

PERSPECTIVES ON DEVELOPING THE BIOECONOMY SECTOR IN ROMANIA

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ABSTRACT:*In the context of the new aim of the European Bioeconomy Strategy and Action Plan the development of the bioeconomy sector is a necessity for Romania in order to pave the way to a more innovative, resource efficient and competitive society, that reconciles food security with the sustainable use of renewable resources for industrial purposes. Romania has good perspectives in this field due to a great potential of the agriculture, increasingly growing standards of food industry, applied research in the pharmaceutical industry, safety and optimization of food products, the value of the biomass produced by the horticultural, forestry, livestock, fishery sectors and biofuels. On the premise that Romania hasn't yet a bioeconomy strategy and/or policies in this field, the objective of this study is to identify the fundamental elements that could help Romanian Government build a customized bioeconomy strategy and/or plan of action. The method used is based on analyzing the best practices used by countries that already triggered the development of their bioeconomy sectors. The result of this study is to offer a scientific base for theory and practice in the bioeconomy field.*

Keywords: *bioeconomy, biomass, bio-based products*

JEL: Q26, Q28

Introduction

The bioeconomy sector encompasses the production of biomass and its conversion into bio-based products and bioenergy (European Commission, 2012). It includes the following sub sectors: agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries (European Commission, 2011). Bioeconomy sub sectors have a strong innovation potential when using a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), (McCormick & Kautto, 2013) enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering), and local and tacit knowledge (European Commission, 2014).

The European Commission's proposal on the bio-economy emphasizes greater resource-efficiency, largely within an industrial perspective on global economic competitiveness, benefiting mainly capital-intensive industries at higher levels of the value chain.

The FAO experts appreciated that demand for biomass will increase substantially in the next decades due to increasing of the world population, expected to reach 9.1 billion by 2050, on the one hand and to expectation for bio foods in preferences of the people, for the other hand. FAO has calculated that the estimated population for 2050 will need 70% more food and feed than they are using now. At the same time, the demand for biomass in sectors such as energy and bio-based products will increase too, although some sectors (for example paper) may show a decreasing demand. In industry sectors is foreseen a transition towards bio-based materials and energy (European Commission, 2014).

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The objective of this study is to identify the main perspectives on the development of bioeconomy sector in Romania using best european practices and investigating the possibilities of different sectors to contribute in developing of this emerging mega sector.

Literature review

Bioeconomy is considered to be a real alternative for the actual global economic development model based on high consumptions of rare materials, often low economic returns, extensively consumer of natural and labor resources (Ionescu, 2013).

The concept of bioeconomy represents more of a vision for a society less dependent on fossil resources and more interested of energy and added-value products (food-feed-fibers, industrial and health products) that respects the sustainable use of bioresources (Socaciu, 2014). Although the bioeconomy cannot replace the fossil-based economy on short term because it draws attention on consumption issues, as much as on the production (McCormick, 2011).

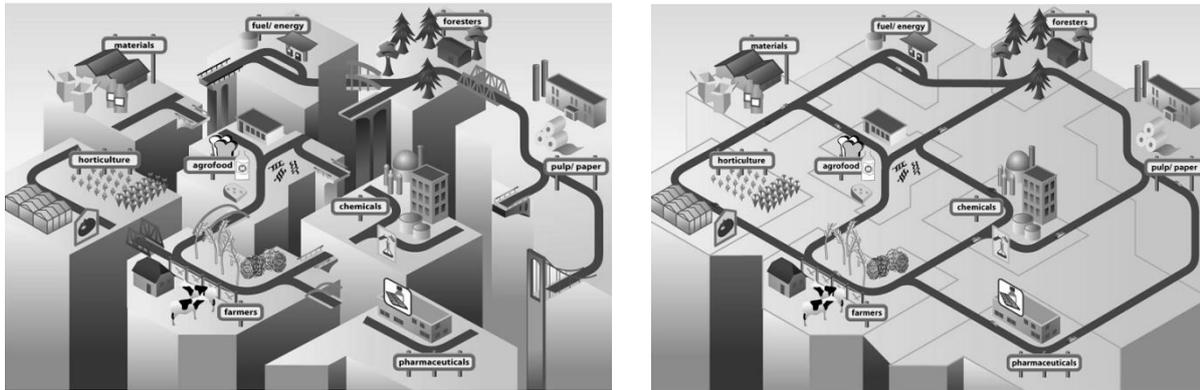
OECD experts also recognizes the importance of the bioeconomy in the special policy agenda „*The Bioeconomy to 2030: Designing a Policy Agenda*”. The central idea of this report is that “the application of biotechnology to primary production, health and industry could result in an emerging “bioeconomy” where biotechnology contributes to a significant share of economic output” (OECD, 2012).

