

Strategic options of public policy for developing the bioeconomy sector in Romania

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Abstract: *The bioeconomy sector is one of the smart specialization areas for the 2014-2020 strategic cycle both in the "Romania's National Strategy for Research, Development and Innovation" and "Romania's National Competitiveness Strategy". The selection criterion was the research of the scientific and commercial potential of the areas that could make Romania more competitive internationally. But how to achieve and stimulate the development of this field was not indicated. Therefore, the objectives of this study are to identify the priorities of Romania's government for an advanced development of this sector and to highlight the subsectors that the Romanian authorities should be more focused on. The aim is to formulate the guiding principles, the strategic approaches and the measures necessary to achieve the potential of the bioeconomy sector in Romania. The method used was to analyze the best practices used by countries that have a national strategy for the bioeconomy sector and started the development in this field.*

Keywords: *bioeconomy sector, public policy, biomass, bioresources*

JEL Classification: Q26, Q28

Introduction

The 21st Century has its own challenges and trade-offs. The world population, which is growing (more than 30% in the next 40 years, from 7 billion in 2012 to 9 billion by 2050 (United Nations, 2013)), needs healthy and sufficient food while facing limited global agricultural areas, soil fertility losses and the reduction of biodiversity. Climate change calls for setting an increasingly low threshold of greenhouse gases' emissions. The finite nature of fossil raw materials, their

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growing demand and the uncertainty created by the political factor will reflect on the market prices, creating opportunities for the use of new or alternative raw materials. In this context, the use of biomass produced sustainably and the innovative development of bioeconomic processes becomes increasingly important.

Bioeconomy or biomass-based economy represents both the structural transition from an economy based on fossil raw materials (overwhelmingly oil) to an economy massively based on (renewable) bioresources and a solution to the problems caused by the challenges above. The new knowledge gained through life sciences offers a deeper understanding of global biological systems, leading to the sustainable use of renewable resources for the benefit of mankind and the environment. Also, the applicability of biotechnologies turns bioeconomy into a linking element between technology, economy, ecology and the sustainable development of the society.

In Romania, the study of bioeconomy and the initiatives to develop this sector are still modest. The only reference to the concept of bioeconomy in official documents of the state authorities are found in the "National Strategy for Research, Development and Innovation 2014-2020", the "National Strategy for Competitiveness 2014-2020" and the "National Strategy for Rural Development 2014-2020", all three suggesting that this might be a sector with potential for smart specialization.

The general premise of this study is the claim that the development of the bioeconomy sector is Romania's chance to take advantage of the opportunities created by the global challenges and to strengthen its international economic competitiveness.

The purpose of this article is to formulate the guiding principles, the strategic approaches and the measures necessary for achieving the potential of the bioeconomy sector in Romania.

Literature review

The bioeconomy sector uses innovations, based on the potential of biomass, generated by life sciences and bioindustries for a sustainable development of the society. The usefulness and benefits of bioeconomic processes have been acknowledged and accepted by all members of the G7 (Canada, France, Germany, Italy, Japan, UK and USA) and by more than 30 other countries in the world (German Bioeconomy Council, 2015) (Staffas, Gustavsson & McCormick, 2013).

The Organization for Economic Cooperation and Development (OECD) and the European Union have politically boosted the international cooperation to promote the development of the global bioeconomy sector by publishing, in this regard, two well documented reports. USA, Germany and Japan have adopted national strategies in the bioeconomy field and have set ambitious targets consistent with the specific economic development of each country. Canada, Britain, France and Italy support and promote intensely the development of the "biomass-based economy" (for a review of the strategies and public policies initiated by the most developed countries of the world, see (Staffas, Gustavsson & McCormick, 2013)).

