

## OPTIONS FOR THE DEVELOPMENT OF AN AGRICULTURAL REGION IN THE LUBLIN VOIVODESHIP ON THE BASIS OF THE CONCEPT OF BIO-ECONOMY

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### ABSTRACT

This study aims to present the role of an institution in the development of Lublin Voivodeship based on the concept of bio-economy. The work covers an analysis of the structure of economy in the analysed region, institutional infrastructure, entrepreneurship, innovativeness and competitiveness in the region as well as administrative, political and economic institutions in the context of implementing the assumptions of the discussed concept of development. The source material comprises strategic documents of Lublin Voivodeship as well as reports and information made available by the analysed institutions. The results of research indicate that scientific and engineering skills, shaped by 97 schools and research and development units, are a strong point of the region as far as supporting the development of bio-economy is concerned. However, the region does not look good in terms of the number of centres for innovation and entrepreneurship.

**Key words:** Lublin Voivodeship, agricultural region, bio-economy, regional development

### INTRODUCTION

The concepts of regional development have changed over the years, which is a result of the need to take into account new phenomena significantly affecting both the economic space, business activity location processes, and the concentration or deconcentration of production [Nowińska-Łaźniewska 2004]. At the same time, the purpose of these concepts is still to improve the innovativeness and hence the competitiveness of the regions. With regard to the specificity and diverse conditions for the development in respective regions (innovation potential, concentration of the specific type of activity), different bases can be identified for the development concepts created [Mempel-Śnieżyk 2013]. In addition, the diverse approach to the development of respective regions results from the fact that regional development is subject to various conditions. These can be grouped according to various criteria. However, most often two groups of factors – endogenous and exogenous factors – are identified. The first group of factors includes own resources of the region determining its development potential. The second group, on the other hand, relates to external factors resulting from European globalisation and national-level processes beyond the control of the region. The identification of boosters and barriers to regional development plays the basic role in determining the lines for the development of respective regions [Strzelecki 2011].

The response to looking for new, more sustainable concepts of growth is the concept of smart specialisation. It is an alternative to the policy promoting investments in multiple areas and sectors, irrespective of the industrial structure of the specific region and knowledge potential. In addition, smart specialisations help identify

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the unique features and resources of the region [Foray et al. 2009]. Smart specialisations include, among other things, bio-economy. It is defined as sustainable production and processing of biomass into a wide range of food, medicinal, industrial and power products and services. Renewable biomass consists of different biological materials for direct consumption and in the form of raw materials used for manufacturing other products [ETP 2011]. Contemporary times, in which the development of science and technology creates new opportunities, make bio-economy one of the most extensive analytical and cognitive concepts and a dynamic sector of economy being one of the largest employers with a huge potential and real grounds for development [Adamowicz 2012]. The bioeconomy concept is a merit-worthy and an innovative approach to an economy of the future, a future likely to be challenged by global population growth, climate change, declining non-renewable resources stocks, water shortages, and environmental degradation [Maciejczak 2013]. The purpose of bio-economy is mainly developing product and process improvements based on the use of biomass and recovery and other natural resources [Czyżewski and Kułyk 2015]. The region in which this concept of development was indicated as the key smart specialisation is Lublin Voivodeship. This is because the region is characterised by natural values, including bio-resources, which can form grounds for its development. It must be noted that having the potential of bio-resources is a necessary but not the sufficient condition for the development of bio-economy. Effective development of bio-economy in the regions is largely determined by the level of knowledge about renewable biological resources and their possible applications in manufacturing bio-products and producing bio-energy.

In addition, the reasons for making the development of the region dependent on the concept of bio-economy follow from the assumptions of the European Commission. The development of bio-economy can stimulate and maintain economic growth and create jobs – also in rural areas. In addition, the emergence of new markets for agriculture not connected with food production, such as bio-energy, may become an additional source of income for farmers and, as a result, they can contribute to faster development of rural areas [McCormick and Kautto 2013].

## OBJECTIVES, MATERIAL AND METHODS

With regard to the specificity of Lublin Voivodeship the purpose of this study is the presentation of the role of institutions in the development of the studied region based on the concept of bio-economy. The work covers an analysis of the structure of economy in the analysed region, institutional infrastructure, entrepreneurship, innovativeness and competitiveness in the region as well as administrative, political and economic institutions in the context of implementing the assumptions of the discussed concept of development. The study, in particular, presents the activities of business institutions, scientific and research and development units, higher schools and centres for innovation and entrepreneurship, parks of science and technology, and clusters that actively participate in the process of supporting the assumptions of bio-economy in Lublin Voivodeship.

