



STRATEGY FOR DEVELOPMENT OF THE BIOECONOMY IN STARA ZAGORA REGION

2021

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Introduction

About the bioeconomy as goals, priorities and conceptual apparatus

The bioeconomy is one of the topics that is increasingly high on the European Union's agenda. A number of initiatives and concrete actions by the European Commission identify the growing importance of a wide range of activities and economic areas that fall under the scope of bioeconomy. As Bulgaria has not yet developed its own National Bioeconomy Strategy and Action Plan, the lack of an established terminology in the field is not surprising. However, for the purposes of this document, it is necessary to introduce some basic concepts concerning the scope and objectives of the bioeconomy.

According to the updated European Union Bioeconomy Strategy proposed by the European Commission in 2018 and adopted by the European Council at the end of 2019, the following definition is introduced:

"Bioeconomy encompasses all sectors and systems that rely on biological resources (biomass from animals, plants, microorganisms, including organic waste), their functions and principles. It includes and interconnects: terrestrial and marine ecosystems and the services they provide; all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture); and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services. To be successful, the European bioeconomy must be based on sustainability and circularity. This will stimulate the renewal of our industries, the modernisation of our primary production systems, the protection of the environment and will improve the biodiversity.

The bioeconomy is a vital element in achieving the goals of the circular economy. In this context, and in line with the overall policy at European Union level and the European Bioeconomy Strategy, it should pursue several specific key objectives.

First and foremost, the bioeconomy is very much about food security and agricultural sustainability. The main priority must be to make proper use of the resources available, production conformable to the real needs of the market and to use all organic waste, which is a valuable product for processing and diversification.

Secondly, the bioeconomy seeks to properly manage the available natural resources, to ensure the conservation of biodiversity and existing ecosystems, by using appropriate tools, including for the future state of the available resources.

Thirdly, the bioeconomy has a significant role to play in providing alternative energy sources and is expected to be one of the main substitutes for non-renewable energy sources in order to meet the European Union's 2030 targets. The use of bio-waste for energy production, through new biotechnologies, should engage even urban agglomerations in the foreseeable future.

Fourthly, the bioeconomy has an important role to play in limiting the quantities of greenhouse gas emissions because of the more efficient and sustainable use of available resources and limiting the climate-burdening practices.

Fifth, the bioeconomy guarantees employment for a large number of people and its development is seen as a source of new and sustainable working places. Along with the development and introduction of new technologies, it must contribute to the diversification of farmers' production and increase the competitiveness of rural areas.

The priorities of the bioeconomy should be considered in several aspects, taking into account the sectors that characterize it and their diversity. In this regard, and in view of the goals it sets, several main priorities of the bioeconomy can be identified:

- Sustainable and sparing use of natural resources;
- Efficient use of bio-waste, including for bioenergy production;
- Development of innovations and their implementation for the creation of new biologically based products, replacing those obtained from non-renewable sources;
- Transforming cities into driving elements of the circular bioeconomy.

Methodology



The present "Strategy for Development of the Bioeconomy in Stara Zagora Region" has been developed in line with the standards for strategic planning at European, national and regional levels. It is consistent with the priorities of other strategic documents at different levels of planning.

Due to the absence of a National Bioeconomy Strategy, there is no hierarchical link between the present document and another

similar summary of the priorities and potential of other planning regions in Bulgaria at NUTS 3 level or higher. To this end, an overview has been made of the existing strategic documents in the field of bioeconomy, both in Europe and in some regions of the European Union, which have developed and already implemented strategies for the development of the sector.

During the preparation of the "Strategy for Development of the Bioeconomy in Stara Zagora Region" the main trends for the development of the bioeconomy at the European level were followed, which are set in the political and strategic priorities of the European institutions. Achieving concrete results in these key areas would allow the Stara Zagora region to increase its competitiveness in the bioeconomy sector and the implemented initiatives to attract counter-funds through various financial instruments.

Overview of bioeconomy policies

Strategic documents in the field of bioeconomy, national documents in force after 2020.

Bulgaria is one of the countries in the European Union that has not yet adopted a National bioeconomy strategy and action plan. However, it should be noted that together with 10 other countries in Central and Eastern Europe, Bulgaria is part of the BIOEAST initiative, which offers a shared strategic framework for research and innovation to work towards a sustainable bioeconomy.

The documents of national and regional character, developed after 2014, which refer to the bioeconomy are:

National Development Programme "Bulgaria 2030"

The National Development Programme "Bulgaria 2030" defines three main strategic goals for Bulgaria, namely accelerated economic development, demographic growth and reduction of inequalities. To achieve them, five separate axes of development have been identified, which will propose specific policies and measures to achieve real results.

One of these axes of development integrates in its concept the ideas of the bioeconomy - "Green and Sustainable Bulgaria", and in two of its priorities, measures and policies are foreseen for the development of an environment that supports the bioeconomy. The priority of the "**Circular and Low Carbon Economy**" is expected to increase the composted bio-waste and recycled household, industrial and construction waste, as well as to introduce separate collection of bio-waste and textile waste.

It is set in the "**Sustainable agriculture**" priority the *"... Improving of competitiveness, including by placing greater emphasis on research, technology and digitalisation, as well as developing the value chain. In addition, efforts will be focused on mitigating the aftereffects of climate change and adapting to it, promoting sustainable development and effective management of natural resources..."*. In addition, the main objectives are to stimulate organic farming and animal husbandry, as well as their digitalisation and the introduction of innovative approaches, including in the bioeconomy.

In addition, the priority "**Intelligent Industry**" of the Development Axis 1. "Innovative and Intelligent Bulgaria" provides for the *"...development and implementation of innovative products, processes and business models aimed at increasing the resource efficiency of the economy, as well as supporting and implementing innovations addressing the still high carbon intensity of the economy"*.

Also, the management of forests and territories in order to prevent climate change and create sustainable ecosystems is enshrined in Priority "**Local Development**" of Axis 3 "Connected and Integrated Bulgaria".

