

BIOECONOMY IN THE EUROPEAN UNION. ANALYSIS OF KEY STRATEGIES AND INDICATORS

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Abstract

A new concept promoted in the European Union, the bioeconomy, can contribute to sustainable economic growth, which respects the environment and promotes renewable resources. The transition to a sustainable economy, supported by bio principles is based on technology, economic profitability and awareness by members of society. This paper addresses this concept and analyzes the European Union's strategy in the field of bioeconomy and funding instruments to achieve this goal. The paper also presents a brief analysis of the indicators that allows the monitoring of the bioeconomic sectors from the economic, social and environmental point of view. The bioeconomy must become a reality in every Member State of the European Union.

Key words: *bioeconomy, European Union, Green Deal, indicator, strategy, sustainable development*

JEL Classification: *Q57, Q01, O13*

I. INTRODUCTION

Talking about “bioeconomy” is like reshaping the traditional economy, using bio-factors of production to create goods for an environmentally-friendly society and for a high living standard. Concerns and debates for the development of this type of economy worldwide, but also nationally and regionally have materialized in the development of various strategies and working documents, which established the definition, specific terminology, components, measurement indicators and examples of good practice in the field of bioeconomy.

The principles of the bioeconomy must be promoted at the level of each country, as it can contribute to sustainable economic growth, which respects the environment and contributes to the conservation of natural resources and the promotion of renewable resources. The transition to a sustainable economy, supported by bio principles, involves rethinking and changing the way of life today, consumer awareness of all the benefits of this transformation, individual and collective responsibility.

The study of the specialized literature in the field of bioeconomy clarifies many of its specific aspects.

II. LITERATURE REVIEW

According to the Organisation for Economic Cooperation and Development (OECD), bioeconomy represents “the aggregate set of economic operations in a society that use latent value incumbent in biological products and processes to capture new growth and welfare benefits for citizens and nations”. (OECD, 2009) The OECD suggests that biotechnology offers solutions to many of the health problems and together with bioeconomy can lead to major changes in the global economy in the future decades.

European Association for Bioindustries considers industrial biotechnology a key component of the bioeconomy, because chemicals, materials and fuels from biomass generates sustainable production that is less dependent on coal, oil and gas.(EuropaBio, 2011)

In its policy package, European Commission defines bioeconomy as “the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy”.(EC, 2012) The bioeconomy includes a wide range of sectors like: agriculture, forestry, fisheries, food, biotechnology, energy sector, chemicals, building and transport.(McCormick, Kautto, 2013)

The bioeconomy emerged as a specialized term after 2005, one of the first steps being the publication by the OECD in 2004 of the document "Biotechnology for sustainable growth and development", which defined the term economics based on the concept of bio as that type of economy that uses renewable bioresources, efficient bioprocesses and eco-industrial groups to produce bioproducts, jobs and sustainable income. The fundamental objective of the bioeconomy is the efficient and sustainable use of resources in the direction of reducing the carbon footprint, substituting fossil carbon with that resulting from biomass from agriculture, forestry, aquaculture.

Some authors consider that bioeconomy is a transition phenomenon or “a sustainable economy initiative for the post-fossil world”.(Borowiecki, Philp, 2019) The transition from the classical economy to a sustainable bioeconomy is based on a set of closely monitored principles that prioritize sustainable consumption and production. The bioeconomy is an important opportunity to meet the challenges of this millennium: increasing global population, continued growth in food consumption, global warming and high pollution, as well as the intensified process of digitalization of society. The strategy for the bioeconomy formulated and applied at national level can be the solution for the dependence on fossil fuels, the path to a smart economic growth and can provide long-term food security, as well as increase employment.

III. BIOECONOMY STRATEGY IN EUROPEAN COUNTRIES

Strategies adopted at European Union level to build a sustainable Europe and a stronger global player set the long-term framework for concrete initiatives and actions in areas such as energy, climate change, research, innovation, industry, transport, agriculture, fishing, environmental policies. The "Europe 2020" and "Europe 2030" strategies aim to increase Europe's resource efficiency, provide new skills and jobs, combat poverty, and support the industry's adaptation to digitalisation.

Europe 2030 strategy continues the actions of the previous decade strategy and outlines the main directions that European Union institutions, Member States, citizens, businesses, social partners, research and academic community must take in order to accomplish the sustainable transition of Europe. This means transition to a circular economy, including circular bioeconomy, as circular economy cuts waste and reduces the need for new resources. The renewed European Union Bioeconomy Strategy in 2018 complements the Circular Economy Action Plan, measuring the sustainable use of renewable resources and of raw materials, which can be transformed into bio-based products, such as: fuels, composites, chemicals, fertilisers and furniture.(EC, 2019).