The source material consists of strategic documents of Lublin Voivodeship as well as reports and information made available by the analysed institutions, including administrative and political institutions, scientific entities, research and development units, higher schools and business environment institutions.

In order to present the agricultural nature of Lublin Voivodeship the economic structure of the analysed region was analysed and compared against the national average and the average for EU-15 member states. To this end, the structural diversity measure calculated according to the formula proposed by Kukuła [1996] was applied:

$$S_t = \frac{\sum_{i=1}^k |\alpha_{it} - \beta_{it}|}{2}, \quad (t = 0, \dots, n)$$

where:  $\alpha_{it}$  – share of  $i$ -component in the  $t$ -period of the structure of A (Lublin Voivodeship),

$\beta_{it}$  – share of  $i$ -component in the  $t$ -period of the structure of B (national average and EU-15 member states),

The structure of economy of Lublin Voivodeship was evaluated based on the latest available data provided by the Central Statistical Office of Poland (GUS), i.e. data for 2013.

## LUBLIN VOIVODESHIP AS THE AGRICULTURAL REGION

Lublin Voivodeship is an outlying region with a relatively low level of social and economic development. Gross domestic product per capita was 30,427 PLN in 2013, which corresponded only to 70.7% of the national figure [GUS 2015]. It ranked Lublin Voivodeship region last among regions in that respect. The ranking in terms of the number of business entities per one thousand inhabitants was not good as well – in 2013 the region was ranked 15<sup>th</sup> out of 16 regions of Poland.

Expenditure on R&D plays a significant role in the development of the region, and in the development of the concept of bio-economy. In 2013 expenditure per capita in the region amounted to 186 PLN and it was lower by half than the average for Poland. Lublin Voivodeship is ranked the last but one among regions even, if one take into account the average monthly per capita available income of households. In 2013 this ratio corresponded only to 85.1% of the national figure.

A characteristic feature of the region is its economic structure, since it determines options and lines for development. The economic structure was analysed based on the structure of employment and value added in the region in comparison to the structure at the national level and at the level of EU-15 member states. Measures of structural similarity assume values in the range  $<0; 1>$ . The lower the value of the ratio, the closer the structure in the analysed region in year  $t$  to the structure in the reference object – on average in Poland or in EU-15. For the purposes of the analysis, a three-sector structure of economy was adopted aggregating national economy divisions into three groups: sector I (agriculture – sections A–B of the Polish Classification of Activities), sector II (industry – sections C–F of the Polish Classification of Activities) and sector III (services – sections G–Q of the Polish Classification of Activities).

Figures presented in Table 1 point to clear differences in the structure of employment between Lublin Voivodeship and the member states of the so-called old 15. The measure of structural diversity in 2013 amounted to 0.347, which is a proof of large discrepancies between the structures being compared. This is mainly because the percentage of employment in the agricultural sector is 10 times higher, with a relatively low level of employment in services. While comparing the structure of employment in Lublin Voivodeship to the national structure of employment, it can be noted that the difference is lower in relation to the 15 member states of the European Union. The measure of distance in 2013 was in this case 0.213, which is also a proof of low similarity of the structures being compared. In 2013 the sector of agriculture employed 17.1% of all the workers, whereas in Lublin Voivodeship this percentage was more than twice higher. The average level of

**Table 1.** Measures of similarity of the employment structure in Lublin Voivodeship to the structure in Poland and EU-15 in 2013

Specification	Percentage of workers according to			Measure of employment structure similarity to	
	sector I (agriculture)	sector II (industry)	sector III (services)	national average	EU-15
Lublin Voivodeship	38.5	17.2	44.3	0.213	0.347
Poland	17.1	26.3	56.6	0.000	0.182
EU-15	3.8	21.5	74.7	0.182	0.000

Source: Own elaboration based on data from the Central Statistical Office of Poland (Gross Domestic Product. Regional Accounts in 2013) and Eurostat.

employment in industry amounted to 26.3% and in services to 55.9%. In Lublin Voivodeship this percentage was 17.2 and 44.3% respectively.

