

## MEASURING ROMANIA’S BIOECONOMY IN THE CONTEXT OF EU DEVELOPMENT STRATEGY

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### **Abstract**

*Bioeconomy is one of the economic sectors to which significant attention is paid in the development strategies at EU level. This sector can be a key factor in reaching the strategic goals for climate change and sustainable consumption. This paper aims to create an overview of the Romania bioeconomy sector and to emphasize the development of the sector in relation with EU bioeconomy.*

*To measure the development of the sector three relevant indicators were chosen: people employed in the sector, turnover and value added of the bioeconomy. The period selected for the study of the indicators was 2008-2017.*

*The main findings of the research highlight that, at EU level, bioeconomy sector is continuously increasing for the selected period regarding all indicators. For Romania was observed a slight decrease of the indicators. Despite that Romania can be considered one of the most important European countries in the context of the people employed in bioeconomy. Agriculture was identified as the main industry in terms of people employed and value added for Romania.*

**Keywords:** Bioeconomy, employment, value added, turnover, EU

**Clasificare JEL:** M40, M41

### **1. Introduction**

It is obvious that humanity is still consuming resources in an unsustainable way. The intensity with which natural resources are used exceeds the capacity of ecosystems to regenerate (Network Global Footprint, 2016). One of the current global challenges is the implementation of the principles of sustainable development, which ensures a balance of the most important objectives: economic, ecological and social (Xu, Deng, & Yao, 2014) (Krajnc & Glavic, 2003). To meet this challenge, one of the important directions for designing internationally representative policies could be the 2030 Agenda for Sustainable Development.

A key area both for achieving the objectives of sustainable development and for the regulation and rational use of natural resources is represented by the bioeconomy. Moreover, a sustainable bioeconomy is the renewable segment of the circular economy. It can turn waste, residues and bio-waste into valuable resources and create innovations and incentives to help traders and consumers reduce food waste by 50% by 2030.

In this context, the bioeconomy is an economic sector that requires increased attention, given that it can lead to economic development with major positive implications at the societal level and with diminished environmental impact and resource use. Analyzing the way how the bioeconomy develops is essential both at European and national level.

The purpose of the current research is to measure the evolution of the bioeconomy in Romania in relation to the evolution of this sector in the European Union. To fulfill the aim of the research, a series of economic indicators considered representative at EU level were analyzed to create a relevant overview concerning the bioeconomy sector in Romania.

The research paper is structured in 5 sections: first section describes a general context of the bioeconomy and the relevant economic indicators, section 2 is dedicated to the research methodology, section 3 presents the main discussions and findings regarding Romanian situation of bioeconomy in correlation with the UE evolution and section 4 highlights the conclusions of the research.

## 2. Overview of the bioeconomy sector

The increasingly gloomy forecasts of climate conditions and the sharp decline in fossil fuel reserves have led to changes in the economy, with a focus on renewable resources. Existing global food security challenges require increased productivity, but with respect for the protection of resources and the environment. Technological advancement and progress in biology and related fields can lead to changes that contribute to reducing the pressure on the environment and the conservation of natural resources. In this context, the bioeconomy is an opportunity through which economic growth can be achieved through environmentally responsible interventions and measures.

The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, microorganisms and biomass products, including organic waste), as well as their functions and principles. It includes and interconnects: the 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, bioproducts, energy and services.

Bioeconomy represents a transition from a fossil-based society to a bio-based society that uses renewable biomass in products and energy (Vainio et al, 2018). Several definitions of bioeconomy share some common elements, such as the recognition that natural resources are limited and thus need to be used efficiently (Kleinschmit et al., 2014). Furthermore, a lot of definitions align economic growth, development and environmental protection (Arts et al., 2010).

McCormick and Willquist (2015) define bioeconomy as an economy where primary resources for materials, chemicals or energy come from renewable biological resources. Within the broader concept of the green economy, the bioeconomic vision focuses on the use of renewable raw materials and the application of industrial biotechnology research, development, and innovation in sectors such as food, food, paper, and cellulose or energy (Scarlat et al., 2015).

