type of transport such as road or rail, on water or in the air. This different transport options available in Baden-Württemberg are optimally used by connecting a variety of routes.

[33] Statistisches Bundesamt Wald und Holz, Flächengröße des Waldes nach Bundesländern – available at https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Wald-Holz/Tabellen/waldflaeche-bundeslaender.html.

[34] Ministerium für Ernährung Ländlichen Raum und Verbraucherschutz, Waldland Baden-Württemberg – available at https://mlr.baden-wuerttemberg.de/de/unsere-themen/wald-und-naturerlebnis/landesforstverwaltung/waldland-baden-wuerttemberg/.

3.12. Italy – region Campania

Region Campania foresees future perspectives in sustainable agriculture (adoption of organic farming methods), Technology and innovation (precision farming and artificial intelligence to reduce waste and increase productivity), Product diversification (new crops and value-added products). The main products are the following[35]:

- Tomatoes: Campania is famous for its San Marzano tomatoes, which are considered some of the best tomatoes in the world. These tomatoes are used in many Italian dishes, including pizza and pasta sauce.
- Mozzarella di Bufala: This is a type of cheese made from the milk of water buffalo. Campania is the largest producer of mozzarella di bufala in Italy, and it is used in many traditional dishes in the region.
- Wine: Campania produces several types of wine, including Falanghina, Aglianico, and Fiano di Avellino.
- Citrus fruits: Campania is known for its lemons and oranges, which are used in many dishes and desserts in the region.
- Olive oil: Campania produces high-quality extra-virgin olive oil, which is used in many dishes in Italian cuisine.
- Artichokes: Campania is the largest producer of artichokes in Italy, and they are used in many traditional dishes in the region.
- Chestnuts: Chestnuts are a popular ingredient in many dishes in Campania, and the region is one of the largest producers of chestnuts in Italy.

Table 17: Main crops in Campania region

Crops	Surface in hectares
lettuce	122 400
strawberry	107 030
tomato	93 220
olives	74 941

Source: http://www.agricoltura.regione.campania.it/psr_2014_2020/psr.html

The main perspectives include the integration of new technologies and innovation can help to increase the efficiency and productivity, the adoption of circular economy principles can help to reduce waste and promote the reuse of resources in the agroindustry, the development of new and innovative products that can meet the changing needs of consumers and expand export markets. The agroindustry sector can also

[35] Agriculture data – Campania Region: http://www.agricoltura.regione.campania.it/psr_2014_2020/psr.html

contribute to the development of sustainable tourism (diversify the local economy, create new job opportunities, and promote the cultural and natural heritage of the region).

Table 18: Average selling price of the main crops in Campania region

Crops	€/kg
lettuce	0.85
strawberry	4.01
tomato	0.81
olives	0.70

Source: http://www.agricoltura.regione.campania.it/psr_2014_2020/psr.html

For the use of the biobased[36] waste the perspectives are focused on the development of new biobased products: biobased raw materials and side-products can be used to develop new biobased products such as bioplastics, biochemicals, and biofuels, which can replace their conventional counterparts and reduce the reliance on fossil resources. Waste valorisation: biobased waste can be transformed into valuable products through processes such as biorefinery and composting, which can reduce waste and provide new revenue streams for industries and communities. Climate change mitigation: the use of biobased raw materials and products can reduce greenhouse gas emissions and contribute to mitigating climate change. Circular economy: Biobased materials and products can contribute to the transition towards a circular economy by reducing waste, increasing resource efficiency, and creating new value chains and business models.
Biobased products are often produced from renewable resources, which have a lower environmental impact than conventional products derived from fossil fuels.

Also, biobased products are often free from harmful chemicals and additives that are commonly found in conventional products. This can benefit consumers' health and safety by reducing exposure to potentially hazardous substances. The development of new biobased products requires research and innovation, which can drive economic growth and create new business opportunities. The growing interest in sustainable and eco-friendly products among consumers can create new markets for biobased products and drive demand for more sustainable practices across industries.