Operationally, the bioeconomy sector produces biomass in order to convert it into bio-based products and energy. It includes the sectors of agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. This sectors and industries have a powerful innovation potential due to the use of a variety of sciences and industrial technologies: life sciences, agronomy, ecology, food science and social sciences, biotechnology, nanotechnology, information and communication technologies (ICT), and engineering. The bioeconomy’s interdisciplinary nature offers a unique opportunity to comprehensively address interconnected societal challenges such as food security, natural resource scarcity, fossil resource dependence and climate change, while achieving sustainable economic (European Commission, 2012).

Until now, many countries have developed strategies and policies related to different biotechnology and bio-based products and industries, but more and more countries are developing strategies that collect all these separate topics under the conceptual umbrella of the bioeconomy (Staffas, Gustavsson, & McCormick, 2013). A shift towards a larger and more advanced bioeconomy will have effects on many aspects of the economy, society and the environment. A bioeconomy strategy reveals the intentions of a nation to protect biodiversity, food quality and quantity, preservation of rare biotopes, and climate change mitigation in a more coordinated way (Staffas, Gustavsson, & McCormick, 2013).

An interesting overview picture (figure no. 1) of the relations between different economic sub sectors of bioeconomy is realized by Joanna Dupont-Inglis (2013) in her presentation “*BRIDGE – A PPP for biobased industries*”. On the left image the author presents the actual situation in which there is no collaboration (“bridges”) between the subsectors of bioeconomy and on the right the ideal scenario when all connections are made through the 9 areas composing a mature bioeconomy.

Figure 1. Overview picture of underdeveloped (left) and mature (right) bioeconomy



Source: Joanna Dupont-Inglis , *BRIDGE – A PPP for biobased industries* (available at <http://www.biofuelstp.eu/spm5/pres/dupont.pdf>, last accessed on 20.03.2015)

Methodology

This research is based on the selection of the most interesting ideas and practices from the literature and also on the governmental, official documents of Romania's authorities' primary documents and other European countries (see Annex no. 1). A systematic search for identification of the relevant background information, suitable for Romania in the field of bioeconomy and an analysis based on benchmarking has been made.

Results and discussion

As the results of our research we identified fourteen sectors which have an important potential in developing the bioeconomy sector in Romania.

Bioenergy (biogas, biofuel) could be develop based on the high agricultural potential combined with considerable experience in refining. Romania is placed in a good position to become a regional leader in the field of biofuels. With innovations appropriate technology Romania can become a key manufacturer / exporter of biofuels in European Union. Vegetable residues and municipal solid form labeled as garbage can be burned to recycle to produce green energy.

Market demand for medical devices based on **bionanotechnologies** is constantly expansion provides an annual growth rate of 7.8%. This is a favourable premise for development of bionanotechnologies.

Romania has numerous brands in the field of **industrial biotechnologies**. 150 companies are applying research results achieved the sub domain, have 1500 employees, a turnover of 300 million EUR and a commercial balance surplus of 200 million EUR. Also Romania has a potentially extremely valuable natural bio-resources is not exploited enough (approx. 50% of the European flora species).

There are 200 companies active in **environmental biotechnology** (sewage plants, firms remediation of contaminated soil by phytoremediation and use of microorganisms) numbers over 2,000 employees with a turnover of 100 million EUR and a trade balance surplus of 10 million euros.

It is estimated that **agricultural biotechnology** will be around 75% of the contribution economic biotechnology to agro-industrial sector. Although multinationals that dominate the food market in Romania are not involved in the development new technology designed by the local R&D and rather import their own technologies, their presence on the market can be an opportunity if the government will stimulate them do relocate their R&D department.