Another transition to sustainability can be made from farm to fork, agriculture and food industry playing an essential role and being part of bioeconomy. A sustainable food system must respect the circular economy principles and deliver safe, healthy, environmental-friendly and animal welfare-friendly food production to consumers. Clean energy is another solution to boost the transition to sustainability, European Union being already one of the most carbon efficient economies in the world. Clean energy is an opportunity for growth and jobs, with almost 1,5 million jobs in renewable energy and energy efficiency in Europe. (EC, 2019)

Sustainability transition has to take into account the social impact of these actions, to make sure that all members of our society have equal and fair opportunities to contribute and to benefit from the rights and living standards in a sustainable Europe. This fact will lead to a better social cohesion in the Member States and across the European Union.

At European level, there are countries that have already adopted holistic bioeconomic strategies (Germany, Finland, Sweden, the Netherlands, Spain, Italy, France) and in other countries there are partial strategies (Belgium, Great Britain, Austria, Ireland). The rest of the Member States does not have dedicated strategies. Depending on the economic profile and available resources, each state focuses on certain bioeconomic sectors. For example, in France the priority sectors are bioenergy, green chemicals, clusters and the circular economy. In Spain, the economy is based on agriculture, stimulating the production and sustainable use of biological resources for food, forestry, industrial bioproducts and bioenergy. Italy is mainly based on the primary sector (agriculture, forestry, fishing, aquaculture) and the secondary sector - food industry, chemical industry, paper, biotechnology and energy sector.

Finland uses forest and aquatic biomass resources, stimulates research and education in the field of bioeconomics. In Germany, the bioeconomy focuses on food security, sustainable agriculture, industry and bioenergy. Denmark stands out with positive results in terms of bioeconomy in the fields of energy, agriculture, cosmetics, chemical industry, healthcare. Ireland's resources have led to the development of forestry, fishing, the marine sector, agriculture, industry and healthcare.

In other Member States, there are references to different sectors of the bioeconomy in strategies or action plans. For example, Romania has elaborated the National Strategy for Competitiveness 2014-2020 and the Strategy for the development of the agri-food sector on medium and long term, horizon 2020-2030. Often, in Central and Eastern European countries, the bioeconomy is seen as a strategy of smart specialization, part of regional development. For example, five smart specialization groups have been identified in Poland (Wozniak, Twardowski, 2021):

- a healthy society,
- agri-food, forestry, environmental bioeconomy,
- sustainable energy,
- natural resources and waste management,

- innovative technologies and industrial processes.

The support of all initiatives, strategies, policies and action plans in the field of bioeconomy has been achieved through European funding instruments. The first instrument is the European Fund for Strategic Investments (2014-2017, extending to 2020), which has allocated 315 billion euros (550 billion euros, after enlargement) for research, development, innovation, growth, jobs and cohesion. Another instrument is represented by the European Structural and Investment Funds (2014-2020), which provided 454 billion Euros from the European Union budget (637 billion Euros national co-financing) for the same objectives provided in the above instrument. Horizon 2020 (2014-2020) represents a funding of 74.8 billion Euros from the European Union budget for research, development and innovation.

Next Generation EU (NGEU) is a temporary financing instrument, that is created to boost the recovery in Europe. Combined with the European Union’s long-term budget, this financing package is the largest in Europe: 2,018 trillion euro (1,8 trillion euro in 2018 prices). This huge amount will help to rebuild the economy and the whole society of a post-COVID 19 Europe. By the way, this new financing instrument will contribute to the building of a greener, more digital and more resilient Europe, which is the overall objective of European Union for the period 2019-2024. To realize this purpose, The European Commission established a set of priorities for the mentioned period (EC, 2020):

- Europe has to become the first climate-neutral continent;
- Europe has to be prepared for the new digitalization strategy;
- European economy must be more attractive through more quality jobs for young people and small businesses;
- Europe has to be stronger and protective for her citizens and her democracy.

IV. BIOECONOMY HEADLINE INDICATORS ANALYSIS IN THE EUROPEAN UNION

The progress of bioeconomy development in European Union overall and by country are measured by the numbers of indicators published. The EU bioeconomy monitoring system has been officially launched in November 2020 on the Global Bioeconomy Summit. There were 19 indicators included in the dashboards in 2020, followed by 19 new indicators in 2021. (Kilsedar et al., 2021) Bioeconomy indicators are estimated based on a combination of multiple sources, as they aim to measure the degree of achievement of sustainable development objectives and the priorities set out in the Green Deal.