National Strategy for Small and Medium Enterprises 2021-2027

Business is a major driver of the bioeconomy and its support at the national level is a key factor in improving its position internationally. The National Strategy for Small and Medium-

sized Enterprises for the period 2021-2027 has been developed, focusing on six areas of impact, with specific strategic priorities. The goals of the bioeconomy can be found in several areas:

- Area 1. **Entrepreneurship**, Priority 3. Encouraging entrepreneurial activity with potentially great impact on economic and social development and environmental sustainability.
- Area 6. **Environment**, Priority 1. Bulgarian SMEs to improve their resource efficiency and energy intensity, as well as to be encouraged to use more renewable energy sources in order to contribute to achieving the country's climate neutrality by 2050.
- Area 6. **Environment**, Priority 2. Bulgarian SMEs to improve their environmental performance and to adopt the production and distribution of green products with the EU Ecolabel

The specific actions that the strategy envisages to help small and medium-sized enterprises achieve the desired result at the end of the period include a number of forms of assistance, the most interesting of which are:

- Increasing the use of different types of renewable energy by SMEs (solar, wind, hydro, biomass and cogeneration systems, etc.)
 - Improving resource / material efficiency and overall transition to a circular model
 - Support for the adaptation of SMEs producing disposable plastics to the production of bio-based products
 - Support to SMEs in the bioeconomy sector (including the blue bioeconomy) to access markets and develop bio-based products.
 - Support to SMEs for the transition to environmental and circular design
 - Support to SMEs to replace non-renewable products with alternative or bio-based products.
-
- Grant funding and financial instruments to meet the different needs of entrepreneurs and start-ups in rural areas.

Strategy for digitalization of agriculture and rural areas of the Republic of Bulgaria

Improving and implementing new technologies in agriculture is of crucial importance to ensuring the sustainability of the sector and increasing its competitiveness in the medium term. The strategy for digitalization of agriculture and rural areas of the Republic of Bulgaria was developed in 2019 and is more than a document with a technical focus. In fact, it will allow the concept of smart agriculture to have the necessary infrastructure and to support various initiatives to develop the idea at local level.

The main strategic goals are in several areas, two of which would stimulate the bioeconomy - "**Increasing the productivity and sustainability of agricultural production**" and "**Protecting the environment and tackling the challenges of climate change.**" Some of the envisaged measures include:

- Process automation and integration of precision agriculture
- Entering innovations through interaction between farmers, universities, research organizations, start-ups and ICT companies
- Integration of blockchain technologies

National Climate Change Adaptation Strategy and Action Plan

Part of the strategic goals set out in the strategy for adaptation to climate change lay the ground for the search for specific solutions on a sectoral basis. Thus, the possible interventions are considered in 9 separate sectors of the economic and social life of the country and key interventions for each of them are identified. Those that can be identified as important for the development of the bioeconomy in Bulgaria are the following:

„Agriculture“ sector

- Sustainable management of agricultural practices for adaptation to climate change
- Promoting the capacity for adaptation and awareness in the agricultural sector
- Promoting research and innovation to adapt to climate change

“Biodiversity and Ecosystems” Sector

- Improving ecosystem management
- Strengthening resilience to climate change by reducing the pressure that is not linked with the climate change
- Sustainable use of regulatory and cultural ecosystem services for adaptation

“Energy” Sector

- Incorporate resilience to climate change in design and engineering
- Increasing the sustainability of energy supplies

“Forestry” Sector

- Improvement and protection of forest resources
- Improving the potential for sustainable use of forest resources

Integrated plan in the field of energy and climate of the Republic of Bulgaria 2021 - 2030

The documents in the field of energy have only a partial significance and relation to the development of the bioeconomy, but it is necessary to take into account the trends in the sector for the next 10 years.

The use of biomass for energy purposes is expected to have a wide potential for development. As a result, initiatives will be stimulated to use more efficiently “...waste and residues from industrial companies without adversely affecting the health and quality of life of the population in the areas where the installations for biomass energy production are located.

In addition, the plan envisages “... to be taken into account for the purposes of increasing the share of renewable energy produced from forestry biomass, biofuels, non-transportable liquid fuels from biomass and gaseous and solid biomass fuels and to regulate requirements for reduction to minimum risk of using biomass resulting from unsustainable production.”

Draft Strategy and Action Plan for the Transition to a Circular Economy of the Republic of Bulgaria for the Period 2021-2027

The strategy for the transition to a circular economy is at the stage of approval at the time of working out the current document, but the fact that the publicly available version is almost complete allows us to consider the main priorities it sets for the 2027 horizon.

It is logical for the bioeconomy to be present in most of the proposed policies and measures for implementation. The “Strategic Goal 1. Green and Competitive Economy” seeks to pursue an economy that uses natural resources more efficiently and thus creates sustainable jobs, while ensuring green growth by protecting the environment. Some of the measures include support for new business models and ecodesign of products through the use of innovative financial support schemes. The possibility of Bulgaria's leading role as a supplier of raw materials of critical importance is also noted. Business will be assisted in finding technologies for the utilization of biomass from agriculture.

In the "Specific Objective 2. Less waste, more resources" of the Strategy for the transition to a circular economy, two specific measures to achieve results are of interest:

- Development of new types of plastics with better indicators in terms of impact on the environment, incl. biologically based plastics and biodegradable plastics;
- Exploring the possibilities for applying techniques for recycling phosphorus or biogas production in a joint process of anaerobic digestion with other suitable biodegradable waste, providing opportunities for independent and co-incineration of sludge for energy production.

It is expected that the priorities of the strategic document will be used and integrated in the planning of the individual regions and administrative areas, which will increase the effective implementation of the measures.

Other strategic documents are also available, the implementation of which would support the development of the bioeconomy in the different regions of Bulgaria. Of these, the **Employment Strategy of the Republic of Bulgaria for the period 2021-2030** can be noted, which sets the expected change in the structure of the professions in demand in order to achieve the goal of climate-neutral Europe by 2050. Additional investment and training needs for people coming from restructured sectors of the economy, such as coal and energy, will be targeted at new occupations, some of which are directly related to the bioeconomy and the circular economy.

It should be noted that most of the municipalities in the Stara Zagora region are in the process of preparing their integrated development plans for the next period 2021-2027, and some of them have already been prepared and approved at the time of preparation of this document (Chirpan Municipality and Radnevo Municipality). They, in turn, will be used to prepare a strategic document that will determine the main priorities and methods for their achievement for the entire Stara Zagora region.

Local initiatives

Following the additional specifics and characteristic conditions of the different regions and in order to achieve more focused and concrete results at the local level, the role of local initiative groups operating in the Stara Zagora region should be taken into account. Local action groups are directed to regions with a population of up to 150,000 and are set up under national rural development programmes, following the CLLD (Community Led Local Development) approach.

Local action groups can support actions aimed at improving infrastructure, natural and cultural resources in rural areas, as well as stimulating the economy and viability of agricultural and non-agricultural holdings. Each group develops a strategy that is tailored to the conditions and needs of the region. All Local Action Groups share the above-mentioned main priorities that can provide funding for initiatives that demonstrate the potential to achieve them by providing funding from the European Agricultural Fund for Rural Development, the European Regional Development Fund, the European Social Fund and the European Fund for Rural Development. maritime affairs and fisheries.

