UNLOCKING BIOECONOMY POTENTIAL IN ROMANIAN AGRIFOOD SECTOR

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Abstract
The bioeconomy concept is generally defined as the use of renewable biological resources to produce food, materials and energy. This concept is now seen as an innovation trigger that will be the cornerstone of a knowledge leap in most economy sectors, on the way towards increasing sustainability of human activity.
Agriculture occupies the most i and in Romania as well. The present study encompasses a general overview on bioeconomy mportant part of the revenues obtained from economic activities in many countries in EU potential in Romania, pointing specific issues regarding the challenges and opportunities for environmental protection and for agricultural activities. From a methodological point of view, the indirect research methods were used, reviewing specialized literature published until now: scientific articles and press releases. Extraction, observation, analysis and comparison of data provided by official databases was also applied.

Keywords: *bioeconomy, agriculture, food industry, Romania, biological resources, management strategies*.
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Introduction

Establishment of the concept of bioeconomy in EU Member States was reflected by increased number of national strategies released in this area in the last years. It started in 2009 when OECD designed a policy agenda for bioeconomy strategy (Organization for Economic Co-operation and Development [OECD], 2009) followed in 2011 by Germany with "National Bioeconomy Research Strategy 2030" (Federal Ministry of Education and Research [BMBF]. 2011), and continued in 2013, with "National Policy Strategy on Bioeconomy-Renewable resources and biotechnological processes as a basis for food, industry and energy" (Federal Ministry of Food and Agriculture in Germany [BMEL], 2013). The latest German strategy approached the bioeconomy concept from a two folded perspective, both innovation through biotechnology and the resource substitution perspective (i.e. replacement of fossil resources by bio-based resources).

In November 2018, EC released its latest bioeconomy strategy (4. Directorate – General for Research and Innovation – European Commission [DGRI], 2018). It is an updated version of what started back in 2012, learning from the past mistakes and incoherencies and carefully design latest trends and prospects. All in one bioeconomy is about producing more with the limited resources available. It is about optimal exploitation of natural resources while promoting wellbeing and protecting the environment. At this moment, many studies indicate that bioeconomy is an emerging concept, which will ensure the sustainable development of human activity, for a prosperous and safe future. This paper gives an overview on bioeconomy as an element for the development strategies for Romania, with a specific highlight on environmental challenges and agriculture opportunities.
From a methodological point of view, the technique of indirect research was used, studying various articles, official statistical information and specialized studies published until now. The information was processed by observation, analysis and comparison of data provided by official databases.

Discussion

Bioeconomy is an economic theory developed by the famous Romanian scholar Nicholas Georgescu-Roegen in the early 1970s (Georgescu-Roegen, 1975). In his view, the biological or "natural" basis of all economic processes and hence human processes led to the depletion of the planet's natural resources. It is important to note that bioeconomy should not be confused with the ecological economy, a separate discipline, as well under increasing development lately.
In Romania, there are significant opportunities for the development of a competitive economy based on bioresources. Agriculture and the rural development sector occupy a particularly important place in the Romanian economy.

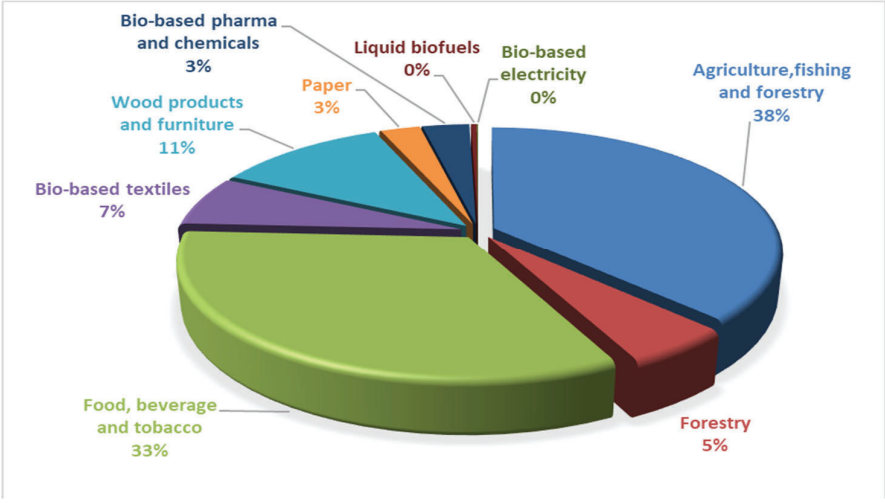

Figure 1. The annual turnover in main bioeconomy sectors, 2015, Romania
Source data: Jobs and wealth in the EU bioeconomy / JRC- Bioeconomics. [Dataset] PID: http://data.europa.eu) 2018 (Joint Research Centre of European Commission [JRC],2018)

With nearly 30% of the population employed in the primary sector and a large proportion of the population living in rural areas, agricultural activities play a central role in the lives of many Romanians. It is to be taken into account, that an effective settlement of bioeconomy concept through development strategies will strongly be influenced by a successful cooperation of multi-actor stakeholders (farmers, industrial partners, business environment, policy makers, and most important, citizens).
Agriculture is one of the main economic activities in many countries in Europe, and in Romania as well. In 2015, agriculture (together with a small share of fisheries and forestry) returned the highest share of turnover in Romania, when speaking of bioeconomy sectors (Figure 1).
Our country possesses a high availability of natural resources, in terms of fertile soils, large areas of agricultural land water and biodiversity.
According to the latest EU bioeconomy strategy, the "bio-based products go far beyond biomass processing" [DGRI, 2018]. The report states that bioeconomy is based on the most recent progress in biotechnology combined with the modern digital revolution.
Taking into account de current situation of agricultural sector, the bioeconomy development in Romania can be built on two key elements, both connected to biomass availability.