Among the most important indicators that express the relationship of the bioeconomy with the economic, social and environmental dimensions of sustainability we mention: primary biomass production, biomass self-sufficiency rate, material use efficiency, innovation, investments, value added of the bioeconomy sectors, comparative advantage, production and consumption of non-food and feed bio-based products, import and export of bioeconomy raw materials and products, employment in bioeconomy and GHG emissions.

The most common indicators in the various published studies and statistical analyzes are: employment by sector of bioeconomy, turnover of biomass producing and converting sectors, value added by sector of bioeconomy.

At the level of the European Union, these three indicators are as follows:

Table 1. Bioeconomy indicators by sector in EU 27 in 2019

Bioeconomy sector	Employment by sector (million jobs)	Value Added (billion euro)	Turnover (billion euro)
Agriculture	8830300	192802.1	436982
Food, beverage and tobacco	4658299	237459.7	1157102.4
Wood products and furniture	1320066	49596.7	176590
Bio-based textiles	791242	25478.7	86120.4
Paper	632755.5	48214.6	188686.4
Forestry	517410	24663.2	49470.3
Bio-based chemicals, pharmaceuticals, plastics and rubber (excl. biofuels)	462379	64524.7	196874.7
Fishing and Aquaculture	161040	5752	12493
Liquid biofuels	25747.3	3251.5	14919.4
Bio-based electricity	25046.7	4952.8	26438.5

Source: JRC-Bioeconomics dataset, Ronzon, T. et al., 2022

Analyzing the data offered by the European Commission’s Joint Research Center (table 1), the three indicators studied record the highest values for agriculture, food, beverage and tobacco, wood products and furniture. This is due to the important restructuring of the European Union's agricultural sector and to the actions

that support the creation of a healthy and environmentally-friendly food system, one of the priorities of the European Union’s Green Deal. The lowest values of the indicators presented in the table above are obtained by the fishing and aquaculture sector. Although aquaculture is diverse in the European Union, it’s production is concentrated on a few species and it accounts for only 20% of fish and shellfish supply in the European Union. The policy actions in this area are focusing on the transition to a sustainable aquaculture.

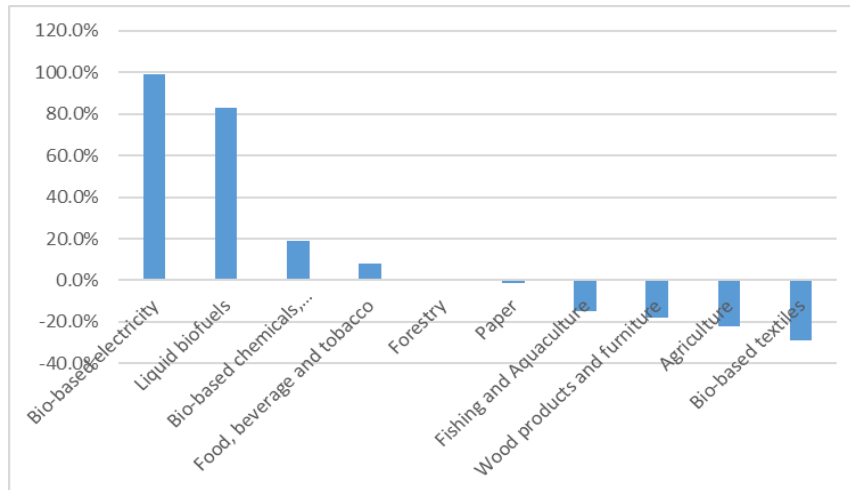


Figure 1. Employment growth in EU 27 in the period 2008-2019

Source: JRC-Bioeconomics dataset, Ronzon, T. et al., 2022

According to the data presented by Ronzon et al. (JRC, 2022), the employment growth in the European Union by sectors of bioeconomy in the period 2008-2019 can be seen in figure 1. In the studied period, bio-based electricity and liquid biofuels have recorded the biggest increase of the number of people employed in this sectors of bioeconomy.

This employment growth is also reflected in the significant increases in turnover and value added for the same sectors of the bioeconomy, whose representations are shown in the graphs below (figure 2 and figure 3).

