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BIOECONOMY CONCEPT – CHALLENGES AND PERSPECTIVES FOR AGRICULTURE

STELIANA RODINO¹

Abstract: *This paper aims to broadly develop the concept of bioeconomy from the perspective of agricultural producers, presenting an analysis of the current challenges as well as the future trends in this field. In the coming period, the world economy is moving towards increased competition for limited natural resources or a low rate of regeneration. Globally, it has been estimated that a 70% increase in food supply is needed to meet the needs of a population of around 9 billion by 2050. As a consequence, agricultural producers are encouraged and forced to increase productivity, which may have different meanings, depending on the way of interpretation. Therefore, it is considered necessary to initially address the sustainable use of resources by defining the responsible bio-economy concept. Modern farmers are not only agricultural producers but also quality food suppliers and ecosystem managers. From a practical point of view, the concept of multifunctional agriculture has already been incorporated into business models and rural development strategies, thus enhancing the quality of life in rural areas. Moreover, the implementation of this development system has allowed farmers to maintain a fair share of the added value of production, thus contributing to the diversification of the rural economy.*

Keywords: *Bioeconomy, multifunctional agriculture, European strategy*

JEL Classification: *P48, Q01, Q16*

INTRODUCTION

In February 2012, the European Commission official reports released the first version of a strategy dedicated to the bioeconomy. Up to the present, most of the Western and Northern Europe member states, have presented and adopted their own national and regional strategy papers supporting the sustainable use of available resources towards accomplishing the specific goals set for the implementation of circular bioeconomy.

The bioeconomy includes the innovative actions taken to produce food, feed, bio-based materials and bioenergy resources and to optimise and develop these products from renewable biological resources. Practically, it encompasses a wide range of industrial sectors such as agriculture, food forestry, fisheries, pulp and paper production. The innovative and sustainable technologies used represent the technological transfer of the most recent findings from chemical, biotechnological and energy industries. Considering the prediction of population growth for the 2050 horizon to approximatively 9 billion, it becomes pretty clear that the pressure on natural resources will continue to grow, unless a proper strategy will be adopted. Therefore, improving the uptake of bioeconomy seems to come as a reasonable choice for overcoming the possible bottlenecks.

The present study aims to present an overview of the concept of bioeconomy, its approaches, goals and the underlying principles from the perspective of agricultural producers, showing an analysis of current challenges and future trends in this field.

MATERIALS AND METHODS

The present research study has a conceptual and a methodological dimension. The information was subjected to qualitative research methods, processed through observation, analysis, assessment and comparison of data originating from official EC reports and scientific works. This paper aims to broadly develop the concept of bioeconomy from the perspective of agricultural producers, presenting an analysis of the current challenges as well as the future trends in this field.

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The concept of bioeconomy – a view through its history

Several definitions of the bioeconomy may be observed for approaching the concept. For example, the Organisation for Economic Co-operation and Development (OECD) has used an early form of the notion of bioeconomy back in 2004, stating that “*A biobased economy is defined as a concept that uses renewable bioresources, efficient bioprocesses and eco-industrial clusters to produce sustainable bioproducts, jobs and income*” (OECD, 2004). Five years later, the same institution defined the bioeconomy as as the process of “*transforming life science knowledge into new, sustainable, eco-efficient and competitive products*” (OECD, 2009). This definition was pointed towards the potentials of innovations in the transformation and more efficient use of bio-based resources.

In the USA definition of the concept, although the sustainability aspect was not highlighted, the main idea was similar to the one above, namely: “*A bioeconomy is one based on the use of research and innovation in the biological sciences to create economic activity and public benefit*” (White House, 2012).

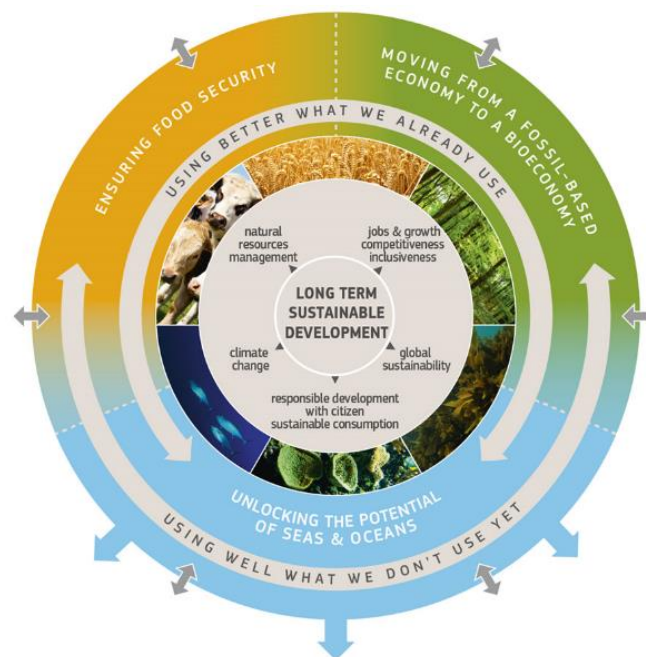


Figure 1. The bioeconomy graphic

*Source: https://ec.europa.eu/research/bioeconomy/images/bioeconomy_graphic_full.jpg

At European level, European Commission released in 2012, the EU strategy on Bioeconomy, defining it 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). With this strategy, Europe established the theoretical foundations for a resource-efficient and sustainable economy (Figure 1). Bioeconomy was designed to focus on the methods of conversion of raw material into value added products with the goal to reach an innovative, knowledge based and low-emissions economy (EC, 2012). A recent review of this strategy was recently published, in November 2017.