There are several active Local Initiative Groups (LAGs) in the Stara Zagora region, which cover all or part of the municipalities in the Stara Zagora Region. These are:

- LAG Chirpan
- LAG Maglizh - Kazanlak - Gurkovo
- LAG Galabovo - Opan
- LAG Brezovo – Bratia Daskalovi

The activity of the Local Initiative Groups is not subject to a common model of work and the activity of the individual units does not follow a centralized approach. However, the strategic commitment to improve economic and social life in the areas concerned, including by stimulating the economic activities falling into the field of bioeconomy and undertaken by private entities and existing legal entities, has a positive effect on local communities and creates preconditions for improvement. of their competitiveness and sustainability as regions of growing importance and attractiveness.

The Municipality of Stara Zagora, as a leading administrative and economic center in the region, pays special attention to the use of energy from renewable sources and biofuels as a strategically important component for the region in the short term until 2023 and in the long term until 2030.

Some of the measures that are expected to enter into force by 2023 include:

- Carrying out an analysis and assessment of the real possibilities for utilization of RES in the municipality of Stara Zagora;
- Increasing the share of energy from renewable sources used in the public sector;
- Encouraging business investments for the construction of renewable energy installations on the territory of the Municipality

In the long run, covering the time until the end of this decade, the Municipality of Stara Zagora provides:

- In the transport sector, local authorities will develop and implement schemes to promote the use of energy from renewable sources, incl. alternative renewable fuels, new generation biofuels and recycled carbon fuels depending on the specific conditions in the municipality
- Creating conditions for the development and use of new generation biofuels, renewable liquid and gaseous fuels of non-biological origin and recycled carbon fuels
- Development of energy infrastructure for production and consumption of energy from renewable energy sources;

In the region of Stara Zagora, several projects are being implemented, realized with European or national funding, which are related to the bioeconomy and improving its development potential. These projects are of national or international character, but some of the activities are implemented in the region or involve the partnership of organizations based in the region of Stara Zagora.

National Scientific Programme "Intelligent Animal Husbandry"

The main goal of the scientific programme is to conduct fundamental and applied research to provide the livestock sector with innovative methods and tools for intelligent and efficient animal husbandry with reduced human resources and decreased environmental impact, and directly refers to the priorities of: UN Programme for sustainable development for the period up to 2030 "Transforming the world" and the 17 global goals for sustainable development included in it; The European Commission's Green Deal 2020; Horizon Europe; The Digital Europe 2021-2027 Programme; The National Programme "Digital Bulgaria 2025"; The Strategy for Digitization of Agriculture and Rural Areas of the Republic of Bulgaria.

National Scientific Programme "Healthy Foods for a Strong Bioeconomy and Quality of Life"¹

The programme aims to provide the necessary conditions for conducting research, applied research and demonstration activities in the priority areas falling within the priority area of Innovation strategy for intelligent specialization "Industry for Healthy Living and Biotechnology".

- Production, processing and supply of safe and healthy food.
- Development of a strong regional bioeconomy.
- Organic products such as functional foods and nutritional supplements.
- Bio-preparations for control and production of safe and harmless foods.
- Bio-preparations for biocontrol and increasing yields in agriculture.
- Food quality for a better quality of life.
- Green / bio-based economy.

BIObec: Preparing the creation of Bio-Based Education Centres to meet industry needs and boost the contribution of the bioeconomy to societal challenges²

The aim of the BIObec project is to develop a comprehensive framework for multilevel bio-based educational centers (BBECs), flexible enough to meet the current and future needs of industry and the surrounding ecosystem at local, regional, national and / or international level. BIOBEC will clarify the needs of different regional ecosystems and provide detailed design, economic and financial evaluation, management plans for the educational centers for training as well as plans for lifelong learning programmes.

¹ <http://www.nnp-food.au-plovdiv.bg/>

² <https://www.bbi.europa.eu/projects/biobec>

SMecoMP: A knowledge Alliance in Eco-Innovation Entrepreneurship to Boost SMEs Competitiveness³

The Bulgarian Industrial Association and the Thracian University were partners in the project A knowledge Alliance in Eco-Innovation Entrepreneurship to Boost SMEs Competitiveness "SMecoMP", funded by the European Union programme for transnational cooperation "Balkans - Mediterranean 2014 - 2020".

The SMecoMP project concerns the development of an educational framework and appropriate training tools to improve the skills of managers in the field of eco-innovative entrepreneurship. The aim of the project is to build a sustainable alliance of knowledge between higher education institutions, vocational training centers and small and medium enterprises in the field of eco-entrepreneurship, management and eco-innovation.

BE-Rural: Bio-based strategies and roadmaps for enhanced rural and regional development in the EU⁴

The main aim of the project is to contribute to developing rural bioeconomies by focusing on regional strengths. These areas are home to a wealth of ecosystems and resources, where the bioeconomy carries the promise of opportunities for rural employment and sustainable growth. This transition towards a new, bio-based regional economy requires the active involvement of a broad spectrum of stakeholders and the sustainable use of agricultural,



forest and marine ecosystems.

Building on this idea, BE-Rural will explore the potential of regional and local bio-based economies and support the development of bioeconomy strategies, roadmaps and business models. To this end, the project will focus on establishing Open Innovation Platforms (OIPs) within selected regions in five countries: Bulgaria, Latvia, North Macedonia, Poland and Romania, as for Bulgaria, the Stara Zagora region is the focus of the main project activities.

AGRI-Eco: Strategic partnership for AGRI-entrepreneurship and EcoInnovation⁵

³ <https://www.smecomp.eu/>

⁴ [Home - BE-Rural](#)

⁵ <https://agrieco.eu/>

AgriEco generates complementary knowledge, skills and resources and realizes unique value in support of training in the field of agri-entrepreneurship. The project is not an alternative to the formal education system, but rather a step towards smoothing the transition from university to a real work environment, including: creating an improved portfolio of new competencies and experience for students; new models of training and development of innovative disciplines; and changing attitudes towards the "education-business" relationship. The project is implemented by a consortium led by the Thracian University, with the participation of universities, business and non-governmental organizations from Bulgaria, Greece, Turkey, Serbia and Kazakhstan.