In the European Union, the bioeconomy sector needs public policies as coherent and integrated as possible aiming at the most relevant research branches for each of its subsectors (McCormick & Kautto, 2013). Encouraging innovation, scientific discovery and multi-disciplinary programs leading to the commercialization of the most competitive bioproducts are also necessary (Socaciu, 2014). The European Commission's proposal for the strategic development of bioeconomy in Europe focuses on a more efficient use of resources in the industry at the level of superior value chains (Schmid, Padel & Levidow, 2012).

The recommendations made so far by the scientific community of Romanian economists for Romania are: encouraging the dialogue between the stakeholders and the private investment (Pipirigeanu, Zaman et al, 2014); connecting a strategy of the bioeconomy sector to the European funding through priority programs focused on bioeconomy; public-private partnership investments in applied scientific research, innovation and the development of skills specific to the development of the bioeconomy sector; and, not least, building the infrastructure essential for the positive development of the bioeconomy sector (Ionescu, 2013).

The significant support of the European Union for bioeconomy offers many opportunities for the Romanian economy. The significant potential for the production of bioresources in Romania, currently underused, could be better used through specific bioeconomy approaches. Achieving this requires new solutions for the sustainable intensification of producing biological resources and the smart use of bioresources (Oancea, 2014).

However, developing and implementing these new solutions requires a significant investment in education and research. The high added value branches of bioeconomy are branches of the knowledge economy. The sustainable intensification of the bioresources production and the smart use of bioresources

also imply an economy where new knowledge is used to increase work productivity.

Methodology

This research is based on the methodology "Public Management Service" (PUMA) and it analyzes the best practices used by the countries that have a national strategy for the bioeconomy sector and therefore initiated the development of this field. These were evaluated and adjusted according to Romania's economic particularities.

Choosing the most interesting development guidelines and best practices appropriate for Romania was made by studying the strategies, the action plans, the reports and the official government documents adopted by the institutions in the most developed countries and / or federations in the world.

Results and discussion

The results of the research consist in identifying the policies' strategic options for developing bioeconomy (see Table 1) and selecting economic branches that have the greatest potential to initiate the positive development of the latter (see Table 3).

Table 1. Areas of action, strategic approaches and measures of public policy for developing the bioeconomy sector in Romania

		Strategic approaches
Cross-sectoral areas of action	Coherent policy framework for a sustainable bioeconomy	Closer dovetailing of bioeconomy policies
	Information and dialogue within society	Expansion of information on the bioeconomy and strengthening the dialogue between society as a whole and the stakeholders in the bioeconomy
	Vocational training and apprenticeship	Qualified specialist personnel for a sustainable bioeconomy
Thematic areas of action	Sustainable production and provision of renewable resources	Sustainable development in agriculture, forestry and fisheries Provision of agricultural raw materials and sustainably higher productivity for the utilised agricultural area Use of the sustainably-available potential of wood and adaptation of the forests to

		Strategic approaches
		climate change Tapping aquatic resources on a sustainable basis, for food, energy and industry Sustainable production of high-added-value food of animal origin
	Growth markets, innovative technologies and products	Tapping growth markets and giving support to innovative technologies and products based on renewable resources
	Processes and value-adding networks	Optimising existing value-added chains and networks and developing new ones
	Competition among uses of land	Reducing the demand for agriculture and forestry areas originating from building development and transport Defusing competition for land-use between food production and renewable raw materials for energy and industry Use of renewable resources must be more strongly concentrated on the most efficient paths of use
	International context	Balance out food production and provision of renewable raw materials for energy and industry Securing market access to renewable raw materials within the framework of international trade Establishing and further developing internationally recognised sustainability standards in agriculture and forestry Expansion of international research and technology cooperations

According to statistics, cumulating the figures for the subsectors of bioeconomy, in 2012 the bioeconomy sector amounted to 21.61% of GDP and the employment rate in the sector was 35.59% of the working population (see Table 2). One may notice the predominance of the economic sectors that produce bioresources (agriculture, forestry and fishing) or that process these bioresources with a (relatively) low added value – for example, the food industry. The share of bioeconomic sectors with high productivity, that produce a significant added value and that are affect greatly the quality of life, such as the industries and services associated with human health (biomedical bioeconomy), is low in Romania.