All in one, bioeconomy is the knowledge-based production and utilization of biological resources, innovative biological processes and principles to sustainably provide goods and services across all economic sectors (GBS, 2015). While most of the Western and Northern European countries have adopted national strategy papers supporting bioeconomy, the Eastern and Central countries lack this kind of strategy. As a first step toward bioeconomy, the countries in Central and Eastern Europe included it in their smart specialisation strategy. Depending on the regional

available resources, bioeconomy comprises industrial sectors such as food, agriculture, green industry, energy or ecology.

Integration of agriculture in the Bioeconomy concept

Agriculture is a significant sector in the European bioeconomy contributing with 0.38 trillion EUR to Europe’s turnover in 2014 (Figure 2.). In Romania, Greece, Poland, Slovenia, Ireland, Portugal and Croatia, agriculture employs more than 60% of the total people employed in the bioeconomy (Ronzon, 2015). Globally, to meet the needs of a population of around 9 billion by 2050 it was estimated that farmers will have to increase by 70% the food production. As a consequence, agricultural producers are encouraged and forced to increase productivity, which may have different meanings, depending on the way of interpretation.

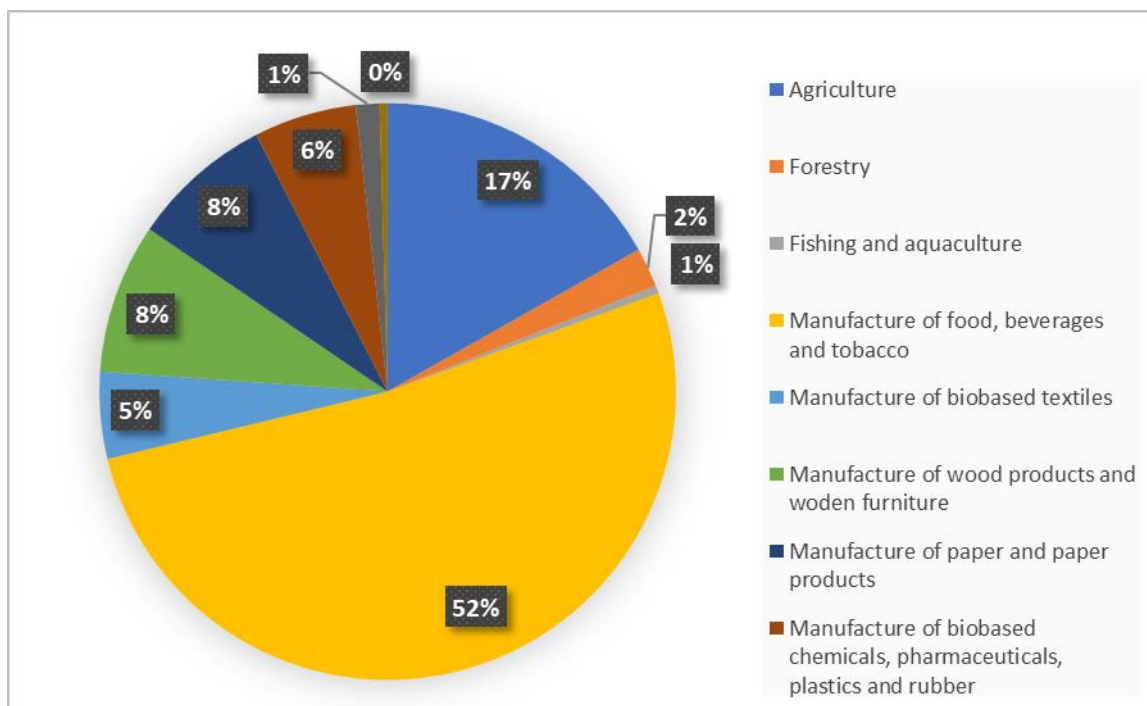


Figure 2. Turnover of Bioeconomy sectors across Europe, as for 2014.

*Data adapted from Ronzon ,2017

Therefore, it is considered necessary to initially address the sustainable use of resources by defining the responsible bio-economy concept with respect to agriculture sector. However, most areas of the available farmland were used over the time in an unsustainable way decreasing productivity throughout methods leading to soil erosion and water and nutrients depletion. Therefore, mmodern farmers must be not only agricultural producers but also quality food suppliers and ecosystem managers.

Bioeconomy offers many opportunities to be explored when speaking about crop and animal production. An optimal use of biological resources implies in the same time a logical sequence of steps, such as proper inventory, evaluation, utilisation and valorisation of waste, residues and by-products from agricultural production systems, starting from cradle to grave, from the production, harvesting, processing, transport and marketing of food, feed and bio-based products (Lainez, 2018).