BUSINESS INCUBATOR "GO-UP"⁶

BUSINESS INCUBATOR "GO-UP" is the first initiative of its kind for the Thracian University, supported by the programme "Dissemination & Exploitation Booster Service" of the European Commission. GO-UP is a combination of successful projects funded by the 7th Framework Programme and Horizon 2020, led by the C-BIRD project "Cooperative Business and Innovative Rural Development: Synergies between Commercial and Academic Partners", coordinated by the Faculty of Economics at the Thracian university, identified by the European Commission as an example of good implementation practice. The consortium includes partners from Bulgaria, Estonia, Serbia, Turkey, Moldova, Bosnia and Herzegovina, Italy. The main goal of GO-UP is to stimulate and accelerate smart growth across Europe and the partner countries by facilitating: start-ups, cooperatives, social enterprises, new investments and start-up initiatives in agriculture, as well as innovations throughout the value chain; through which to create new employment opportunities and improve the regional framework for SME development by supporting and building a network of local and regional partners in the public, private, civil society and academic sectors.

BIOSTEP: Promoting stakeholder engagement and public awareness for a participative governance of the European bioeconomy

This project, funded by the Horizon 2020 programme, is implemented by a consortium of 9 partners, which includes the Bulgarian Industrial Association. Its main aim is to increase the overall awareness and understanding of the bioeconomy, as well as its consequences and the benefits of informing and engaging the citizens. BioSTEP brings together key stakeholders and policy makers to discuss the necessary steps towards a holistic strategy, which weaves the bioeconomy into the fabric of policy making across many sectors throughout EU Member States. BioSTEP will also identify and disseminate best practices on the participatory development of national and regional bioeconomy strategies for participation in the bioeconomy management.

The potential for development of the bioeconomy in Stara Zagora is the subject of an in-depth study included in a published comparative analysis between the regions of Stara Zagora and Veneto, Italy, using a tool for active participation of citizens, businesses and local authorities to manage the bioeconomy.

⁶ <https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/d-e-booster>

DeCarb - Supporting the clean energy transition of coal-intensive EU regions

This project is funded by the INTERREG EUROPA programme, with a leading partner Agency for Regional Economic Development - Stara Zagora and a consortium of 8 other organizations from European Union countries. The overall goal of the project is to exchange experiences and transfer of good practices on how to make the transition from the era of high-intensity carbon economy to the future of clean energy. This must provide the affected regions with sustainable development, economic and social stability and a role in the 2030 energy mix.

The shift to a low-carbon energy of the EU economy will have a profound economic and social impact on regions with intensive coal extraction. However, it is recognized that this transition must be fair. The EU's "Clean Energy for All Europeans" package is designed to accelerate the transition to clean energy, growth and job creation. In this sense, DeCarb aims to support public authorities to initiate the necessary efforts, unite their capacity and share experiences in:

- identifying growth strategies to minimize the potential negative impacts of the transition to low-carbon energy;
- ensure the maximum possible funding from the ESIF and the EFSI, as well as other financial instruments;
- encourage public dialogue and to overcome conflicts of interest.

Some of the expected results are:

- Approximately EUR 19 million of funds raised to support renewable energy projects, retraining of the workforce and reclamation of coal mining areas;
- Raising awareness and consensus in the energy sector, the workforce and the public to support measures for transition to clean energy.

Business and bioeconomy

The bioeconomy, as mentioned earlier, is interconnected and covers all sectors that operate or depend on natural and biological resources. This in practice involves extremely significant, both financial and human resources. It is natural that the relevance and importance of the bioeconomy as a trend for economic development in the foreseeable future in the single market of the European Union, and globally, starting from Europe's leading position as an engine of change towards a greener society, is consistent and led by business.

The platform for modelling of agro-economic research data, maintained by the European Commission's Joint Research Center, tracks some key trends in Member States' bioeconomies, using data from several large-scale research projects funded by various European Union programmes, such as Horizon 2020. According to a special monitoring system for the bioeconomy in the EU⁷, established by the European Commission, the bioeconomy within the European Union (EU27 without Great Britain) represents:

- 17.5 million jobs or 9% of the workforce
- 614 billion euros of added value from the bioeconomy or about 5% of the EU GDP

⁷ [Bioeconomy \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&code=sdg_8_3_1&plugin=1)

- Another approximately € 872 billion in added value from bio-based services, should the services sector be included

The agriculture and the production of food, beverages and tobacco are the dominant sectors of the European bioeconomy⁸. However, the sectoral composition of the bioeconomy varies from one Member State to another for a number of reasons, including the level of use of biomass resources, their historical economic specialization, R&D investments already made and others⁹. The ten economic sectors most important for the bioeconomy at European Union level are: agriculture; production of food, beverages and tobacco; biologically based chemicals, pharmaceutical products, plastics and rubber (except biofuels); wooden products and furniture; paper; forestry; textile products from biomaterials; fisheries and aquaculture; biologically based electricity; liquid biofuels.

According to the same study, in Bulgaria in 2017, there were almost 848 thousand people employed in activities falling under the scope of the bioeconomy, with over 75% of them in enterprises in the agricultural sector. In comparison, during the same period, on average for the European Union, this percentage was just over 51%, i.e. the potential for development of the bioeconomy in Bulgaria towards other sectors is not to be ignored.

A recent major study by the European Commission, EU Biorefinery Outlook to 2030 (published in June 2021)¹⁰, examines the potential for biorefinery development in different countries of the European Union. The projections for Bulgaria show the following trends:

- Significant growth in the wood industry is expected that will lead to a high potential of available woody biomass residues and therefore it presents opportunities for development in this direction. The EU wood processing industries have a significant concentration of facilities in Central Europe and Scandinavia, in Southern Europe they are significantly limited, with few opportunities for interaction in countries such as Bulgaria and Croatia.
- There are very few processing facilities in the northern countries of Central and Eastern Europe, such as Latvia, Lithuania and Estonia, the same as in the southern countries, such as Romania and Bulgaria, indicating that in these regions there are fewer synergy opportunities for biorefineries based on sugar biomass.
- Industrial sites in Bulgaria are scarce, although the country has the potential to have sufficient feedstock and existing industries whose waste can be sources of biomass, but investment in infrastructure and supply chain is needed for the successful deployment of biorefineries in Bulgaria.

Businesses can also be directly stimulated to start or diversify their activities, even in traditional sectors. For example, in May 2019, the European Commission and the European

⁸ OECD (2019), Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences, OECD Publishing, Paris, <https://doi.org/10.1787/9789264307452-en>

⁹ Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050. Urban Development;. Washington, DC: World Bank. © World Bank. <https://openknowledge.worldbank.org/handle/10986/30317> License: CC BY 3.0 IGO

¹⁰ EU Biorefinery Outlook to 2030 (Lot 3) Studies on support to research and innovation policy in the area of bio-based products and services, 2021, European Commission, Directorate-General for Research and Innovation

Investment Bank (EIB) launched a package of loans for the agriculture and the bioeconomy with specific objectives in support of young farmers. It is part of a broader initiative for young farmers that is run by local banks and leasing companies operating across the EU, which includes a minimum 10% distribution for farmers under the age of 40¹¹.