Table 2. The structure of bioeconomy

Subsectors of bioeconomy	% GDP	% Active population
Agriculture, forestry and fishing	5.62	29.10
Industries that process bioresources	7.91	3.23
Food industry	5.38	2.10
Pulp and paper	1.67	0.82
Energy from bioresources	0.72	0.28
"Green" chemistry	0.14	0.03
Biomedical bioeconomy	0.12	0.02
Bio-pharmaceutical products	0.05	0.01
Total	21.61	35.59

Sources: Statistical Yearbook 2012, <http://www.insse.ro/cms/ro/content/anuarul-statistic-2012>, [Accessed: May 2015]

The smart use of bioresources, in order to produce bioproducts with high added value (for example, by recovering valuable ingredients from bioresources before they are processed into biofuels) and the acquiring of new technological inputs for achieving the sustainable intensification of the production of bioresources are actual ways for implementing bioeconomy (see Table 3).

Table 3. Field priorities and economic arguments for strategic development of bioeconomy sector in Romania

Field	Description	Economic arguments
Bioenergy	Using the potential of wood and agricultural biomass for obtaining renewable energy (biogas, biofuels, biomass combustion and fossil fuels combined, in cogeneration)	<p>Romania's high agricultural potential and its considerable experience in refining place her in a top position to become a regional leader in the field of biofuels.</p> <p>Through innovation, Romania can become a key producer/exporter of biofuels in the European Union in the field of biofuels compliant with the European standards in force.</p> <p>Vegetable and municipal residues can be burned in solid form to produce green energy and thus recycle a resource labeled as "waste".</p>

Field	Description	Economic arguments
		The cultivation and use of energy crops that are only planted once and are being harvested annually or every two years may allow Romania to reduce its intensive logging of forests.
Bionanotechnology	Knowing and exploiting phenomena and entities at a nanoscale in order to obtain green energy, selectively detecting the environmental contaminants, researching the components of physiological fluids, synthesizing effective drugs, creating super-fast electronic components, designing completely new materials.	<p>The market demand for medical devices based on micro and nanotechnologies is constantly expanding: an annual growth rate of 7.8% is expected.</p> <p>Romania benefits from the existence of more than 150 companies active in biotechnology.</p>
Industrial biotechnology	Developing the high agricultural potential and the significant biomass production through major industrial biotechnologies, thereby taking the research aimed at developing biofuels, biocatalysts and other bioproducts to a pilot/prototype/ industrial scale	<p>Romania has an extremely valuable potential for natural bioresources that is not being sufficiently used (about 50% of the European flora species)</p> <p>There is currently a growing market demand for products defined by the "BIO" component</p> <p>Biotechnologies are a development opportunity for SMEs and the enzymatic processes represent an opportunity for innovation and development.</p> <p>The existence of some Romanian brands in the field: 150 companies using the results of research conducted within this subdomain; number of employees – 1500; turnover – 300 million Euros; trade balance surplus – 200 million Euros.</p>
Environmental biotechnology	Biotechnology is based on biological systems (microorganisms, plants, invertebrates) and their	There are 200 active companies in the field of environmental biotechnology (sewage treatment plants, companies remediating