Analysing the social and economic characteristics of Lublin Voivodeship, apart from the structure of employment, attention must be paid to the structure of creating value added in the region. The analysis was carried out in a manner similar to the analysis of employment using the measure of structural similarity (Table 2).

**Table 2.** Measures of similarity of the employment structure in Lublin Voivodeship to the structure in Poland and EU-15 in 2013

Specification	Share of sectors in gross value added			Measure of gross value added structure similarity to	
	sector I (agriculture)	sector II (industry)	sector III (services)	national average	EU-15
Lublin Voivodeship	6.0	28.1	65.9	0.055	0.086
Poland	3.1	33.6	63.3	0.000	0.112
EU-15	1.5	24.0	74.5	0.112	0.000

Source: Own elaboration based on data from the Central Statistical Office of Poland (Gross Domestic Product. Regional Accounts 2013) and Eurostat.

According to the figures presented in the Table 2, the effect of the agricultural sector in Lublin Voivodeship on creating gross value added is almost twice higher than at the national level and four times higher than on average in the member states of EU-15. The share of sector I in the total gross value added in the region is nearly twice higher than on average in Poland and four times higher than on average in 15 member states of the so-called old Union. The measure of structural diversity of value added in Lublin Voivodeship in relation to EU-15 (0.086) indicated a greater similarity of this structure to the structure in the EU rather than the average structure in Poland. It was due to a greater share of the services sector in value added that was closer to the share of industry in the European Union.

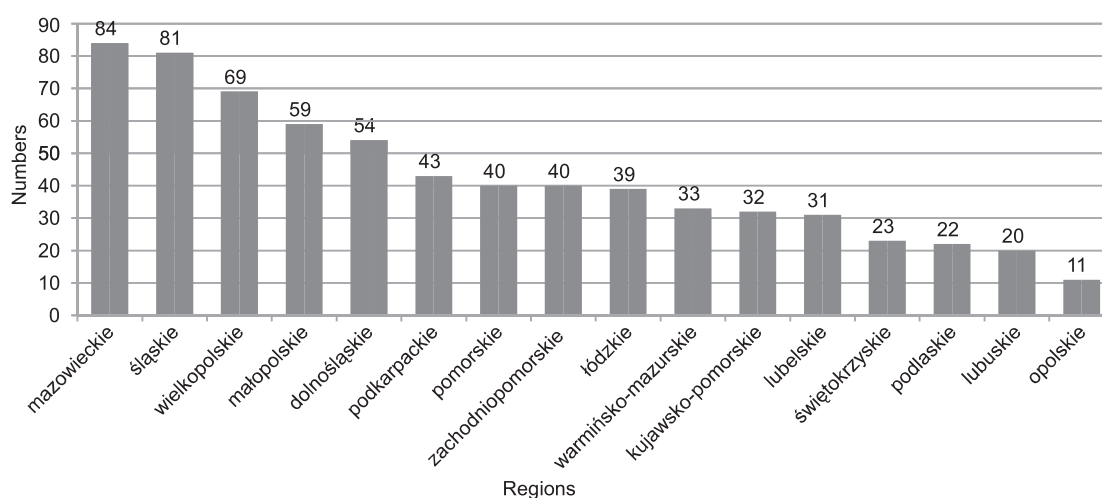
The specificity of the analysed region, including high significance of the agricultural sector, provides reasons to search for development strategies making use of the potential of this region and making its development more dynamic. Such chances are sought, among other things, in bio-economy, a concept attempting to solve the accruing social problems and providing a chance for faster economic growth [Gołębiowski 2015]. It should be explained by the fact that agriculture and natural resources have been used in the production of food, feeds, fibres, fuels and environmental goods. The latest changes in demand refer to quantity, quality, technology, traditional energy markets as well as chemistry, which increases the demand for non-food products and services. These changes, in combination with an increase in the consumer requirement of various properties of food, contributed to the emergence of quickly developing and globally integrated bio-economy [Swinnen and Riera 2013].

## INSTITUTIONS AND INSTRUMENTS SUPPORTING BIO-ECONOMY IN LUBLIN VOIVODESHIP

As confirmed by scientific studies, bio-economy develops differently in different countries and regions [Stuart and Sorenson 2003, Tödting and Trippel 2005]. This is caused by the differentiation of biomass resources, required technologies, political situation, existing knowledge or specialisations of businesses. Hence, it is believed that no universal idea of bio-economy development exists but there are certain verified solutions that can be adequate and applicable in different places [Gustafsson et al. 2011]. In addition, the activity of local governments and proper promotion of the territorial unit play a significant role in the development of bio-economy.