Biomass energy consumption is expected to increase both in final energy consumption as well as with the production of electricity. The additional consumption of energy from biomass will require an increase in the amount of biomass in Bulgaria (produced in a sustainable way), and in the period 2020-2030 it will increase by 37%¹². The largest increase is in the use of energy from biomass in the industrial sector, where in 2030 the increase is nearly 100% compared to 2020. In the household sector, which uses the largest amount of biomass (share of 66% in the final energy consumption in 2020) the growth will be more moderate (11%). In the transport and services sectors, the increase is lower in 2030 compared to 2020, by 2.3% and 2.6%, respectively.

The current unprecedented health crisis hints at the very diverse and large-scale role that the bioeconomy can play in ensuring diversification of food, feed and raw material supplies at first, but at the same time helping to limit and reduce the negative effects on climate, while simultaneously contributing to job creation and supporting rural areas development. Various experts at European level, supported by real commitments from the current composition of the European Commission, offer a new perspective for promoting sustainability and a smooth transition to a circular economy after COVID-19 in the framework of the European Green Deal and the European Plan for Reconstruction and Development, in compliance also with the objectives of the European Bioeconomy Strategy. This implies the creation of new models for work and cooperation between the different sectors, an in-depth analysis of current challenges and their importance for ensuring the sustainability of the local economy, including through a greater penetration of the bioeconomy. Last but not least, it is necessary to pay the necessary attention to human capital and the social effect of a possible change in the economic model in the countries of the European Union. Particular attention must be paid to underdeveloped economies and the low-income population must be engaged, attracted to the labour market and involved in the creation of bio-based value chains.

¹¹ National strategy for SMEs” 2021-2027 r.

¹² Data from (B)EST model, E3-Modelling, Deloitte, from Integrated plan for energy and climate of R Bulgaria 2021 – 2030r.

Bioeconomy - potential for development in Stara Zagora region

Stara Zagora region - overview

Stara Zagora region is located in the Central Southern Bulgaria and covers the Stara Zagora plain, the Kazanlak valley, parts of the Balkan Mountains and Sredna Gora mountains. The total area of the region is 5151 km², which represents 4.6% of the territory of the country and a population of 323,685 people. There are 11 municipalities in the region with 206 settlements (10 towns and 196 villages), which are very different in terms of security, resources, economic and infrastructural potential. These are: Bratya Daskalovi Municipality, Gurkovo Municipality, Galabovo Municipality, Kazanlak Municipality, Maglizh Municipality, Nikolaevo Municipality, Opan Municipality, Pavel Banya Municipality, Radnevo Municipality, Stara Zagora Municipality and Chirpan Municipality.

The climate is moderately continental, with relatively mild winters, long and mild springs and autumns. The annual amount of precipitation is on average about 450-550 mm. Soil and climatic conditions are very favourable for growing all types of crops from the temperate zone. This allows the area to successfully grow cereals, technical, oilseeds, essential oils, fiber, vegetable crops, fruit species and vineyards. Leading is the cultivation of cereals (wheat, barley), which are a good basis for the development of the laundry industry and favour the solution of the feed problem for the development of animal husbandry.

The cultivation of essential oil and medicinal crops is very important in the area. The area is world famous for the production of the highest quality rose oil and is a leader in Europe in the cultivation of medicinal crops and export of dried herbs.

It is essential to have a very good supply of water resources - rivers, dams, canals, hydraulic facilities and mineral springs, which favour the development of spa tourism.

First-class domestic and international road transport connections are crossed on the territory of the region, which connect the northern border of the Republic of Bulgaria along the Danube River with the southern one, to Greece and Turkey. The traffic flows on the two railway lines connecting the western parts and the capital with the Black Sea ports of Burgas and Varna and with the southeastern border of the Republic of Bulgaria with the Republic of Turkey and Greece are intensive. The routes of the transport corridors № 4, 8 and 9 also intersect here.

The possibilities of the regional bioeconomy

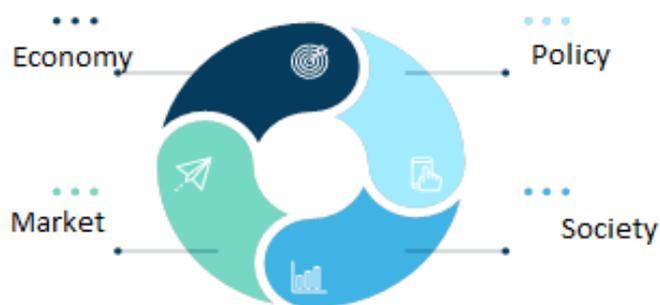
The bioeconomy is a real opportunity and an effective approach through which economic priorities and environmental factors are sustainably balanced.

The main message is to greater responsibility in the relationship "man-nature" and a gradual transition to a completely new way to meet societal needs, in which the leading principles are environmental dependence and the principle of environmental impact¹³.

In this process, the need for parallel reforms is becoming increasingly clear:

- In the economic sector, including the offering of new technological solutions within the overall process of economic transformation, i.e. different goods and services are produced and sought in different ways, which is characterized by sustainability;
- In the socio-cultural models - behavior / nature of consumption, restructuring of supply;
- In the political and administrative system, the functioning of which should follow global changes.

Figure 1 Perspectives of the bioeconomy



Strategic goals of the Strategy for development of the bioeconomy in Stara Zagora region:

- Development of the local bioeconomy based on the key factors and advantages for the region;

- Creating conditions for development and strengthening of sectors on a biological basis, promoting the introduction of new technologies;
- Increasing the economic competitiveness of the region and building an environmentally conscious society.

The specific objectives of the Strategy for Development of the Bioeconomy in Stara Zagora Region are:

- Effective management of resources in accordance with the principles of sustainable development - rational use of production areas; sustainable management of land, forest and water resources; Waste Management; development of organic agriculture, market for organic products and bio tourism; networking, clustering and shared value; coherence between the bioeconomy and rural development; digitalisation in rural areas.
- Generation of the necessary knowledge and technologies to be the basis of the sustainable and climate-neutral economy of the region

¹³ The principle of ecological dependence, according to which people are dependent on nature to survive, and that the properties and character of the nature they encounter have a significant causal impact on the course of their lives.

- The principle of environmental impact - human actions have a significant impact (planned and unplanned) on nature.