Field	Description	Economic arguments
	ability of using a diverse range of organic and inorganic compounds during the metabolic processes.	contaminated soil through phytoremediation and the use of microorganisms) with more than 2,000 employees and a turnover of 100 million Euros and a trade balance surplus of 10 million Euros.
Medical and pharmaceutical biotechnology	Developing new effective biotechnology methods, means and products for diagnosis and therapy in human and veterinary medicine.	Given the economic difficulties of the Romanian medical system, increasing therapeutic effectiveness, early diagnosis and personalized medicine justify the investment in medical biotechnological research, ultimately leading to reduced expenditure and a good management. The natural bioproducts sector is well represented in Romania by holdings or companies interested in the research and development of new types of bioproducts, using both the wild and the organically farmed flora.
Molecular design (bio)synthesis, semi-synthesis, high resolution screening	Molecular design, chemical or biochemical synthesis of entities with a biological active potential, next to cellular therapeutic targets discovered, in order to obtain high purity and low cost drugs to increase the population's access to (innovative and generic) drugs.	The export of medical and pharmaceutical products – FOB 2011: 739 million Euros; Import CIF 2011: 2,361 million Euros The existence of industrial producers of plant extracts for pharmaceutical and similar products, SMEs and innovative start-ups Facilities for producing active bio- and semisynthetic substances in conservation that can be augmented and put into operation at Antibiotice SA Iași

Enhancing a productive and sustainable bioeconomy sector in Romania 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.

Conclusion

A bioeconomy sector will provide opportunities for a "green" economic growth, creating jobs, developing a circular structure of the Romanian economy, strengthening Romania's competitiveness regionally and globally and encouraging a higher quality research and innovation in Romania.

The transition to a sustainable bioeconomy requires vision and a long-term national strategy strongly supported by the Romanian Government and will be aimed at five major strategic objectives (SO):

SO1. Developing consistent public policy options that support and facilitate the development of a bioeconomy sector as sustainable as possible:

- they will need to strengthen the knowledge network in the strategic specializations of the bioeconomy sector and to ensure a better cooperation and coordination between research and innovation areas;
- their implementation will have to be coordinated with the help of the stakeholders and communicated to the public;
- it is essential to stimulate the sustainable use of biomass in all strategic specializations along the value chains;
- any regulations postponing or halting the development of the bioeconomy sector will have to be reviewed and adapted to new circumstances, so as not to affect the public policies in this area;
- given that biomass is an important source of green "energy" in Romania, the policies in the renewable energies sector must be directed to its capitalization;

SO2. Prioritizing the integration of education and professional training in clusters that help the development of bioeconomical value chains:

- encouraging multidisciplinary research, innovation and technology transfer along value chains specific to bioeconomy;
- although the technical potential of bioeconomy has grown in recent years, scientific results are still needed to reduce compromises in the bioeconomy sector;
- the investments in the research infrastructure should help the transition between academic research and industrial production;

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- the stimulation of applied research aimed at closing the waste management circuits and at focusing on the waste streams;
 - developing innovative business models to link the bioeconomy sectors to the recycling sector;
 - supporting the research aimed at the discovery of techniques and crops to optimize the economic, environmental and social efficiency of the biomass;
 - facilitating the regional cooperation opportunities to create international clusters;

SO3. The production and use of biomass for the entire value chain specific to the bioeconomy sector in Romania:

- exploitation of bioresources so as to provide maximum social and economic value;
- reviewing and ensuring that the quality of the imported biomass observes the European standards;
- labeling the bioproducts so as that the consumers are best informed about them and the opportunity arises to increase the demand;
- using in a greater degree the biomass produced in Romania;

SO4. Strengthening the competitiveness of the bioeconomy subsectors in Romania:

- in order to develop the bioeconomy sector is not enough to have an industry that starts using biomass instead of fossil raw materials; also, consumers must be informed about the bioproducts marketed in the subsectors of bioeconomy (by developing selling standards, certification and labeling);
- the initiative to encourage the creation of markets for bioeconomy will have to be taken by the Romanian Government through a pioneering program of public procurements of bioproducts;
- public policy measures will involve ensuring a uniform and stable availability of biomass for industrial applications (the streams of sorted and recycled waste or the residues will require specific action);

SO5. Romania's position as a European and international partner in the development of the bioeconomy:

- helping international and interregional cooperation, not only to ensure sufficient biomass and growing sells for the Romanian sector of bioeconomy, but also to exchange good practices and to favor exportation;

- international, European or regional agreements will have to be harmonized with various public policies and external goals in order to eliminate unnecessary regulations.

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