The Campania region has also focused on the healthcare sector and blue economy promoting 4 important investment packages in the field of biotechnology for health in the translational research sector. The first concerns the structuring of 13 technological platforms for the fight against oncological pathologies concentrated in 10 technological trajectories falling within the Innovative therapeutic approaches (Low molecular weight chemical product Cell therapy Peptide Monoclonal antibody Regenerative medicine Vaccine Recombinant protein Orphan drugs (rare oncological diseases) , radiopharmaceuticals.) and in Diagnostics genome sequencing, molecular biology and precision mechanics, nanophotonics, liquid biopsy,

[36] UOD Green Economy and Bioeconomy Campania Region: https://www.regione.campania.it/imprese/it/regione/d-g-sviluppo-economico-e-attivita-produttive/50-02-03-uod-energia-efficientamento-e-risparmio-energetico-green-economy-e-bioeconomia

integration of clinical data with molecular ones (NGS technology), biomarkers. The second concerns the creation of 4 research infrastructures for the fight against oncological pathologies concentrated in 7 technological trajectories concerning diagnostic imaging (II and III generation high-throughput sequencing with technological imaging, flow cytometry and confocal microscopy based on preclinical imaging with dynamic high resolution light microscopy (confocal), Development of bio-markers Development of tracers for Imaging) New diagnostic systems: nano-biophotonics and Diagnostic system for translational healthcare Technologies based on 'microarray', Next Generation Sequencing (NGS). The third concerns the activation of 27 technology transfer projects for innovative companies with high potential for the fight against oncological pathologies - Campania Terra del Buono with a percentage distribution of 48% in ICT applications[37] and technologies in support of diagnosis and prevention of pathologies, 11% in ICT applications and technologies to support the management and implementation of social and health processes, 11% in foods and functional nutritional products for the prevention of pathologies, also through customized protocols, and finally 11%, 1% in the development of technologies and processes for the valorisation of production waste. The fourth concerns the funding of research and development services for the fight against Covid-19 in the first phase of the health emergency, in order to activate the regional research system in the production of innovative solutions for the fight against the spread of the pandemic. The following figure shows the investments activated for the technological domain Biotechnology and health in the period 2014-2020 by the POR Campania ERDF with reference to the technological trajectories most involved. The Blue Economy is a strategic sector for the development of territories in the medium and long term and is based on seven production sectors, which define its characteristics and activities: 1. Fish supply chain (Marine living resources): includes activities related to fishing (primary production), fish processing (Processing of fish products) and the related wholesale and retail trade (Distribution of fish products) 2. Marine extraction industry (Marine non-living resources): concerns the extraction activities of natural resources from the sea, such as oil and natural gas and other minerals 3. Marine renewable energy: Offshore wind farms 4. Port activities: includes port and marine projects, handling and storage 5. Shipbuilding and repair: understood as the set of boat building, shipbuilding and demolition activities, the manufacture of instruments for navigation and the construction and installation of related industrial machinery and equipment 6. Maritime transport: all transport of goods (Freight transport) and people (Passenger transport) by water, together with the related insurance and intermediation activities of the same transport and logistic services (services for transport) 7. Coastal tourism (Coastal tourism): activities related to the accommodation and transport.

[37] Region Campania plan for innovation: http://www.regione.campania.it/regione/it/tematiche/ricerca-e-innovazione/piano-di-azione-ed-interventi-per-la-ricerca-e-l-innovazione?page=1

4. Regional comparison analysis

In this chapter, a comparative analysis of the results obtained in different regions is carried out. The first part provides an overview for each region, highlighting the main results of the respective analyses. Subsequently, the comparative analysis is detailed, highlighting the main similarities and differences between the various regions. The aim of this chapter is to provide a general overview of the bio value chain in the regions examined, identifying strengths, weaknesses, main differences, and common aspects.

Spain – region of Aragon

In Aragón, agriculture is based on a family model that is losing importance due to globalization and the need for greater investments. The region is famous for the quality of certain agricultural products such as cherries from the Jalón Valley and peaches. The agri-food sector is important, with a primary production of meat, milk, and dairy products. Forest biomass could reduce the use of fossil fuels. The social economy plays a significant role, with numerous organizations helping disadvantaged groups overcome economic and social barriers. However, the region faces challenges related to the modernization of agricultural techniques and environmental sustainability, with a growing interest in adopting more ecological and innovative agricultural practices.

Greece – region of Western Macedonia

Western Macedonia aims to diversify its economy and reduce its dependence on lignite by promoting renewable energy sources and sustainable solutions. Greece's smart specialization strategy emphasizes innovation in sectors such as agrifood, digital technologies, and sustainable energy. The innovation agency supports research and development at the regional level. The region is characterized by a combination of traditional agriculture and modern technologies, with ongoing projects aimed at improving energy efficiency and environmental sustainability. Initiatives for the development of renewable energies, such as wind and solar, are gaining ground, contributing to a greener and more resilient transition.