Given the economic difficulties of the Romanian medical system, medical and pharmaceutical biotechnologies (increasing therapeutic efficacy, early diagnosis and personalized medicine medical) will ultimately reduce costs management.

Bio-natural products sector is well represented in Romania holdings or firms interested the research and development of new types of bio, exploiting the spontaneous flora, but also the organically farmed.

Exports of medical and pharmaceutical products are situated at 739 million EUR and production capacity of bio-active substances and semisynthetic conservation can be completed and commissioned to Antibiotics SA Iași. Therefore **molecular design (bio)synthesis, semi synthesis and high throughput screening** could be easily produced in Romania.

Following an optimized design, bioequivalence studies in Romania were 2-3 times cheaper than those made in European countries making **in vitro/in vivo design of generic medicines** very profitable in Romania.

Conditioning of the Romanian drug industry is strong (annual sales of nearly 1 billion euros) and dynamic (multinational and national companies having 22 factories in 9 cities), **optimization of delivery profile biopharmaceutical and pharmacokinetic** could become a source of innovation in bioeconomy sector.

There are other main contributors to developing of bioeconomy in Romania, as food industry, The Romanian **food industry** is the largest manufacturing sector in the country, with a turnover exceeding 1 billion euros, and the largest employer, over 186,000 employees, plus a very large food processor type micro-enterprise and crafts 1-2 people. Food products account for around 35% of retail. National Institute of Statistics data from 2011 shows that the food industry, the 8239 registered operators, make 7-8% of total exports of Romania. In 2009-2011 exports of live animals and food increased by 80%, while the coverage of imports by exports increased from 44% to 71%.

Romania must value **safe, accessible and optimized nutritional food** contributing to agrifood sector value added and employment in rural areas, the quality of food and consumption which in turn influence the state of health of the population. Research for improving the nutritional quality of foods through their reformulation, reduction content of food ingredients (sugar, salt, fat) and increased content of others (compounds bioactive), combating obesity and undernourishment.

Romania could become an important pole of innovation in the European Innovation Partnership in agriculture (PEI), by exploiting local horticultural Genetic Resources and the use of sustainable technologies throughout horticultural production chain (**developing new products, practices, processes and technologies in horticulture**). Of the 3.856.000 farms, over 1 million have specific horticultural, Romania is exploiting only 4.1% of the agricultural area of 13.298.000 ha. According to National Institute of Statistic, in 2011 there were 2.167 businesses in the area, 13.697 employees, a turnover of 2.530.486.288 RON, export of 104.000 tons, import of 482.000 tons.

In the period 2014-2020, due to the conversion program/restructuring of viticulture and horticulture, it is estimated over 1.5 billion investment in horticultural holdings, deposits storage combined processing plant vineyards and national and regional market. Romania has a rich gene pool and local horticultural are facilitating the design and implementation of modern technologies and practices to improve the quality and quantity of the final product. Orographic diversity, pedo-climatic and biocenotic opportunities for cultivating a number great variety of annual and perennial horticultural species.

Animal husbandry, veterinary medicine, aquaculture and fisheries represents between 30-45% of the GDP of the agriculture and should be adapted to the challenges of XXI century. There are a large number of potential beneficiaries of research results (~ 20% of the population is involved directly/indirectly in this sub domain). In this sub domain, research, development and innovation circuit is fast (eg. Animal nutrition). Thus, 1-2 years are enough to achieve applicable results, and can be implemented quickly without the need for complicated technologies/investments. Therefore, there are no obstacles rapid major macroeconomic outcomes.

National application of innovations on **sustainable production of field crops adapted to the impact of global climate change** will increase in 2014-2020/2025, thanks to financial support

through the introduction of innovation as a measure CAP rural development and mitigation solution generated by global climate changes.

According to National Institute of Statistic (2011) there are 3.6 million farmers representing 60% of the rural labor force; active farmers can absorb the offer of varieties and innovative technologies capable of diminishing the impact of changes climate registering an upward trend.

In cereals and industrial crops operates 30,216 farms, 800 companies with 40.000 employees and a turnover of 16,192 million RON, plus 3.6 million family farms. Reported to production in the EU, Romania ranks 5 to wheat, 3 to corn, 2 to sunflower and 6 to potato.