Biomass production is seen as an important sector composing the bioeconomy, in most of the European countries. The agriculture sector together with forestry and fisheries and aquaculture represents the main supplier of biomass. Competing uses of biomass as well as overexploitation of resources as a response to the increasing demand for biomass for non-food uses (e.g. biofuels) puts a severe pressure on the agricultural resources. Continued conflicts between different sectors of the bioeconomy and their use of biomass for food, material and energy production can be expected in

the near future. This can be avoided by focusing on the by-products and waste streams of food production and developing smart sustainable farming, fisheries and aquaculture (Mathijs E et al, 2015; EU 2012). For example, Thorenz et al 2018 indicated that the agricultural sector produces large amounts of residues utilizable for bioeconomic purposes. Straw shows the highest potential, with approximately 95 Mt of LCF, of which the promising are wheat straw (46 Mt), barley straw (16 Mt) and rape seed straw(14 Mt). Apart from straw, significant quantities of maize stover (31 Mt) can be extracted from grain maize production (Thorenz, 2018).

Challenges of the agricultural bioeconomy

Producing more food with limited resources is a challenge to be faced worldwide. This can be achieved by optimal use of agricultural inputs on the one hand, and the efficient utilisation of resulted by-products and waste recovery, as a key factor driving to competitiveness and sustainable value chains.

In the same time, to reach the revitalisation of rural economies, the concept of multifunctional agriculture will have to be included in the future rural business models. More competitive results will be obtained by increasing agriculture productivity. However, the agricultural productivity relies heavily on two of the earth's primary resources: soil and water (Sarkar, 2018). It is generally accepted the fact that environmental sustainability is the only path to obtain renewable organic material. This particularly applies to the efficient use of natural resources, especially water and soil bioeconomy as primary resources of the traditional economic sectors (agriculture, forestry, aquaculture and fishery) (Lainez, 2018). Agriculture requires essential and limited resources to produce biomass, such as land, fertile and functioning soils, water and healthy ecosystems, but also external inputs in the form of resources such as minerals and energy for the production of fertilisers (EC, 2012).

A key area of intervention in agricultural bioeconomy is the climate impacts mitigation by climate-smart technologies with the aim to reduce the negative impact of weather events on food security. Many authors consider that the climate change has a huge impact on impact agricultural productivity.

It is considered that nowadays agriculture is highly energy intensive due to the use of nitrogen fertilisers, chemical pesticides, irrigation, and machinery, as well as feed for livestock production. The replacement of fossil-based inputs by regulating and supporting ecosystem services promises to reduce agriculture-induced impacts while reducing yield gaps (Bommarco et al., 2013; Mathijs E. et al., 2015). All these challenges are closely related to environmental, health and food safety and consumer demands for organic and local food. Moreover, they are driven by the predicted increase of global population, the shift towards animal protein-rich diets, the growing threat of antimicrobial resistance, and crop losses and wasted food, specifically fruits and vegetables and seafood (Sarkar, 2018). In short, it may be stated that the main challenges for setting up an agricultural bioeconomy are: assuring food security; management of natural resources in a sustainable way; mitigation and adaptation to climate change.

In the last decade, the greenhouse gases (GHG) emissions of agriculture reduced, being at this moment nearly 25% less than the 1990 level. However, GHG from agriculture account for almost 10% of the EU's GHG emissions. There is hope for further reduction of this percent, by taking specific actions towards improvement of manure management, enteric fermentation, use of synthetic fertilizers, monitorization and reduction of food losses and recycling of food wastes and meat processing (EC, 2012; EC, 2017) As future prospects, the development of local bio-economies may improve the resilience of vulnerable areas, especially remote rural areas. Farm-sized biogas plants may reduce farmers' dependence on energy while solving the manure management problem. Rural bio-refineries may help remote rural areas to obtain energy and material self-sufficiency (Papendiek et al., 2012).

CONCLUSIONS

As a conclusion, it should be noted that the primary production of biomass (Meyer, 2017) is the center of most of bioeconomy strategies all over the world. The agricultural bioeconomy implications include:

- sustainable use of natural resources (soil, water, nutrients, genetic resources and biodiversity)
- sustainable agricultural production (plant breeding, crop production, livestock) incorporating the latest agricultural technologies (e.g., precision farming);
- optimisation of agricultural production systems in terms of sustainability

Nevertheless, despite intensive awareness raising and governments' implication, the potential of many European countries to develop a biobased economy remains a far off concept, largely untapped. Many factors contribute to this situation, including insufficient involvement of stakeholders in designing bioeconomy strategies, due to their lack of practical knowledge regarding this concept, technology transfer and exploitation of up to date scientific research. Although in Eastern Europe, there are various initiatives on implementation of bioeconomy under European and national grants, to most people the idea of a bioeconomy remains an abstract concept.

Bioeconomy offers many opportunities to be explored when speaking about crop and animal production and agriculture represents a significant sector in the European bioeconomy contributing with an important share Europe's turnover. As future prospects, the development of local bioeconomies may improve the resilience of vulnerable areas, especially remote rural areas.

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