Bulgaria – region of Plovdiv

In Plovdiv, some important sectors include paper and textiles. Agriculture produces residues that can be a source of biomass, although they are currently not widely used. The forestry sector is an important source of biomass. Organic products are not yet widespread due to poor connections with research centers. There are growth opportunities for bio-based products such as composting, bioenergy, and biofuels. The region is working to improve the integration between agriculture and scientific research, promoting innovation and the adoption of advanced agricultural techniques. Regional policies are also incentivizing the use of renewable energies and the reduction of carbon emissions.

Slovakia – the Nitra Self-Governing Region

Slovakia has great agricultural potential, but it is hindered by the fragmentation of land ownership. It has ample water resources but needs investment in irrigation systems. The agricultural sector is characterized by

low financial returns and an excessive focus on exporting low-value-added cereals and oilseeds. The national strategy aims to increase domestic food production and reduce imports, with a focus on innovation in agriculture and food production. The region is also exploring new technologies to improve water resource management and increase the sustainability of agriculture. International cooperation projects are helping to implement innovative solutions and promote shared knowledge between farmers and researchers.

Slovenia – whole country

In Slovenia, most farms are small and non-specialized, requiring structural changes to increase added value. The industrial sector, on the other hand, is dominated by large companies that create more value. The agri-food industry produces waste that is used to produce biogas or other products through various processing methods. Slovenia is investing in modernizing its agricultural infrastructure and training farmers to improve productivity and sustainability. The adoption of advanced technologies and the implementation of sustainable agricultural practices are at the heart of regional development policies, with a particular focus on promoting organic farming and low environmental impact food production.

Croatia – region Adriatic Croatia

The Adriatic Croatia is characterized by diversified agriculture and significant production of olive oil, grapes, and citrus fruit. The wood and furniture sector is significant, producing various wood products. Mariculture represents an important economic activity. However, there is still a lack of a national strategy for the circular bioeconomy, though initiatives are underway to develop it. The region is striving to improve the sustainability of its agricultural practices and promote sustainable tourism as an integral part of its economy. Pilot projects are exploring new opportunities for the use of biomass and renewable energy, aiming to reduce dependence on fossil fuels and improve energy efficiency.

Hungary – region North-Hungary

Hungary has favorable conditions for agriculture and is heavily focused on the development of organic farming. The agri-food sector is significant, with the production of meat, dairy, and beverages. Recently, there is a growing interest in alternative energy sources, such as biomass and biogas. The region is investing in research and development projects to improve agricultural productivity and reduce the environmental impact of agricultural practices. The adoption of advanced technologies and the implementation of sustainability policies are at the heart of regional initiatives, with a particular focus on promoting precision agriculture and sustainable management of natural resources.

Romania – West region

Romania's energy strategy emphasizes renewable sources such as biomass, which significantly contributes to the overall energy consumption. Nationally, the promotion of renewable energy is incentivized by specific

laws. Biomass, in addition to producing energy, is used for heating and as a raw material for biofuels, potentially creating a new industry in the agri-food sector. The region is working to improve energy efficiency and promote the sustainable use of natural resources. International cooperation projects are supporting the transition to a greener and more resilient economy, with a particular focus on promoting renewable energy and reducing carbon emissions.

Czechia -region BIOEAST

The agricultural sector in the Czech Republic is well-developed, but lacks a comprehensive strategy to evolve towards a bioeconomy. Agricultural residues and domestic food waste represent a significant source of biomass. The ecological management of mountainous areas in the Moravia-Silesia region supports organic farming and livestock breeding. The region is investing in research and development projects to improve agricultural productivity and promote the sustainable use of natural resources. The adoption of advanced technologies and the implementation of sustainable agricultural practices are at the heart of regional development policies, with a particular focus on promoting organic farming and low-impact food production.

Netherlands – region Apeldoorn

The economy of Apeldoorn is characterized by the food and paper industry, with innovations in bio-based products and circular economy strategies. The construction of sustainable housing and the use of alternative materials are promoted. The plastic industry aims to improve waste separation and the use of bio-based materials. The region seeks to enhance the efficiency of its agricultural infrastructure and promote the adoption of sustainable practices. International cooperation projects are exploring new opportunities for the use of biomass and renewable energy, aiming to reduce dependence on fossil fuels and improve energy efficiency. Innovation is at the heart of regional policies, with a particular focus on promoting the bioeconomy and resource circularity.