According to the European Union (EU) “the bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy” (European Commission, 2012), whereas the Organisation for Economic Co-operation and Development (OECD, 2009) thinks of a bioeconomy “as a world where biotechnology contributes to a significant share of economic output.

The EU bioeconomy already has a turnover of over € 2.3 trillion and provides jobs for over 22 million people, representing about 8.2% of the total EU workforce (European Commission, 2018).

In 2018, the revision of the EU bioeconomy strategy put emphasis on balancing the three pillars of sustainable development. The revision also integrated a number of former criticisms by attributing equal importance (i) to the scaling-up of bio-based sectors and (ii) to the understanding of the ecological boundaries of the bioeconomy, as well as (iii) to the development of the bioeconomy at the local level as a way to better distribute the benefits of bioeconomy development. Moreover, ecosystem services were explicitly integrated into the definition of the bioeconomy.

The bioeconomy offers important opportunities for new jobs, regional economic development and improved territorial cohesion, including in remote or peripheral regions. It has the potential to be an important source of income diversification for farmers, foresters and fishermen, as well as to stimulate local rural economies by increasing investment in skills, knowledge, innovation and new business models.

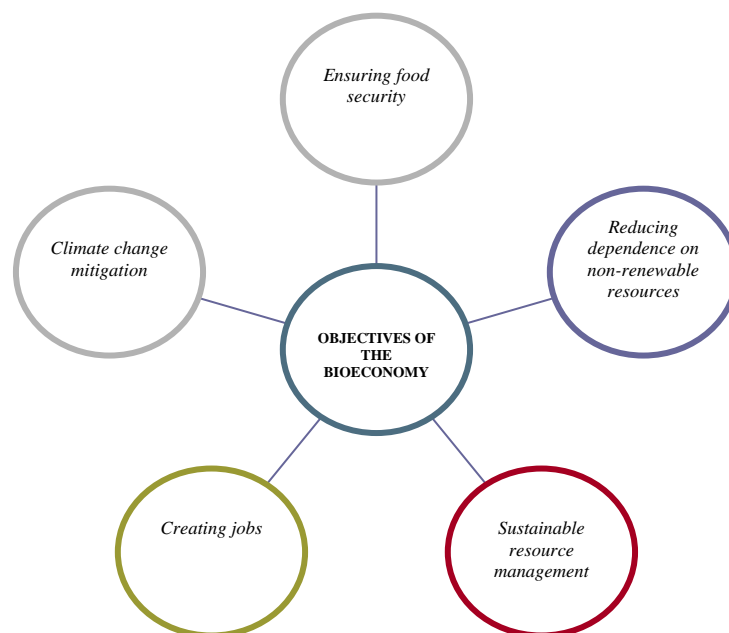


Figure 1 – Objectives of the bioeconomy

To achieve the objectives in Figure 1, three main areas of action are proposed to create a sustainable and circular bioeconomy:

- strengthening and expanding the bioeconomic sectors, unlocking investments and markets;
- rapid implementation of local bioeconomies across Europe;
- understanding the ecological limits of the bioeconomy.

The European Commission (EC) is financing several activities to monitor bioeconomy development in Europe, mostly under the “Bioeconomy Knowledge Centre” project led by its Joint Research Centre (JRC). First, the JRC assesses a socioeconomic indicator set for different bioeconomy sectors (number of persons employed, turnover, value added, labour productivity), and it estimates member state performance on a transition path to higher productivity (Ronzon, Camia and Barek, 2018). This concern to monitor or evaluate bioeconomy as a whole or specific bioeconomy sectors can be observed worldwide. A couple of countries are proposing to increase monitoring and measuring activities, including the implementation of integrated information and observatory systems, and others are in the process of developing comprehensive monitoring systems. A sketchy overview of these efforts is presented in Table 1.