In Romania newly introduced varieties in crop productivity growth generates approx. 8-10%, and profit rate hike approx. 15%. Market demand for varieties climatic and biotic stress tolerance during 2015-2025, will increase the European plan approx. 50%. It will be required varieties with high rate of energy conversion, capable of providing necessary raw materials for second generation biofuels.

Conclusions

In order to develop an bioeconomy sector Romania needs to maximize its potential along the smart specializations by creating a suitable Strategy and Action Plan, increase research investments, develop bio-based markets and better communication with the public.

The bioeconomy sector requires continued and increasing support from public funding and private investment and must contribute to better coherence between national, European and global research and innovation efforts.

Enhancing a productive and sustainable bioeconomy sector requires more research, rural, marine and industrial infrastructures, knowledge transfer networks and improved supply chains. This will support integrated and diversified biorefineries, including small-scale local plants. Biorefineries will have to replace these fossil resources by renewable ones (including wastes), creating new sources of income and jobs for the agriculture, forestry, fisheries and aquaculture sectors.

A responsible bioeconomy sector for Romania calls for participatory models that engage citizens and end-users in order to reinforce the relationship between science, society and policy making. More informed dialogues will allowing science and innovation to provide a sound basis for policy making and informed societal choices, while taking into account legitimate societal concerns and needs in the bioeconomy

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Annex 1. Overview of specific bioeconomy strategy and policies documents

| Country, federation or organization reports | Document title | Publication year | Source | Objectives Focus: Technical and/or political | Measurable targets | Priority areas |
|---|--|------------------|------------------|--|--------------------|-------------------------------|
| Australia | Biotechnology and Australian Agriculture | 2008 | ACIL Tasman | Technical (explanatory) | No | Agriculture and biotechnology |
| OECD | The Bioeconomy | 2009 | Organization for | Technical | No | Biotechnology, |

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|----------|--|------|--|----------------------------|--------------------------------------|---|
| | to 2030: Designing A Policy Agenda | | Economic Cooperation and Developme nt | | | agriculture and industry |
| Canada | The Canadian Blueprint: Beyond Moose and Mountains | 2009 | BioteCanada | Political | Yes (qualitative) | Biotechnol ogy |
| Finland | Distributed Bio-Based Economy Driving Sustainable Growth | 2011 | Finnish Innovation Fund (SITRA) | Political | Yes (qualitative) | Efficient resource use and biomass refining |
| Malaysia | Bioeconomy Initiative and National Biomass Strategy 2020 | 2011 | Ministry of Science, Technology and Innovation | Technical | Economic Targets | Biotechnol ogy |
| Germany | National Research Strategy: Our Route Towards a Biobased Economy | 2011 | Federal Ministry of Education | Technical | Yes (qualitative) | Agricultur e, health, food |
| EU | Innovating for Sustainable Growth: A bioeconomy for Europe | 2012 | European Commission | Political and Technical | Economic targets and scenarios | Food, resource, innovation and skills |
| USA | National Bioeconomy Blueprint | 2012 | White House Administrati on | Political | Yes (qualitative) | Biotechnol ogy |
| Sweden | Swedish Research and Innovation Strategy | 2012 | Swedish Research Council for the Environmen t, Agricultural Sciences and Spatial Planning (FORMAS) | Technical | No | Efficient resource use and research gaps |
| Russia | Bioindustry and Bioresources – BioTech 2030 | 2012 | - | Political | Yes (qualitative) | Biotechnol ogy |
| Austria | Bioeconomy Background | 2013 | - | Political | Yes (qualitative) | Efficient resource |

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|--------------|-----------------------------|------|--------------------------------------|-----------|-------------------|--|
| | Paper | | | | | use and research gaps |
| Netherland | Bio-based Economy 2010-2015 | 2013 | - | | Yes (qualitative) | Biotechnology |
| South Africa | The Bio-economy Strategy | 2013 | Department of Science and Technology | Political | Yes (qualitative) | Bio-based product, services and innovations, agriculture, industry, health |

Source: adapted after Staffas, L., Gustavsson, M., & McCormick, K. (2013). Strategies and Policies for the Bioeconomy and Bio-Based Economy: An Analysis of Official National Approaches

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