The options for the development of bio-economy are largely determined by institutions and instruments supporting this concept. European innovative partnerships and shared planning initiatives are also very important in this process [Bartoszczuk 2014].

Despite Lublin Voivodeship is one of the Polish regions worst developed in terms of the number of centres for innovation and entrepreneurship (Fig.), it should be supposed that the dynamics of transformation processes and involvement of regional and local authorities will contribute to increasing the number of such entities and intensifying activities to grow the social and economic potential.



**Fig.** Centers for innovation and entrepreneurship in Poland according to voivodeship in 2014

Source: Own elaboration based on Bąkowski and Marzewska [2015].

Generally, institutions supporting the development of bio-economy can be classified into two groups – administrative and political institutions as well as economic institutions [Kalbarczyk et al. 2015]. Such an approach will be also applied in further analysis. The first group consisted of the Marshal Office of Lublin Voivodeship, Lublin City Hall and district authority offices (Table 3). On the other hand, the analysis of the role of economic institutions in the development of bio-economy was limited to institutions forming the business activity environment (Table 4) including scientific and development units, higher schools, centres for innovation and entrepreneurship, business organisations, agencies, foundations and associations for development [Kalbarczyk et al. 2015].

**Table 3.** The role of selected administrative and political institutions in Lublin Voivodeship in supporting bio-economy

Name of institution	Examples of activities supporting bio-economy
Marshal Office of Lublin Voivodeship	supports innovation, implements development programmes supporting the development of bio-economy: Regional Operational Programme of Lublin Region, Programme for the Development of Renewable Energy Sources for Lublin Region, Consolidation Works Programme for Lublin Region for the years 2014–2020
Lublin City Hall	support in creating and operating cluster structures and promoting them at the local, national and international level
District authority offices	activity based on district development strategies referring directly to assumptions set forth in regional strategic documents

Source: Own elaboration based on information provided by the above-named institutions.

The analysis of support for the development of bio-economy from business environment institutions focuses in particular on institutions forming the innovative environment. This environment is built by scientific, research and development units, higher schools and centres for innovation and entrepreneurship [Kalbarczyk et al. 2015]. Table 4 lists major units and institutions from this group and gives examples of activities fostering the development of bio-economy.

**Table 4.** Scientific, research and development units, higher schools, business environment institutions and centres for innovation and entrepreneurship in Lublin Voivodeship and their role in supporting bio-economy

Institution/Organisation	Examples of activities supporting bio-economy
Maria Curie-Skłodowska University in Lublin, University of Life Sciences in Lublin	Setting up a consortium for a project in the area of bio-economy
Institute of Agrophysics of the Polish Academy of Sciences	Carrying out a project in the area of bio-economy
University of Life Sciences in Lublin and Wrocław University of Science and Technology	Carrying out a project in the area of bio-economy
Lublin Development Foundation	Provider of pro-innovative advisory and training services regarding transfer of knowledge, activities within the Eastern Business Angels Network, coordinating the Cluster of Business Environment Institutions, supporting start-ups
Foundation for Lubelskie Development	Comprehensive assistance in running micro, small and medium-sized businesses, coordinating the Lublin Eco-Energy Cluster involving entities dealing with power engineering, and production and utilisation of biomass for power engineering purposes, supporting the development of business solutions
Polish Foundation of Centres for Supporting Economic Development OIC Poland in Lublin	Providing businesses, institutions and organisations with solutions for developing human resources, designing and implementing innovative training and education and consulting projects
Polski Fundusz Gwarancyjny Sp. z o.o.	Supporting private business activity by granting securities in connection with bank loans granted to micro, small and medium-sized businesses
Lubelski Park Naukowo Technologiczny Sp. z o.o.	Participating in the commercialisation of the results of scientific and technological research in economy, establishing wide relations with the scientific and business environment in Poland and abroad, creating an innovative environment in the region, stimulating local entrepreneurship, attracting foreign investors and supporting innovative projects
Centre for Innovation and Technology Transfer of the Lublin Park of Science and Technology	Supporting transfer of technologies from scientific and research institutions to businesses, stimulating local entrepreneurship and attracting foreign investors, supporting innovative projects and new innovative businesses set up by university graduates, assistance in obtaining third party financing for innovative projects
Institute of Soil Science and Plant Cultivation	Supporting the innovativeness of Polish agriculture. Studies to evaluate options for obtaining biomass and utilizing traditional crops for power engineering purposes. Building a system of geographical information for the needs of bio-economy and creating interactive web applications to acquire, model and popularize knowledge of bio-economy. Project performance under the Seventh Framework Programme of the EU, including but not limited to Delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe (S2BIOM) (2013–2017)

Source: Own elaboration based on information provided by the above-named institutions.