Germany – region Baden-Württemberg (Ba-Wu)

Germany is one of the leading agricultural producers in the EU, with a high density of livestock farms. The bioeconomy is supported at both national and regional levels, with Baden-Württemberg being a pioneer in bioeconomy research and strategy. Bio-based industries are active in agriculture, forestry, fishing, bio-based materials, bioenergy, and waste management. The region is investing in research and development projects to improve agricultural productivity and promote the sustainable use of natural resources. The adoption of advanced technologies and the implementation of sustainable agricultural practices are at the heart of regional development policies, with a particular focus on promoting organic farming and low-impact food production.

Italy – region Campania

Campania focuses on sustainable agriculture and the adoption of organic methods and innovative technologies such as precision farming. Circular economy is promoted to reduce waste and improve resource efficiency. The region also invests in biotechnology for health and the blue economy, with a focus on translational research and the fight against oncological diseases. Campania is striving to improve the sustainability of its agricultural practices and promote sustainable tourism as an integral part of its economy. Pilot projects are exploring new opportunities for the use of biomass and renewable energy, aiming to reduce dependence on fossil fuels and improve energy efficiency.

The analysed regions present unique specificities and different opportunities for the development of the bioeconomy. Most of the regions have strong agricultural and forestry potential, but each faces specific challenges related to land ownership fragmentation, technological innovation, and resource management. Collaboration between industry, research, and local governments is essential to fully exploit the potential of the bioeconomy and promote sustainable and inclusive development.

Examining the biological value chain in the different regions, some key differences emerge:

- **Spain – region of Aragon**: The value chain is influenced by the quality of agricultural products and forest biomass, with a strong emphasis on the social economy.
- **Greece – region of Western Macedonia**: The focus is on economic diversification and the promotion of renewable energies, with an innovative research support system.
- **Bulgaria – region of Plovdiv**: The value chain is based on traditional sectors such as paper and textiles, with growth opportunities for bio-based products.
- **Slovakia – the Nitra Self-Governing Region**: Land ownership fragmentation and the need for innovation are the main challenges, with a focus on increasing domestic food production.
- **Slovenia – whole country**: Modernization of small farms and the use of food waste for biogas production are key elements of the value chain.
- **Croatia – region Adriatic Croatia**: Diversified agriculture and the production of wood and furniture are relevant, with increasing attention to the circular bioeconomy.
- **Hungary – region North-Hungary**: The promotion of organic farming and alternative energies is central to the value chain.
- **Romania – West region**: Biomass is fundamental to the energy strategy, with significant promotion of renewable sources.
- **Czechia -region BIOEAST**: The management of agricultural residues and food waste is at the heart of the bioeconomy, with support for organic farming.
- **Netherlands – region Apeldoorn**: Innovation in bio-based products and the circular economy are pillars of the value chain.
- **Germany – region Baden-Württemberg (Ba-Wu)**: The bioeconomy is supported by strong research and innovation, with a wide range of active bio-based industries.
- **Italy – region Campania**: Agricultural sustainability and the adoption of innovative technologies are central, with significant investments in biotechnology and the blue economy.

In summary, each region presents unique strengths and areas for improvement, but all share the common goal of promoting a sustainable and resilient bioeconomy. Collaboration and knowledge exchange between

regions can accelerate the achievement of these goals, fostering inclusive and environmentally respectful economic development.

Regions analysed in the BIOLOC project demonstrate a variety of approaches and development levels in their bioeconomy initiatives. Here is a comparative overview of the different regions:

Agricultural and Forestry Potential

Spain (Aragon) and Slovenia are characterized by a strong agricultural and forestry presence, with a particular focus on valorising agricultural and forestry residues for bioenergy production. Slovakia (Nitra) and Romania (Western Region) show great agricultural potential but face challenges such as land ownership fragmentation and the need for a national strategy to improve agricultural efficiency.

Innovation and Technology

Germany (Baden-Württemberg) and the Netherlands (Apeldoorn) are leaders in technological innovation and circular bioeconomy, with significant investments in research and development and a strong biotechnology sector. Campania in Italy is making significant investments in advanced technologies for the treatment of organic waste and the production of bioproducts.

Economic Diversification Strategies

Greece (Western Macedonia) and Bulgaria (Plovdiv) are working to diversify their economies, reducing dependence on traditional sectors such as coal and paper production, respectively. Both regions are investing in waste management projects and bioenergy production.