- Development of specific solutions and coordination mechanisms in the context of the Community's strategic priorities, such as the 2030 Agenda for Sustainable Development - currently sectoral approaches to the bioeconomy in Bulgaria are not sufficiently integrated in terms of coordination, implementation and monitoring.
- Linking the above activities with the active participation of society and all stakeholders - policy can set the agenda and pave the way, but the transformation to sustainable business will be possible only with broad support from society as a whole.

Priority areas for sustainable bioeconomy in Stara Zagora region

Production of food and organic products

Bio-based products have advantages in terms of climate, environment, resource efficiency and sustainability. Nevertheless, the introduction and validation of innovative bioeconomic products and market processes is still a major challenge, as they must compete with products already known to consumers and benefit from established marketing channels, recognition and infrastructure.

Although consumers' desire to buy organic products is enough to pay a higher market price, the initial demand for alternative organic products is often not high enough to make their production cost-effective. In the Stara Zagora region there is a potential for the production of medical and cosmetic products, food supplements with antioxidant effects; for the production of new functional milk-based foods; for organic honey production; as well as for the introduction of innovative technologies in animal husbandry and the production of traditional foods of animal origin.

Other important components that support the market uptake of organic products are information and raising consumer awareness of the specific advantages and disadvantages of these products. Product labels and, where applicable, certification labels create transparency and enhance trust in bio-based products. Selecting and promoting good examples of sustainable use of biologically based raw materials helps to raise public awareness and create additional incentives for the use of renewable raw materials.

Public procurement is another important tool that can be used to support the creation of organic products. A stronger focus of public procurement on organic, sustainable products can help create such products. Market power and the role model of the public sector can serve as an incentive to open markets to new products and services.

The logic of organizing the production activity in agriculture determines that any change in the technical characteristics (production methods, new rotational schemes, non-production elements at the farm level, programming of activities) is a direct reflection of the change in external factors. The possibilities for modification of the production systems, which are directly related to the biodiversity of the region, are reduced to de-intensification of the production, diversification of the product types, as well as development of the non-production elements. The so-called forming factors can be reduced to the specifics and nature of market demand and the change / evolution of production systems (Table 1):

Table 1 Making factors for the development of organic farming and the market of organic products

Demand in the food industry and trade	Influence of the evolution of agricultural systems
Strong influence of the food industry and the trade sector - as a result there is a concentration of a relatively large share of production in a small number of producers. Increasing proportions of the value added in the processing and sale of products.	Concentration of production of basic products with reduced relative share of on-farm processing and reduced percentage of direct sales.
The competition is growing in the direction of demand for basic products at the lowest possible price.	Labour productivity Increasing, realizing economies of scale and standardizing production methods.
The food industry requires standardized products for processing (homogeneity criterion) and commercialization, while suppliers require durability during the storage period.	The strategy of homogeneity of diversity is applicable, the choice depends on demand.
Demand for strategies for differentiation of products to the end user, which implies increasing specialization of production.	Increasing adaptation to scale in different sought-after product groups limits the adaptability and flexibility of manufacturers.

Forestry

Regarding the forest fund, the Stara Zagora region has a well-developed forestry and forest industry - nearly 70% deciduous forests (beech, oak, hornbeam, poplar, linden, acacia) and 30% coniferous plantations. In practice, the region has significant forest resources and its sustainable management can contribute to the production of significantly higher amounts of heat and electricity, as well as reduce greenhouse gases in the atmosphere. Data on biomass energy (wood plus crop and animal waste) provide an indication of the economic and social importance of wood energy. In recent years, the production and consumption of wood pellets and wood chips has increased, and these products, which are a processed forest biomass, have become increasingly popular, both for domestic consumption and for export.

Effective resource management

• Sustainable management of land (including reclaimed lands), forest and water resources

In recent decades, the pressure on land resources has become clearer and sharper, mainly due to the need to protect natural habitats and biodiversity, in the context of ongoing urbanization processes and expansion of adjacent infrastructure, extraction of abiotic raw materials - coal, sand, gravel, limestones and dolomites, mineral raw materials, clays and marls, etc.), and the gradual reclamation of the areas vacated by mines. Among the mentioned factors we can include the processes of creating renewable energy systems.

Following the techniques and basic principles of the bioeconomy, a combination of different approaches to sustainable reduction of competition in land use can be relied upon here, while preserving resource efficiency.

One approach is to categorize agricultural systems according to their new / adapted management concepts¹⁴. Industrial agriculture aims to maximize economic benefits through a high level of mechanization and application of synthetic pesticides and fertilizers for crop production and through the use of specialized breeds and intensive nutrition and reproductive management for livestock. The integrated agriculture uses both synthetic and biological means to supply nutrients and control pests, but applies measures to manage levels that are considered economically justified and that reduce or minimize environmental and health risks. In addition, integrated agriculture uses the natural properties of plants and animals used for production purposes, such as drought resistance in certain crops or tolerance to diseases and parasites in certain breeds of animals. The conservation of natural resources, including genetic resources, is the focus of both organic farming and conservation farming.



Another approach involves the implementation of infrastructures and processes for the



selection, separation and recovery of secondary materials and the adoption of methods of combined and cascading use, aimed at overall reduction of the

use of raw materials and resources, while maximizing their efficiency. Cascade use as a process is a complex interaction of material flows and their utilization at different levels, in

¹⁴ Garg MR, Sherasia PL et al (2013) Effects of feeding nutritionally balanced rations on animal productivity, feed conversion efficiency, feed nitrogen use efficiency, rumen microbial protein supply, parasitic load, immunity and enteric methane emissions of milking animals under field conditions. Anim Feed Sci Technol 179(1):24–35

different phases of consumption and in different cascade chains¹⁵. However, modern technologies offer a significantly wider range of options that allow the cascading use of various raw materials, including biomass. The use of biomass, either for material purposes or as an energy carrier, is often discussed in terms of food security, scarcity of non-renewable and fossil resources, climate change mitigation and management, and the use of renewable energy. The use of the cascade as a basic principle can contribute to the strategic increase of resource efficiency. An important question of the cascade principle is whether or not the direct use of energy from the generated biomass is considered a cascade use. Relatively few definitions include both end-of-life energy use and direct use of biomass energy. The use of nutrients (flora, fauna) that require little or no space (e.g. waste and debris) can also lead to a significant reduction in pressure on land resources¹⁶.