Table 1 – Overview of the evaluation systems for bioeconomy

Country	Evaluation system	Short description	Source
Argentina	Contribution of bioeconomy sectors to GDP	-	Bracco et al., 2018; Lechardoy, 2018
Malaysia	Malaysian Bioeconomy Contribution Index (BCI)	a composite index which combines five parameters: bioeconomy value added, bio-based exports, bioeconomy investments, bioeconomy employment and productivity performance	Al-Amin (2015)

Finland	Set of indicators	five economic indicators: output, value added, investments, employment and exports of bioeconomy goods	Finnish Ministry of Employment and the Economy (2014)
Italy	Set of KPI's	This set includes, at the time of this report, 30 indicators grouped along 8 areas: biomass availability, productive and employment structure, human capacity, innovation, investment, demographics and markets	Italy (2019)
EU	MontBioEco	A set of 30 indicators to evaluate 5 strategic objectives: creating jobs and maintaining competitiveness, reducing dependence on non-renewable resources, mitigating and adapting climate change, ensuring food security, managing natural resources sustainability	BioMonitor (2019)
Italy	Toolkit	a catalogue of criteria and indicators, a collection of instruments and measures, a catalogue of good practices and case studies and guidelines for elaborating regional profiles	BERST (2019)

The interest for the bioeconomy is actual and quite intensively studied worldwide as can be seen in the table above. At the level of Romania, no studies that analyze the way in which this sector has evolved in the last period or to create an overview at national level regarding the bioeconomy have been identified. The study aims to eliminate this gap by highlighting the evolution of the bioeconomy in Romania and estimating the potential of this field in relation to the objectives presented in Figure 1.

### Research methodology

To evaluate the performance of Romania regarding the bioeconomy sector, we choose to analyze three significant indicators. These indicators are defined as follows:

- **number of people employed** is the total number of persons who work in the observation unit, as well as persons who work outside the unit who belong to it and are paid by it.
- **turnover** comprises the totals invoiced by the observation unit.
- **value added at factor cost** is the gross income from operating activities after adjusting for operating subsidies and indirect taxes.

These indicators have been identified in the literature analyzed in the previous section as the main tools used to assess the bioeconomy and its trends at national or global level. The selected data covers a 10 years period between 2008 and 2017. The data were processed empirically to create a detailed picture of the bioeconomy in Romania compared to the evolution of the concept in Europe.

### Discussion and findings

#### *Bioeconomy evolution*

The bioeconomy of the EU employed around 20.1 million people in 2008 and 17.5 million people in 2017. It registered a decrease of 2.6 million people. The decrease of people employed in bioeconomy started from 2007 and was maintained till 2016. 2017 was the first year (from the period of 10 years analyzed) that did not register a decrease in people employed in bioeconomy. From 2008 until 2016 the decrease was around 2.7 million people. The increase from 2016 until 2017 was around 0.1 million people and this increase is very important for the bioeconomy sector.

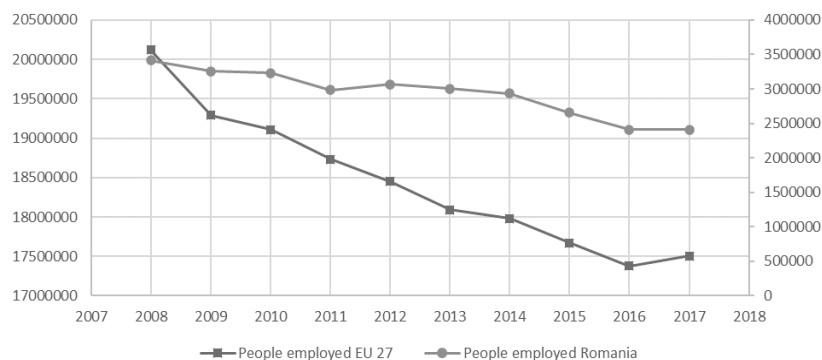


Figure 2 – Evolution of people employed in bioeconomy 2008 - 2017

Compared to EU 27, Romania also registered a decreasing tendency. The people employed in bioeconomy in 2008 in Romania were around 3.4 million people and in 2011 the people employed reached 3.0 million people.