Sustainability and Agricultural Practices

Hungary (Northern Region) and Croatia (Croatian Adriatic) are promoting sustainable agricultural practices and the use of energy crops. Hungary is focusing its efforts on developing organic farming, while Croatia is exploring the use of algae and marine crops to produce bioplastics and biofuels.

Collaborations and Business Support

Many regions are collaborating with research institutes and universities to develop new bio-based technologies and support local businesses. The Czech Republic (BIOEAST) and Slovenia are implementing training and support programs for start-ups in the bioeconomy sector.

In summary, while each region has a unique context and specific challenges, they all share the goal of promoting a sustainable bioeconomy. The ongoing initiatives and projects in these regions offer a promising framework for the future of the bioeconomy in Europe, with significant potential for economic growth, environmental sustainability, and technological innovation.

Table 19: Comparison between regions

Region	Agriculture	Biomass / Energy	Innovation	Agricultural and Forestry Potential	Collaborations and Business Support
Spain – Aragón Region	Family model, quality agricultural products (cherries, peaches)	Forest biomass	Interest in ecological and innovative agricultural practices	Strong agricultural and forestry presence	Numerous social economy organizations
Greece – Western Macedonia Region	Traditional agriculture	Renewable energies (wind, solar)	Support for research and development	Economic diversification	Regional innovation agency
Bulgaria – Plovdiv Region	Paper and textile production	Agricultural and forestry residues	Growth opportunities for bio-based products	Important forestry sector	Promotion of agricultural innovation
Slovakia – Nitra Autonomous Region	Agricultural potential, land ownership fragmentation	Ample water resources	Innovation in agriculture and food production	Great agricultural potential	International cooperation projects
Slovenia	Small farms, agri-food waste	Biogas production	Modernization of agricultural infrastructure	Strong agricultural and forestry presence	Training programs and support for start-ups
Croatia – Adriatic Region	Diversified agriculture (olive oil, grapes, citrus fruits)	Biomass and mariculture	Pilot projects for biomass use	Diversified agriculture	Circular bioeconomy initiatives
Hungary – Northern Hungary Region	Organic farming	Biomass and biogas	Research and development projects	Favorable conditions for agriculture	Promotion of organic farming

Romania – Western Region	Agriculture and biomass	Biomass for energy and biofuels	Promotion of renewable energies	Great agricultural potential	International cooperation projects
Czech Republic – BIOEAST Region	Well-developed agriculture	Agricultural residues and food waste	Research and development projects	Ecological management of mountainous areas	Support for organic farming
Netherlands – Apeldoorn Region	Food and paper industry	Biomass and bio-based materials	Innovation in bio-based products	Innovations in bio-based products	International cooperation projects
Germany – Baden-Württemberg (Ba-Wu) Region	Agricultural production and livestock	Biomass and bioenergy	Research and innovation	High density of livestock	Pioneer in bioeconomy research and strategy
Italy – Campania Region	Sustainable and organic agriculture	Biomass and biotechnology	Innovative technologies	Significant investments in biotechnology	Promotion of the blue economy

5. Conclusion

BIOLOC will address non-technical challenges entailed by the transition to the CBE from the perspective of local development to elaborate on concepts and solutions that will favour a positive cascading effect on communities by fostering a participatory and inclusive approach to developing resilient innovative biobased activities open to the contribution of socially disadvantaged or marginalized groups. In BIOLOC 13 European regions have been selected based on the estimation of their CBE potentials defined from the interpolation of feedstock availability (strengths), socio-economic indicators (weaknesses), existing networks and immaterial infrastructures (opportunities) and peripherality with regards to CBE development and current trends (threats).

In this context, ***D4.1 "Analysis of local context"*** has been developed in the framework of ***WP4*** activities related to ***"New and updated network-oriented business models, governance and local capacity building"*** and it is the outcome of ***T4.1 "Analysis of local baseline, value chains and ongoing initiatives"***.

The aim of this document is to analyse the bio-baseline in the regions participating in BIOLOC project, regarding the following points:

- socio-economic activities
- bio-based value chains
- productive districts
- specialisations
- strengths and pain points

The information reported in the document was collected with structured questionnaires, information given by local partners and online research.

For each of these regions, an analysis of the main sectors that make up the bio-base value chain was carried out. Although in general the sectors analysed are the same for each region, each analysis has differences with the others, due to the presence of particular cultural, economic, environmental, social and territorial characteristics.