The condition for the development of bio-economy is a close relationship between private activity and research in the public sector. The terms of cooperation and synergy between public research institutions and industrial operations of various sizes and in various industries are important for the maximum effect of developing enterprise in the area of bio-economy. New types of associations such as clusters, networks and innovation alliances for open innovation projects and “untypical” alliances between sectors that have rarely cooperated so far will now play an important role in the development of respective industries in the area bio-economy [Chyłek and Rzepecka 2011]. Table 5 focuses on the role of selected clusters operating in the territory of Lublin Voivodeship in the development of bio-economy.

**Table 5.** The role of selected clusters in Lublin Voivodeship in supporting bio-economy

Institution/Organisation	Examples of activities supporting bio-economy
Lublin Eco-Energy Cluster	Coordinating cooperation between entities dealing with (solar, wind, water and geothermal) power engineering and production and utilisation of biomass for power generation purposes. The cluster is an association of entities providing employment to nearly 3 thousand people. Scientific and development operations have 233 employees. In 2014–2015 the associated entities implemented 50 innovations. The associated businesses develop their export activities
Eco-Innovation Cluster	Supporting eco-innovative solutions. The cluster associates businesses and organisations with competences, skills and experience in eco-innovative projects
Lublin Clusters (Eastern ICT Cluster, Eco-Innovation Cluster, Lublin Biomedical Cluster, Eastern Metal Processing Cluster in Lublin, Lublin Wood Association – Regional Cluster in Lublin)	The purpose of the initiative was to encourage clusters to form larger units of organisation. Such projects are based on cooperation between clusters and cluster initiatives in the area of Lublin region and autonomous businesses carrying out innovative operations as well as research organisations, business environment institutions and local governments
Biotechnology Cluster	Cluster associating 21 entities including Lublin City Hall, four universities, Lublin University of Technology, as well as the Institute of Agrophysics of the Polish Academy of Sciences. The main priority of the cluster is stimulating cooperation in the industry, which will contribute to supporting the networking of science and business and promoting innovative solutions designed in the region. Its main task will be help in establishing relations between business-people and university staff

Source: Own elaboration based on information provided by the above-named institutions.

The development potential of the region with respect to the development of bio-economy is supported by scientific and technological competences of the region. Assuming that knowledge is the core pillar of the development of bio-economy, one can assume that its development in the analysed region is largely shaped by the potential to generate and diffuse knowledge. Ninety-seven universities, colleges, and research and development units operate in Lublin Voivodeship [GUS 2011]. These entities allocate about 60% of R&D expenditure to research into agricultural, natural, medical and health sciences. Nearly half comprises expenditure on research in agricultural and natural sciences. One third is expenditure on financing engineering and technical sciences [Marshal Office of Lublin Region in Lublin, 2014]. The significance of agricultural studies in the development of bio-economy is mentioned, among others, by Krasowicz [2016], who indicated that the agricultural studies carried out for instance by the Institute of Soil Science and Plant Cultivation (IUNG) in Puławy reflect the strategic areas of bio-economy and development priorities of Polish agriculture.

In addition, the analysis of grants used by academic staff members of regional universities points to a clear specialization in sciences connected with agriculture and environmental protection. This is supported by the

activities of specialist research institutes in Lublin and Puławy [Marshal's Office of Lublin Region 2014]. In the context of options for the development of bio-economy in the region, a particular role should be assigned to educating high-skilled staff able to utilize high technologies in their work. According to data provided by the Central Statistical Office of Poland [2011], in Lublin Voivodeship the student – inhabitant ratio in 2011 was the highest among 16 regions and it was above 9%. A specific characteristic of the region is also a share of students of agricultural faculties higher than in other regions (except Warmia and Masuria), which with respect to an important role of agriculture in the development of bio-economy is a positive aspect.