A third approach is the reclamation of degraded and unused areas and land that is used inefficiently. Examples include the sustainable management of post-mining landscapes and sites with underutilized capacity for agriculture. An integral part of this approach is the recognition of the importance of fallow land, headlands, hedges, trees or buffer zones, from which biodiversity benefits. Urban areas can also be used for urban agriculture.

In addition to the above, a fourth approach to reducing the pressure on land resources is to increase the productivity of areas used in agriculture and forestry. This process, of course, should balance the conservation of biodiversity and landscapes. From an economic and environmental point of view, a sustainable increase in productivity per unit area can be achieved through precision farming and the creation of an optimal varietal structure. This includes activities in the field of plant selection, targeting varieties that are more suitable for specific places and climates, more efficient in terms of nutrient and water use, and more resilient and resistant to biotic and abiotic stress. These activities subsequently relate to the further development of organic farming systems, including activities related to adaptation to climate change.

With regard to water resources, the forecast is for an increase in irrigation costs in the coming years, if the trend of decreasing rainfall and extending the growing season due to climate change continues. The condition of the water supply network and the need for investments for reconstruction and modernization remain problematic.

Creating networks, clusters and shared value

Clusters are by definition a geographically connected concentration of similar, interconnected and complementary companies with active business relationship channels that use common and specialized infrastructure, labour markets and services and face common threats and opportunities for development. In practice, this means that **clusters are directly dependent**

¹⁵ Bringezu, S, Ramesohl, S. Arnold, K, Fishedick, M, von Geibler, J, Liedtke, C and Schütz, H (2007) What we know and what we should know – Towards a sustainable biomass strategy. Wuppertal Papers No 163. Wuppertal Institute for Climate, Environment and Energy: Wuppertal.

¹⁶ Monograph "Analysis and profile of the state and potential for regional bioeconomy" with the team - team under FP 4.2 "Regional ecosystems for bioeconomy" of Component 4 "Bioeconomy, food systems and integrated regional development" (2020), Academic Publishing House, Thracian University, ISBN 978-954-338-164-7

on the realization of shared value, and at the same time have the real resources to create it¹⁷.

Key factors for realizing shared value¹⁸:

1. Enterprises with long-term development horizon;
2. Support to municipalities and local authorities and institutions;
3. Experience in research and traditions in the partnership between business and academia;
4. Partnership between enterprises and municipalities;
5. Availability of experts and research potential;
5. Access to financial programmes and resources;
7. Cluster approach for association of interests.



There is no specialized legislation for the creation of cluster and network structures, for their effective structure and functioning. Depending on the chosen goal and organizational status, their mechanisms for creation, operation and management are determined by various regulations. This is to some extent a reason to slow down the initial process of building clusters and networks. European and national agricultural policy play an important role in the creation of various production chains, clusters and other network structures in the agribusiness sector. With their programmes they are aimed at stimulating the processes of cooperation, communication, coordination and cooperation between producers, processors, traders, scientific institutions, local authorities and others. in order to increase the competitiveness of agricultural holdings, processing companies and the regional economy¹⁹.

The forestry sector is second in importance for the development of the bioeconomy and bio-based production chains. The characteristics of the productions in the forest sector largely determine the opportunities for development of horizontal and vertical technological chains. Wood and wood products are the main raw materials and materials that are processed sequentially, going through different stages of production to obtain the final product. These close links between the individual productions, based on raw material, technological and

¹⁷ Francescato, V. and Negrin, M. (2013) "The cluster of Biomass Producers. Italian best practices and the rule of biomass trade centers for ensuring quality and long-term supply". Retrieved online at: <http://www.congresobioenergia.org/ponencias/AIEL.pdf>

¹⁸ Foray, D., David, P., Hall, B. (2009), Smart Specialisation–The Concept. Knowledge Economists Policy Brief, No. 9, (June). Available from: http://www.ec.europa.eu/invest-inresearch/pdf/download_en/kfg_policy_brief_no9.pdf

¹⁹ Monograph "Analysis and profile of the state and potential for regional bioeconomy" with the team - team under FP 4.2 "Regional ecosystems for bioeconomy" of Component 4 "Bioeconomy, food systems and integrated regional development" (2020), Academic Publishing House, Thracian University, ISBN 978-954-338-164-7

production characteristics, are the basis for continuous improvement of the production, going through the different phases of processing, for increasing the efficiency in the separate production units and the general economic efficiency. Economic efficiency increases even more in the branched vertical technological chains with the inclusion of secondary wood resources (technological waste) in various industries.

Unlike subcontractor chains and networks, which have a relatively constant nature and are built on production and technological features, horizontal product lines are developed mainly on the basis of horizontal production specialization and cooperation between individual enterprises. Through the horizontal product lines, the participating companies realize a synergistic effect of acquiring new or improved technologies, ways of processing raw materials, organization of production, labour and management, etc.

Horizontal specialization in the industry can be developed both in the direction of building product lines and sub-detailed ones. They can involve not only companies in the industry, but also from other industries - such as companies producing glass, plastic parts, mechanisms of metal, marble and others.

The development of innovative bio-based products, processes and services is a key driver of the bio-based economy and should be supported. In many cases, the development and establishment of regional bio-supply chains can be achieved by intensifying the relationships of already established participants in the product chain.

In addition, existing supply chains in the bioeconomy need to be optimized to reduce raw material consumption, protect the environment and the climate by reducing the use of non-renewable raw materials and improving their overall economic competitiveness.

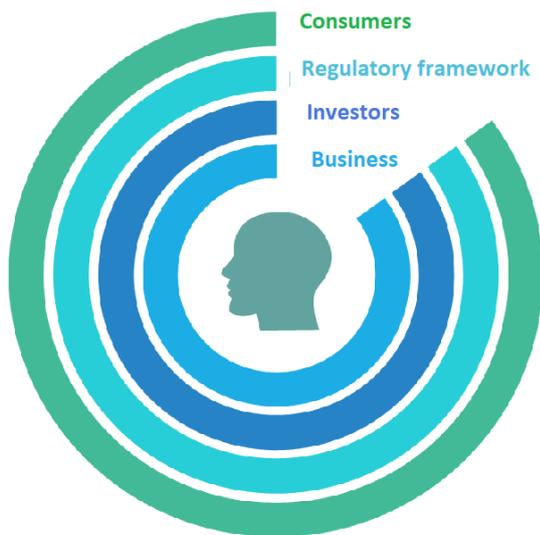
Organizational and technical concepts should also be further developed at enterprise level. This will help to optimize the production, storage and initial processing of renewable raw materials and thus contribute to the more efficient use of bio-resources. This can apply to both the collection of secondary and residual materials; and for the processing of raw materials obtained from agriculture and forestry into better quality intermediates.