- On the one hand, many waste streams are not used appropriately, as there is low circularity implemented in the production cycles, and modest green energy generated.
- On the other hand, current biomass yields could be improved by optimal application of modern technologies (Botezat et al., 2018).

Therefore, both prerequisites could be overcome by accessing existing progress in the field of ***precision farming and in biotechnology.***

Precision farming

Precision farming was defined as the use of digital technologies able to provide, evaluate, process and analyze data of high resolution for practical application in decision taking in the management of livestock and crop production (Fuglie, 2016).
Precision farming considers and manages each crop or farm animal individually to meet its tailored needs and to optimize its development. It consists of a set of tools that help farmers to identify, measure, anticipate, and manage economic, climate, environmental, and health risks in particular, and therefore, make the best decisions (Pierpaoli et al., 2016). It enhances the sustainable use of natural resources being seen as an integrated management system, combining ICT for the optimal assessment of temporal and spatial changes in the farm. It is considered that precision farming is a vehicle to reach the goal of optimizing yield with minimum input and reduced environmental pollution (Far & Rezaei-Moghaddam, 2018).
Farmers have at their disposal modern management technologies that provide them with detailed and real-time information on the crops by detecting existing nutrients in the soil (Morey et al., 2017), analyzing crop status by remote sensing and multispectral analysis generates an early report on the health of the crops (Bastiaanssen et al., 2000). We can basically talk about crop management for each and every square meter and each farm animal.
The main advantages of using these technologies are:

- ✔ Land management based on variations in the field.
- ✔ Optimal management of plant production inputs: fertilizer, irrigation water, herbicide, insecticide, seeds)
- ✔ Targeted local analysis of specific parameters thus being able to reduce waste, produce in an environmentally friendly manner, and increase profits

The precision farming includes the use of remote sensing (Huang et al., 2018), unmanned aerial vehicles (Mogili & Deepak, 2018). GPS technologies and sensor technologies.
Sensors were proven to be effective in precision farming (Veena et al., 2018), to gather data on:

- availability of soil water;
- soil compaction;
- soil fertility;
- index of the foliar surface;
- local climate data,
- weed mapping.

Biotechnology

A special attention is given to potential synergies between species (Bennich et al., 2018), following the interaction between plants and between plants and soil microbiota.
For example, the use of intercropping brings beneficial effects for the plant populations, including resistance mechanisms, and release of compounds with suppressive effects on phytopathogens, weeds and pests.
Biotechnologies are also used to solve problems in all areas of agricultural production and processing. This includes plant selection to raise and stabilize yields to improve resistance to pests, diseases and atmospheric conditions (germ, drought) and to increase the nutritional content of foods.
Innovation driven results in the area of biotechnology include bioproducts obtained from zootechnical, horticultural, agricultural by-products including innovating technological inputs for the improvement of plants resistance at biotic (diseases, pests) and abiotic (drought, frost, salinity, extreme solar radiation) stress.
In Romania, the biotechnology sector offers major investment opportunities and can become a serious competitor at European level due to competitive advantages from the perspective of human resources, operating costs, Research, Development and Innovation (RDI) costs. The problem to be overcome is that the financial resources allocated through RDI programs are still insufficient. At the national level, clusters centered on the different branches of biotechnology (medical biotechnology, agricultural biotechnology, environmental biotechnology) have been set up, but mainly the members are research institutions, and the main purpose was the networking. The participation of Romanian companies in the biotechnology sector in EU RDI programs has been intensified in the 2014-2020 programs (Operational Program Competitiveness 2014-2020 and National RDI Program III), when the biotechnology sector has become a priority and strategic for Romania. On this line, the 2014-2020 structural funding package was a consistent one, especially for the private sector. These programs have resulted in stimulating and facilitating the participation of Romanian organizations in the Horizon 2020 framework program.

Conclusions

The movement towards bioeconomy in Romania means rethinking the way we produce food. The solution is that agriculture becomes more than a biomass supplier, the goal being to reduce waste and losses, having in mind taking an agroecological approach of sustainable development. This means to build upon biodiversity conservation and safeguard ecosystems services.

Identifying transition pathways, opportunities and finding a practical vision implies an extended analysis, Intra-chain and multi-sector collaboration and raising awareness on sustainability goals of bioeconomy concept in agriculture. Agriculture and the rural development sector occupy a very important place in the Romanian economy. With nearly 30% of the population employed in the primary sector and a large proportion of the population living in rural areas, agricultural activities play a central role in the lives of many Romanians.

Precision farming can significantly improve the efficiency of the way we use the natural resources, especially when used along with the biotechnological progress.

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