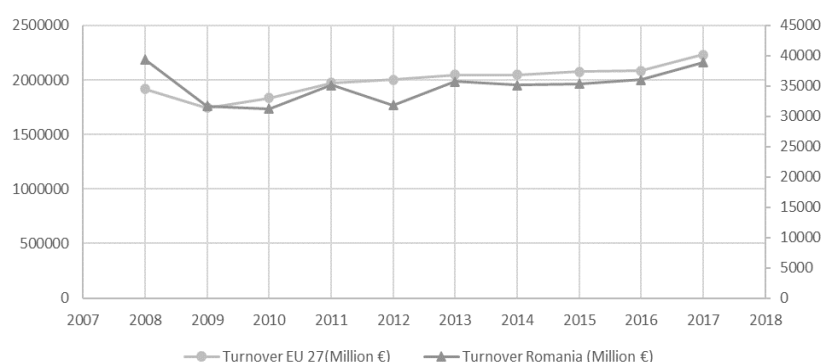


Figure 3 – Evolution of turnover in bioeconomy 2008 - 2017

The bioeconomy generated a turnover in amount of 1,916 billion euros in 2008 and of 2,232 billion euros in 2017. We can observe an upward trend from 2008 to 2017. Only 2009 registered a decrease in turnover generated by bioeconomy in amount of 171 billion euros. In Romania, the situation is a little bit different. As the figure shows, the turnover fluctuates from year to year. The turnover registered a decrease in 2009, 2010, 2012 and 2014. Even if Romania is very representative for EU Bioeconomy in terms of people employed, the turnover generated is very low comparative with the turnover generated in other EU countries.

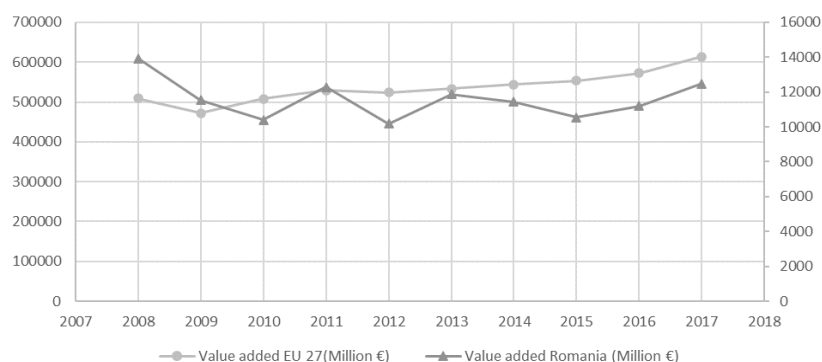


Figure 4 – Evolution of value added in bioeconomy 2008 - 2017

Another important indicator of economic performance is represented by value added in bioeconomy. In EU 27, the value added generated is in amount of 509 billion euros in 2008 and

614 billion euros in 2017. Also, we can point out that the trend is an upward one for EU 27. Therefore, Romania registered a fluctuating trend comparing with the linear trend registered by EU 27. Romania’s bioeconomy generated the biggest value added in 2008 (14 billion euros), followed by the one in 2017 (12 billion euros).

*People employed*

The number of people employed in the bioeconomy of the European Union (EU 27) is around 20.1 million people in 2008 and around 17.5 million people in 2017. As it can be observed in the figure above (Figure 5), agriculture represents the most important industry in the bioeconomy in terms of people employed (57% in 2008 and 53% in 2017). This industry employed 11,382,700 people in 2008 and in 2017 the number of people employed in agriculture has reached 9,273,470. Food, beverage and tobacco industry employed 4,308,225 workers in 2008 and 4,398,761 workers in 2017. It is the second employer in bioeconomy, representing 21% in 2008 and 25% in 2017.