[Coherence between the bioeconomy and rural development](#)

Deploying local bioeconomies across Europe is one of the objectives of the European Bioeconomy Strategy to ensure that the bioeconomy as a whole is a driver for inclusive and sustainable growth at local level. This includes the development of local structural programmes in the Member States and their territories, such as their regions, rural areas, cities and coastal areas. Most biomass is produced and processed in rural areas and used as food or fodder or for material or energy purposes, and in this connection rural areas play a central role in the bioeconomy.

At the regional level, ecosystems are built mainly by the usual participants in regional innovation systems: government structures and regional public administration, business, representatives of sectoral associations and business intermediaries, as well as academic, scientific and technological institutions.

Clusters are an important tool for concentrating stakeholder efforts around specific sectors /



products of the bioeconomy. Similar dynamics are observed both in highly industrialized regions and increasingly in rural areas. Compared to traditional industrial clusters, those related to the bioeconomy often have to integrate producers of biological resources, i.e. farmers as well as their associations, e.g. cooperation. In practice, this means that coordination at the managerial level is needed between different areas of institutional and policy intervention (e.g. research and innovation, agriculture, environment) to promote the bioeconomy²⁰.

Specific areas that could benefit from deployment strategies in this context include:

- Using the potential of bio-innovation, including in agriculture.
- Development of new products, processes and value chains based on biology, as well as new approaches to developing the activities of producers in rural areas.
- Innovative applications of food and agricultural systems, including food waste and by-products management (including nutrients), recycling.
- New opportunities and application of forest resources in construction, textile industry, furniture production and chemical industry.



Digitalization

In an optimistic scenario, the growth of digital competences and the application of artificial intelligence will strengthen rural economies, optimize the use of productive resources, improve the quality of life of employees in the sector and the community as a whole. At the same time, the real social, economic and environmental effects of digitalisation in agriculture, and in agriculture in particular, are still not well known, both from a scientific and a practical point of view.

The new interconnections and expected effects form complex relationships between the different layers of interaction within agriculture, which have a high potential to generate risk and instability, as well as resulting inequalities from different rates of rural development.

²⁰ Dupont-Inglis, J.; Borg, A., Destination bioeconomy – The path towards a smarter, more sustainable future. *New Biotechnology* 2018, 40, (Pt A), 140-143.

These areas may become even more unstructured ecosystems due to global digitalisation processes, including the lack of defined basic governance structures, stakeholder roles and value chains, lack of interoperability and data sharing, difficulties in the selection and implementation of digital technologies.

The great potential for innovation, related to the intensification of digitalization processes throughout the supply chain of the bioeconomy, can realize opportunities for process optimization. Connecting the bioeconomy with the current process of digitalization also creates an opportunity for the development of innovative business models. This applies to all areas of production. For example, the use of digital innovations in agriculture and forestry can lead to significant savings in resources such as soil, crop protection products, fertilizers and energy.

Table 2 Impact of digital technologies on rural development

<i>Effect/Impact</i>	Justification
<i>Digital technologies are changing society in rural areas</i>	<ol style="list-style-type: none"> <li data-bbox="603 779 1418 952">1. Digital technologies develop knowledge through open access platforms for training and qualification; encourage the transfer of knowledge and skills; allow the organization of on-site trainings. <li data-bbox="603 952 1418 1243">2. Digital technologies maintain social connections - provide communication and access to information for people with disabilities or localization in remote areas; strengthen ties within the local community; maintain traceability within the product chain; unite the communities of different stakeholders and stimulate social ties and relations of solidarity. <li data-bbox="603 1243 1418 1415">3. Digital technologies promote the specifics and resources of rural areas - support migration processes, attract specific labour resources, provide new economic opportunities for the development of territorial marketing. <li data-bbox="603 1415 1418 1588">4. Digital technologies improve the standard of living in rural areas - help businesses find new markets without having to physically reorganize production facilities and resources. <li data-bbox="603 1588 1418 1803">5. Digital technologies provide new or improve existing services - develop services such as telemedicine; promote the sustainable use of natural resources and climate change management; facilitate the application / use of databases.
<i>Digital technologies create new opportunities for rural development</i>	<ol style="list-style-type: none"> <li data-bbox="603 1803 1418 2042">1. Sharing Economy and Industry 4.0 generate innovation at all levels, including technological, social, human, cultural and economic. Digital technologies ensure the return of production activities in local areas; new forms of industry / industry are emerging that depend on and participate in the digital transition.

Digital technologies are causing a change in workflow organization practices

2. Create added value for rural areas - digital technologies can stimulate economic growth, create new jobs and added value for the benefit of rural areas.
3. Digital technologies make better use of local strategies and infrastructure .
1. Digital technologies transform the way of work , obliging public and private stakeholders to change their established workflow practices;
2. Digital technologies lead to increased mobility , whereby professional commitments can be fully fulfilled remotely.
3. As the application and complexity of digital technologies increase, so does the need for new skills and competencies .

As a result, reducing costs and increasing efficiency make primary production much more competitive and environmentally friendly. There is also the potential for profit through the use of sensor technology, large databases, fast connections and robotics in the production and processing of nutrients and in the context of precision farming. It is important to focus resources on how to make optimal use of digital technologies, for example in creating new labour market demand - green occupations, improving animal welfare, protecting the environment and biodiversity, and more generally. to achieve sustainable development.

Conclusion

Economic development, in the context of green transition and transformation, faces a number of challenges arising from a combination of key factors, such as climate change and its impact on agriculture and biodiversity, poverty levels, digital processes and new dividing lines in society, especially among young people (and in view of the new pandemic reality), the need for significant structural reforms and increased institutional confidence. The above, in addition to the traditional pressures of growing global competition, inevitably has significant implications for governments and institutions, local communities, business, science and education.

At the same time, these fundamental changes open new opportunities for interdisciplinary cooperation in the fields of business and management, information and communication sciences, economics and social sciences, and ecology. Although the bioeconomy is not a clearly defined industrial sector, understanding the theory of industrial life cycles is crucial for structuring the process of transformation to a knowledge-based bioeconomy. The bioeconomy needs to be cross-sectoral defined and interpreted. On the one hand, new sectors are emerging, e.g. in the field of bioplastics, waste management or the production of organic products. On the other hand, the already existing sectors in the field of automotive, battery production technologies, pharmaceuticals, etc., will gain new meaning with the implementation of bioeconomic approaches. The bioeconomy can make an important contribution to accelerating investment by providing new opportunities that generate key innovations and thus ensure sustainable production and consumption. This, in turn, should accelerate the technological paradigm shift.

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