The analysis described in this document will be the basis for the work that will be developed in ***Task 4.2- Matchmaking and creation of opportunities for local value chains***, and specifically in ***D4.2 - Opportunities for local value chains***. Specifically, the analyses developed in D4.1 will be used to create a list of possible opportunities in the bio value chain for each region analysed. Through the results obtained in this document, the areas of this value chain where the greatest growth can be expected will be further analysed. Consequently, the work carried out in D4.1 can be considered as the basis of the analysis developed later in D4.2.

References

1. Adjarova L., Jibreel L., et al., D.2.1 Country report: Bulgaria, CELEBio, available at - https://celebio.eu/wp-content/uploads/2020/07/Bulgaria-Country-Report.pdf
2. Aragón: líder de las cerezas – available at https://identidadaragonesa.wordpress.com/2016/06/09/aragon-lider-de-las-cerezas/
3. At a glance: HUNGARY'S CAP STRATEGIC PLAN, European Commission – available at https://agriculture.ec.europa.eu/system/files/2023-04/csp-at-a-glance-hungary_en.pdf
4. Baden - Württemberg statistisches landesamt, Agrar-struktur – available at https://www.statistik-bw.de/Landwirtschaft/Agrarstruktur/.
5. Baden - Württemberg statistisches landesamt, Boden-nutzung – available at https://www.statistik-bw.de/Landwirtschaft/Bodennutzung/LF-NutzngKultFrucht.jsp.
6. Baden - Württemberg statistisches landesamt,Er-werbs-tätige, Erwerbstätige am Arbeitsort im Bundesvergleich – available at https://www.statistik-bw.de/Arbeit/Erwerbstaetige/ET_wirtschSektoren.jsp#:~:text=So%20arbeiteten%202021%20in%20Berlin,knapp%2031%20%25%20im%20Produzierenden%20Gewerbe.
7. BIOEAST Bulgaria available at: https://bioeast.eu/republic-of-bulgaria-ministry-of-agriculture-food-and-forestry/#
8. Bioeconomy – Baden-Württemberg's path towards a sustainable future – available at https://www.biooekonomie-bw.de/en/articles/publications.
9. Bioeconomy in Germany Opportunities for a bio-based and sustainable future – available at https://www.fona.de/medien/pdf/Bioeconomy_in_Germany.pdf
10. Bioökonomie Baden – Württemberg – available at https://biooekonomie.baden-wuerttemberg.de/,Lde/Startseite/Akteure+in+BW/Online+Kompetenzatlas?search=true&umkreis=10&ort=&textsuche=&themen=Nahrungs-%20und%20Futtermittel&organizationType=
11. Biotech Guide Baden-Württemberg – available at https://www.bio-pro.de/download_file/force/15677/73274.
12. BIT La bioeconomia in Italia - available at https://cnbbsv.palazzochigi.it/media/1767/bit1_it.pdf.
13. Blue Economy and Sustainable Development: Croatia Case: https://www.croris.hr/crosbi/publikacija/prilog-skup/650256
14. Boshnakova-Petrova M., 2020 Agricultural Census Confirms Farm Consolidation and Growth, 2020 – available at https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=2020%20Agricultural%20Census%20Confirms%20Farm%20Consolidation%20and%20Growth_Sofia_Bulgaria_05-13-2021.pdf.
15. BUDAY Z., SZABÓ M., D4.4 National bioeconomy dossier: Hungary, CELEBio, 2020, available at: https://www.cei.int/sites/default/files/2022-04/CELEBio_Bioeconomy%20Dossier_%20Hungary.pdf
16. Bulgaria: 2020 Agricultural Census Confirms Farm Consolidation and Growth – available at https://www.fas.usda.gov/data/bulgaria-2020-agricultural-census-confirms-farm-consolidation-and-growth