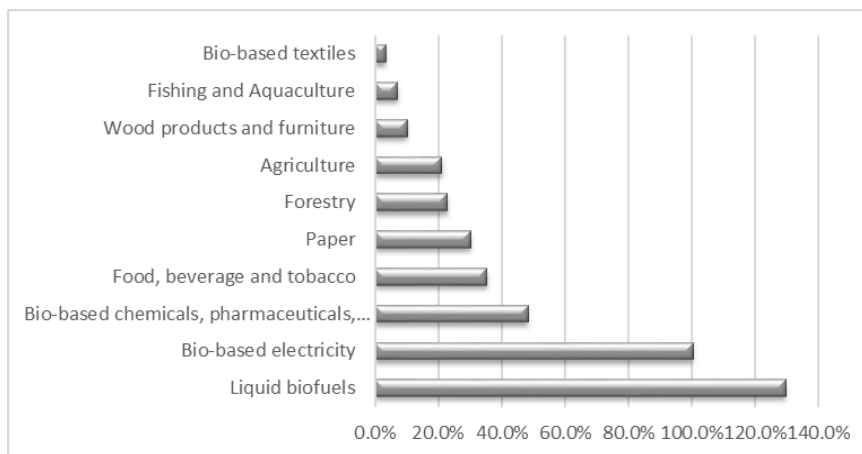


Figure 2. Value Added Growth in EU 27 in the period 2008-2019

Source: JRC-Bioeconomics dataset, Ronzon, T. et al., 2022

In the period 2008-2019, the increase in value added is about 130% for the liquid biofuels sector and 100% for bio-based electricity. The most modest increases were in the bio-based textiles (almost 3%) and fishing and aquaculture sectors (about 8%).

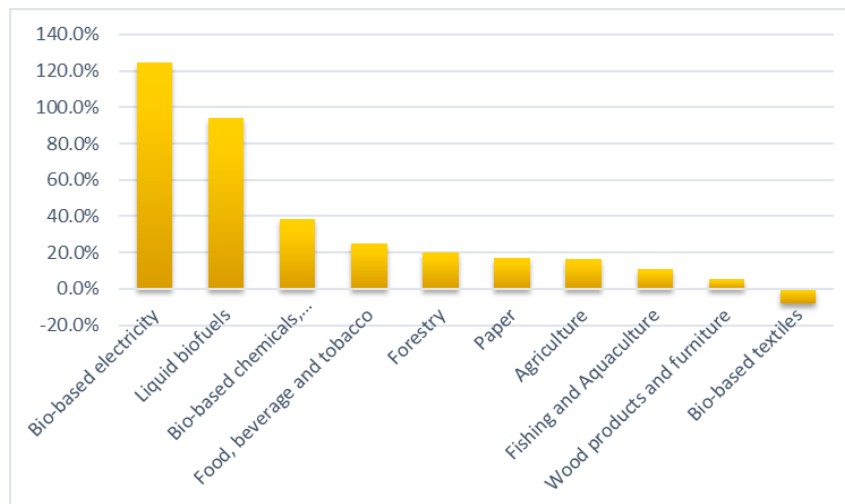


Figure 3. Turnover growth in EU 27 in the period 2008-2019

Source: JRC-Bioeconomics dataset, Ronzon, T. et al., 2022

Analyzing the data on turnover, we can see in figure 3 the most spectacular growth for bio-based electricity and liquid fuels. These increases for the two important sectors of the bioeconomy are in line with some of the priorities set by the European Union institutions in the Green Deal, namely clean, affordable and secure energy, sustainable and smart mobility, zero pollution, green finance and investment, research and innovation.

V. CONCLUSION

In the last two decades, new concepts have emerged in the European Union and around the world to meet the growing social and economic challenges of limited natural resources, climate change, food shortages in many disadvantaged areas of the world and increasing consumption of fossil resources. In this context, at the level of each country, but also at the level of international institutions, strategies and policies have been developed to support the development of a green economy, a circular economy or in other words, the bioeconomy.

The European Union's work agenda sets out priorities for action for Member States, from which almost half of them are directly targeted at the bioeconomy. First of all, at Union level, there is a need to stimulate investment, economic growth and job creation. Secondly, actions must be taken to combat climate change and ensure a safer, more sustainable and affordable energy market. Last but not least, a more fair internal market and the bringing together of the European Union's external action instruments are needed for it to become a stronger player in the world.

The transition from the classical economy to the sustainable bioeconomy is based on a set of closely monitored principles and is quantified using a system of indicators, whose values follow the degree of fulfillment of the objectives set out in the Green Deal.

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