Chances for the development of bio-economy in Lublin Voivodeship that is an agricultural region are large with regard to its potential bio-resources. On the one hand, bio-economy is a traditional approach (baking bread, brewing beer, preserving food etc.). On the other hand, it covers the new and the innovative (new biomaterials, bio-preparations etc.). Thus, this concept covers both classic sectors and industrial biotechnology. However, agricultural and food production and processing is a predominant element of bio-economy in terms of total production and employment [von Braun 2013]. In Lublin Voivodeship, this sector is one of the largest segments of economy. According to data provided by the Central Statistical Office of Poland, in 2013, cropland in the region accounted for 70% of its total area. This region is also one of the major national producers of cereals (9.1%), sugar beets (16.5%), vegetables (9.8%) and fruits and berries (20.4%).

## CONCLUSIONS

The transformation of the theoretical concept of bio-economy into well-functioning reality requires integrated, sustainable measures to be taken by politicians, business entities, scientists, local governments, investors and other stakeholders as well as by ordinary citizens. In order to put such an intention into effect, well-functioning information systems and properly oriented educational and promotional activities, relevant support systems, availability of funds and a favourable social climate are required. In addition, a proper organisation and management system, social dialogue, monitoring system and methods of evaluation are needed.

Furthermore, bio-economy requires permanently growing public financial support and private investments, which will contribute to improving the consistency of domestic, European and global expenditure on scientific research and innovation. Often, there is a clear discrepancy between research and practical application of its results with regard to the lack of knowledge and the existence of institutional barriers between specialists: scientists, innovators, producers, end users, decision-makers and the society. This gap can be reduced by knowledge transfer networks, knowledge and technology brokers and social undertakings forming a part of wider initiatives of citizens and the parties concerned.

According to the results of research, instruments for supporting bio-economy in Lublin Voivodeship are associated with the development of industrial infrastructure and innovative bio-economy. They include scientific projects, support for innovative activities of small and medium-sized businesses, participation in national and international research and technology projects, involvement of regional authorities, developing energy production, setting up regional clusters, and creating positive attitudes of consumers to the products of bio-economy. Scientific and engineering competences shaped, among other institutions, by schools and research and development units, are a strong point of the region from the point of view of supporting the development of bioeconomy. Thus, the scientific potential of the region should be particularly utilised. The teaching activities of universities, including the choice of faculties and development of scientific research, should become an element connecting business entities and support institutions into a chain of cooperation. Big involvement of the scientific community in the implementation of the assumptions of bio-economy and designing innovative industrial solutions together with business entities will provide a chance.

Efficient utilisation of bio-resources should lead to the development of cooperation between entities in various branches of economy. The recent trend of shifting the activities supporting the assumptions of innovative



bio-economy towards parks of technology and cooperation between various entities within clusters is also worth maintaining. They play an important role in supporting science and business networking as well as promoting innovative solutions created in the region. Moreover, investments in propagation activities and wider scale activities and the development of entrepreneurship and advisory services throughout the value chain must be continued.

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## **MOŻLIWOŚCI ROZWOJU REGIONU ROLNICZEGO NA PODSTAWIE KONCEPCJI BIOGOSPODARKI WOJEWÓDZTWA LUBELSKIEGO**

### **STRESZCZENIE**

Celem opracowania jest prezentacja roli instytucji w rozwoju województwa lubelskiego według koncepcji biogospodarki. Praca swym zakresem obejmuje analizę struktury gospodarki badanego regionu, wyposażenia instytucjonalnego przedsiębiorczości, innowacyjności i konkurencyjności w regionie, a także instytucji administracyjno-politycznych i gospodarczych w kontekście realizacji założeń omawianej koncepcji rozwoju. Materiał źródłowy stanowią dokumenty strategiczne województwa lubelskiego, a także raporty oraz informacje udostępnione przez instytucje samorządowe. Wyniki badań wskazują, że za mocną stroną regionu z punktu widzenia wsparcia rozwoju biogospodarki należy uznać kompetencje naukowe i technologiczne, kształtowane m.in. przez 97 uczelni i jednostek badawczo-rozwojowych. Niekorzystnie wypada natomiast badany region pod względem liczebności ośrodków innowacji i przedsiębiorczości.

**Słowa kluczowe:** województwo lubelskie, region rolniczy, biogospodarka, rozwój regionalny