17. Bundesministerium für Wirtschaft und Klimaschutz, Lebensmittelindustrie – available at https://www.bmwk.de/Redaktion/DE/Artikel/Branchenfokus/Industrie/branchenfokus-lebensmittelindustrie.html.
18. Centraal Bureau voor de Statistiek
19. Čermáková E., Grešlová P., et al., Zpráva o životním prostředí v Moravskoslezském kraji, 2021 – available at https://www.cenia.cz/wp-content/uploads/2023/02/Kraje_MORAVSKOSLEZSKY_2021.pdf
20. Český statistický úřad – available at https://www.czso.cz/csu/czso/11-zemedelstvi-rumfyzqa27
21. Clariant Specialty Chemicals/Clariant News
22. Climate Change in Baden-Württemberg – available at https://um.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/documents/publication/Climate_Change.pdf.
23. CODA Experience Lab: https://www.coda-apeldoorn.nl/nl/locations/experiencelab
24. Common Agricultural Policy Strategic Plan 2023-2027 for Slovenia, https://skp.si/wp-content/uploads/2022/11/SN-SKP_izpis-iz-SFC-7.11.2022.docx.
25. Country Report WP3 A-3.1. Cross-clustering partnership for boosting eco-innovation by developing a joint bio-based value-added network for the Danube Region, Interreg Danube Trasnational Progamme – available at https://ipe.ro/Country%20Report%20Baden%20W.pdf.
26. Croatia Ministry of Agriculture
27. Data for 2021, Poročilo o stanju kmetijstva, živilstva, gozdarstva in ribištva, https://www.kis.si/f/docs/Porocila_o_stanju_v_kmetijstvu/ZP_2021_splosno__priloge_6.9.2022.pdf.
28. Data for 2021, Statistical Office of the Republic of Slovenia – available at https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/H200S.px/
29. Data for 2021, Statistical Office of the Republic of Slovenia – available at https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/1673145S.px.
30. DECLARACIÓN INSTITUCIONAL ARAGÓN ECONOMÍA SOCIAL - https://www.aragon.es/documents/20127/90385846/Declaraci%C3%B3n+Institucional+Arag%C3%B3n+Econom%C3%ADa+Social.pdf/b9c7796b-a6b0-704e-cd7c-aa7124940da0?t=1677500275973
31. Dettenhofer M., D.2.1 Country report: Czech Republic, Celebio, available at: https://celebio.eu/wp-content/uploads/2021/04/CELEBio_D.2.1_Biobased-Economy-Business-Opprotunities-in-CZ.pdf
32. DRAFT RESEARCH AND INNOVATION STRATEGY FOR SMART SPECIALISATION OF THE SLOVAK REPUBLIC 2021-2027: https://mirri.gov.sk/wp-content/uploads/2018/10/Research-and-innovation-strategy-for-smart-specialisation-of-the-Slovak-Republic-2021-2027.pdf
33. Economic, social and territorial situation of Slovenia, European parliament – available at https://www.europarl.europa.eu/RegData/etudes/BRIE/2018/617462/IPOL_BRI(2018)617462_EN.pdf
34. ERA portal Slovakia
35. Eurostat
36. Financial needs in the agriculture and agri-food sectors in Germany – available at https://www.fi-compass.eu/sites/default/files/publications/financial_needs_agriculture_agrifood_sectors_Germany.pdf.