Therefore, the number of persons employed in the EU bioeconomy registered a strong decrease from 2008 to 2017. The largest decrease regarding the employment was recorded in agriculture, followed by Bio-based textiles. The people employed in agriculture decreased with 2,109,230 from 2008 to 2017, and in Bio-based textiles with 324,393. Food, beverage and tobacco industry was a strong employer and registered an increase of 90,536 people from 2008 to 2017.

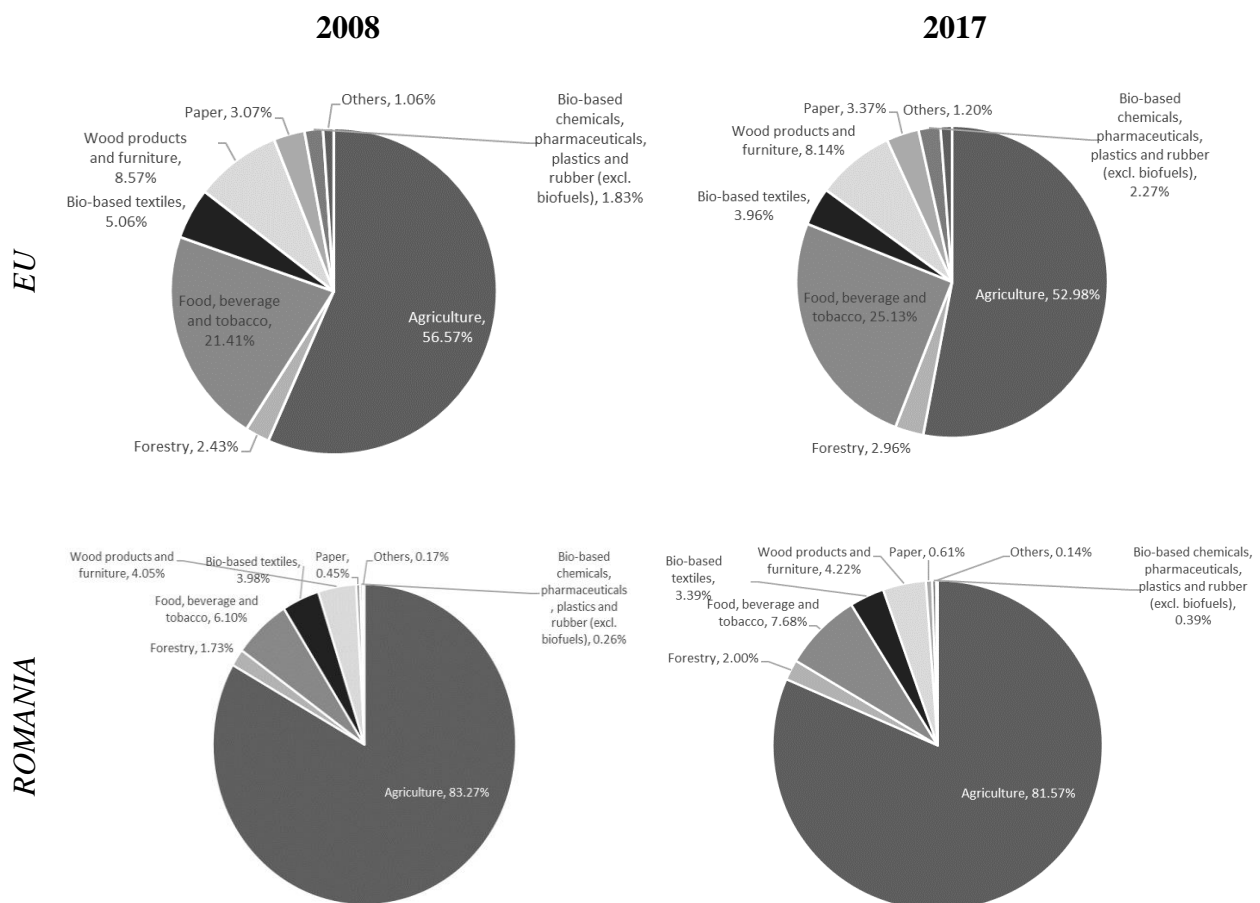


Figure 5 – People employed in bioeconomy sector, EU vs Romania

Romania can be considered one of the most important European countries in the context of the people employed in bioeconomy. In the figure above (Figure 5), we present a comparison between the number of people employed in bioeconomy in Romania in 2008 and 2017. As it can be observed, the number of people employed in bioeconomy decreased from 3,416,075 in 2008 to