37. Germany's Green Transition An R&I Perspective October 2020 - available at https://icdk.dk/-/media/websites/icdk/locations-reports/hq-copenhagen/germanys-green-transition_final-with-isbn.ashx.
38. Hofman V., Voltr V., et al., SITUAČNÍ A VÝHLEDOVÁ ZPRÁVA PŮDA – available at https://eagri.cz/public/web/file/697802/Puda_2021_Web.pdf
39. https://gsri.gov.gr/wp-content/uploads/2022/11/Synopsis_National-Smart-Specialisation-Strategy-2021-2027.pdf
40. https://www.agrimatie.nl/ThemaResultaat.aspx?subpubID=2232&themaID=2272&indicatorID=2046
41. INVESTMENT GUIDE Baden-Württemberg – available at https://www.bw-invest.de/fileadmin/user_upload/bw-invest/Investitionsfuehrer/InvestmentGuideBW_2020_EN.pdf.
42. Juvančič L., Gasan Osojnik Črnivec I., et al., Strategic Concept Paper for Bioeconomy: Slovenia, BIOEAST, 2023 – available at https://www.daes.si/storage/post-content/eRZ8nYZHIrhR7z0GVyCfw5Xz2HGQ2WLOdKUoFbov.pdf
43. Lesy České republiky, Moravskoslezský kraj – available at https://lesycr.cz/media/kurovec-caste-dotazy/moravskoslezsky-kraj/
44. Máček R.,Henelová V., MORAVSKOSLEZSKÝ KRAJ ÚZEMNÍ ENERGETICKÁ KONCEPCE MORAVSKOSLEZSKÉHO KRAJE NA OBDOBÍ 2020 – 2044, 2020 – available at https://portal.cenia.cz/eiasea/download/U0VBX01TSzAyN0tfbmF2cmhfODUxMTc0MjIyMDkzNjkxNjgyMC5wZGY/MSK027K_navrh.pdf.
45. Mapping of actual state of play and needs Synthesis report – available at https://www.alpine-region.eu/publications/smart-sme%E2%80%99s-mapping-actual-state-play-and-needs-synthesis-report.
46. Ministerium für Ernährung Ländlichen Raum und Verbraucherschutz, Waldland Baden-Württemberg – available at https://mlr.baden-wuerttemberg.de/de/unsere-themen/wald-und-naturerlebnis/landesforstverwaltung/waldland-baden-wuerttemberg/.
47. MJM agro – available at https://www.mjm.cz/skrobarna-lihovar-mlyn
48. NATIONAL ENERGY STRATEGY 2030, Ministry of National Development, 2012 – available at https://2010-2014.kormany.hu/download/7/d7/70000/Hungarian%20Energy%20Strategy%202030.pdf
49. National Regional Development Strategy of the Slovak Republic: https://trimis.ec.europa.eu/sites/default/files/project/documents/national_regional_development_strategy.pdf
50. Notice from the Port of Koper – available at https://metrans.eu/notice-from-the-port-of-koper/
51. PLAN ARAGONÉS DE IMPULSO A LA ECONOMÍA SOCIAL 2022-2025– available at https://transparencia.aragon.es/sites/default/files/documents/plan_aragones_impulso_economia_social_2022_2025.pdf.
52. PLOVDIV - Geography and history - available at https://circabc.europa.eu/webdav/CircaBC/ESTAT/regportraits/Information/bg051_geo.htm
53. RDA BSC SMEs: Plovdiv District – available at https://rda-bg.org/en/index.php/regionalDevelopment/regional

54. Regional Cluster Atlas Baden – Württemberg – available at https://www.clusterportal-bw.de/fileadmin/media/Download/Downloads_Publikationen/Cluster-Atlas_2019_englisch.pdf.
55. Slovenia's Sustainable Smart Specialisation Strategy 2030 – available at https://www.gov.si/assets/ministrstva/MKRR/Strategija-razvoja-Slovenije-2030/Slovenian-Development-Strategy-2030.pdf
56. Smart Specialisation Platform Croatia: https://s3platform.jrc.ec.europa.eu/croatia
57. Socio-economic inclusion of vulnerable groups in the Municipality of Plovdiv through improved access to education, employment and health – available at https://eumoney.bg/en/projects/BG05M9OP001-2.056-0002-2014BG05M2OP001-C01/detail/
58. State strategy for a sustainable bioeconomy Baden-Württemberg- available at https://um.baden-wuerttemberg.de/fileadmin/redaktion/m-um/intern/Dateien/documents/Bioeconomy-strategy-barrierefrei.pdf.
59. Statistical Office of the Republic of Slovenia, https://pxweb.stat.si/SiStatData/pxweb/en/Data/-/0301975S.px/
60. Statistical Office of the Slovak Republic
61. Statistisches Bundesamt Wald und Holz, Flächengröße des Waldes nach Bundesländern – available at https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Landwirtschaft-Forstwirtschaft-Fischerei/Wald-Holz/Tabellen/waldflaeche-bundeslaender.html.
62. Stöber, L.F.; Boesino, M.; Pyka, A.; Schuenemann, F. Bioeconomy Innovation Networks in Urban Regions: The Case of Stuttgart. Land 2023, 12, 935. https://doi.org/10.3390/land12040935.
63. UE objectives on decarbonization: https://www.europarl.europa.eu/news/it/headlines/society/20180305STO99003/ridurre-le-emissioni-di-anidride-carbonica-obiettivi-e-azioni-dell-ue
64. Virant G., Koprivnikar Krajnc M., D.2.1 Country report: Slovenia, CELEBio, 2020 - available at https://celebio.eu/wp-content/uploads/2020/07/Slovenia-Country-Report.pdf.
65. Youth Center Plovdiv - a powerful factor for local development – available at https://eeagrants.org/archive/2014-2021/projects/BG-LOCALDEV-0008
66. ZÁKLADNÍ INFORMACE A LEGISLATIVA – LESY – available at https://www.msk.cz/cs/temata/zivotni_prostredi/zakladni-informace-a-legislativa-_-lesy-1286/