2,409,839 in 2017. Romania has kept the same trend in the period of 10 years in terms of the number of people employed as the EU 27. The decrease is significant (1,006,236) and the industry on which the impact was significant is agriculture, which represents the most important part of the bioeconomy in Romania (82% employed in agriculture). The people employed in agriculture decreased with 878,700 and this represents 87% of the total decrease of people employed in bioeconomy in Romania.

Food, beverage and tobacco employed 8% of the workers in bioeconomy in 2017 and also recorded a decrease in people employed from 2008 to 2017.

*Turnover*

Also, turnover represents an important indicator of economic performance. At EU 27 level, the turnover in the bioeconomy in 2008 was 1,916 billion euros and recorded a continuous increase until 2017 when it was in the amount of 2,232 billion euros. The Food, beverage and tobacco industry is very representative in the bioeconomy, generating the half of the bioeconomy turnover in 2017. It is followed by the agriculture which generates 19% of the bioeconomy turnover and Wood products and furniture, Paper and Bio-based chemicals, pharmaceuticals, plastics and rubber (excl. biofuels), each generating 8% (Figure 6).

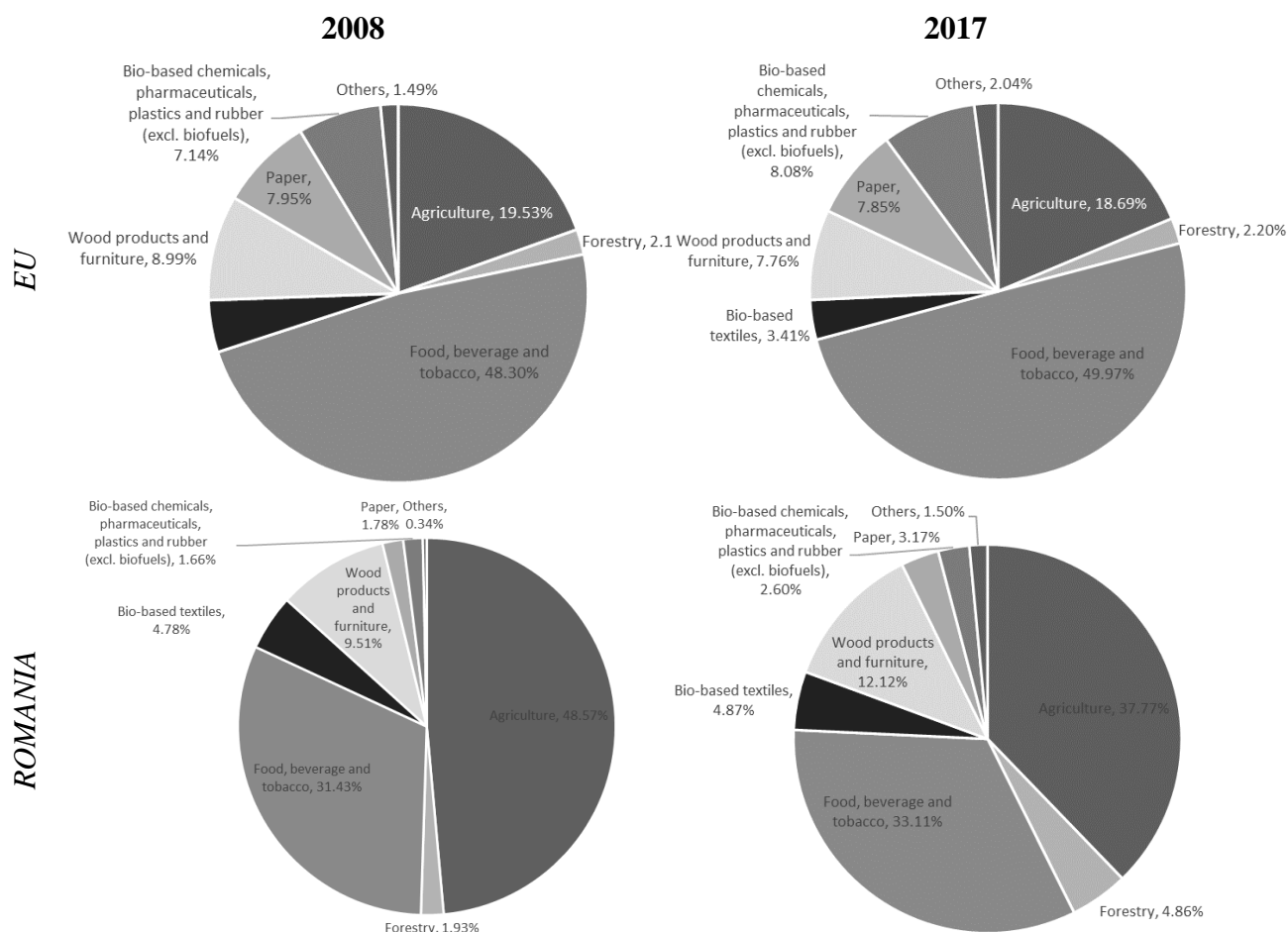


Figure 6 – Turnover in bioeconomy sector, EU vs Romania

Regarding the turnover generated by bioeconomy in Romania we identified an insignificant decrease in the 10 years period (2008-2017) in amount of 0.511 billion euros. The turnover, at the level of bioeconomy categories, recorded a decrease only in agriculture (4 billion euros). The other industries recorded an increase. The biggest increase in terms of turnover was registered by

Forestry (1.1 billion euros) and it is followed by Wood products and furniture (0.968 billion euros), Paper (0.533 billion euros) and Food, beverage and tobacco (0.491 billion euros).

*Value added*

The bioeconomy generated a value added of 509 billion euros in 2008 and 614 billion euros in 2017. Even if the number of people employed recorded a decrease from 2008 to 2017, the value added generated recorded an increase of 105 billion euros from 2008 to 2017. Food, beverage and tobacco industry generated a value added of 175 billion euros in 2008 and 215 billion euros in 2017. So, this industry generated the 35% of the value added of bioeconomy. It is followed by agriculture that generated 31% and Bio-based chemicals, pharmaceuticals, plastics and rubber (excl. biofuels) that generated 10% in 2017, as presented in Figure 7.

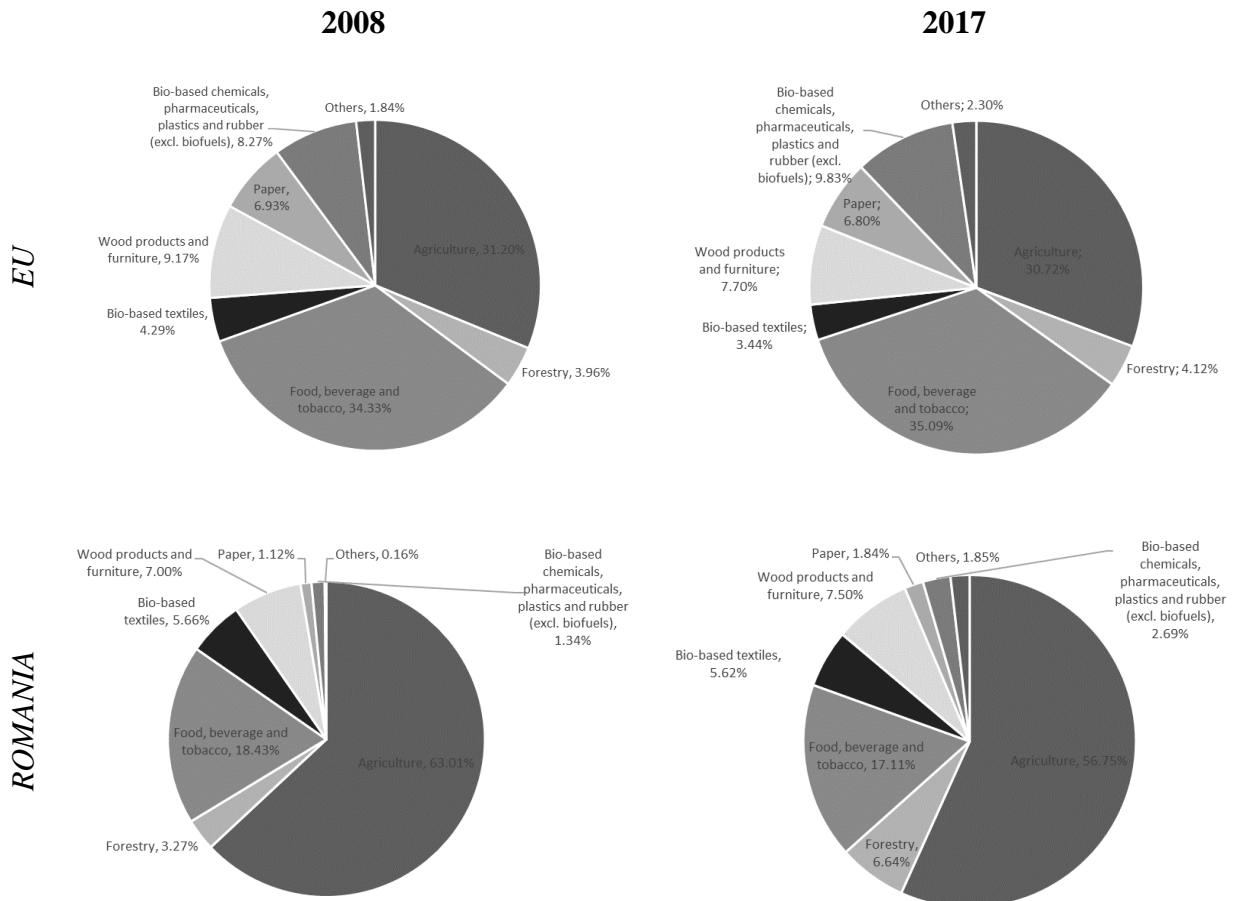


Figure 7 – Value added in bioeconomy sector, EU vs Romania

In Romania, the value added generated by the bioeconomy in 2008 was 14 billion euros and in 2017 was 12 billion euros. It maintains the same evolution as the other indicator of economic performance, namely the turnover. The decrease recorded is in amount of 1.4 billion euros in the 10 years analyzed. Agriculture is also the one that has suffered the greatest impact in terms of value added, a decrease of 1.7 billion euros (Figure 7).

**5. Conclusions**

Evaluation of the bioeconomy sector is a hot research topic in the literature, because in accordance with the results, future strategies can be developed and financial incentives can be implemented. Measuring the development is a step that provide information for the decision-



making process. It is crucial to identify the stages of development for bioeconomy in every member state to implement a strong strategy at EU level.

In Romania can be observed that all the analyzed indicators recorded a decrease for the analyzed period, 2008-2017. People employment decrease was determined by the growing of the level of innovation in the agriculture, in special, and, also, in the other industry, in general.

In terms of turnover, compared to 2008, Romanian Food, beverage and tobacco industry is one of the growing bioeconomy components. Stimulating this sector through appropriate government policies and subsidies can lead to a development of the bioeconomy at the national level. At the same time, supporting this industry can also contribute to the growth of people employed in the field of bioeconomy.

In order to achieve the objectives of the bioeconomy strategy and action plans, it is needed to support more the Romanian sector with specific incentives and a coherent and more detailed strategy at national level.

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