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## THE BIOECONOMY SECTORS FINANCIAL SUPPORT

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**Лимар В.В. Фінансова підтримка біоекономічних секторів**

Стаття присвячена аналізу фінансової підтримки біоекономічних секторів. Біоекономіку визначено як стійке виробництво та перетворення біомаси на продукцію харчування, медикаменти, волокна, промислову продукцію та енергію, де біомаса представляє собою біологічний матеріал, який може бути використаний як сировина; відіграє дуже важливу роль як у стимулюванні економічного зростання, так і формуванні ефективних відповідей на глобальні виклики. Таким чином вона робить внесок до розумної, стійкої та інклюзивної економіки.

Визначено, що розмір європейського ринку біоекономіки становить приблизно 2 трлн. євро, а зайнятість сягає 21,5 млн. осіб з перспективами на подальше зростання. Крім того біоекономіка в змозі відповісти на глобальні виклики сьогодення та підвищити загальний рівень життя. Виділено такі сфери, на які біоекономіка матиме позитивний вплив: сільське господарство, кліматичні зміни, вичерпаність корисних копалин, стиль та якість життя людства, харчові звички, корисне харчування та захист рослин і тварин від шкідників.

**Ключові слова:** біоекономіка, відновлювана біомаса, стійке виробництво, розумні біо-продукти, економічний та соціальний розвиток.

**Лымар В.В. Финансовая поддержка экономических секторов**

Статья посвящена анализу финансовой поддержки биоэкономических секторов. Биоэкономика определена как стабильное производство и материализация биомассы в продукты питания, медикаменты, волокна, промышленную продукцию и энергию, где биомасса представляет собой биологический материал, который может быть использован в качестве сырья; играет очень важную роль как в стимулировании экономического роста, так и формулировке эффективных ответов на глобальные вызовы. Таким образом она делает вклад в умную, стабильную и инклюзивную экономику.

Определено, что размер европейского рынка биоэкономики составляет приблизительно 2 трлн. евро, а занятость достигает 21,5 млн. человек с перспективами на дальнейший рост. Кроме того биоэкономика в состоянии ответить на глобальные вызовы современности и повысит общий уровень жизни. Выделены такие сферы, на которые биоэкономика будет иметь позитивное влияние: сельское хозяйство, климатические изменения, исчерпанность полезных ископаемых, стиль и качество жизни человечества, пищевые привычки, полезное питание и защита растений и животных от вредителей.

**Ключевые слова:** биоэкономика, возобновляемая биомасса, стабильное производство, умные био-продукты, экономическое и социальное развитие.

**Lymar V. The bioeconomy sectors financial support**

The article is devoted to the analysis of the bioeconomy sectors financial support. The bioeconomy was defined as the sustainable production and conversion of biomass, for a range of food, health, fiber and industrial products and energy, where renewable biomass encompasses any biological material to be used as raw material - can play an important role in both creating economic growth, and in formulating effective responses to pressing global challenges. In this way it contributes to a smarter, more sustainable and inclusive economy.

It is estimated that the European bio-economy currently has an approximate market size of over 2 trillion Euros, employing around 21.5 million people, with prospects for further growth looking more than promising. In addition to being economically favorable, the bioeconomy can help to meet the most urgent global challenges improving public well-being in general. Areas that it can benefit include social and demographic development and its impact on agriculture, the growing pressure on water, the threat of climate change, the limited resources of fossil fuel, the need for sustainable development, the impact of changes in lifestyles and eating habits, the demand for safer and healthier foods and the prevention of epizootic and zoonotic diseases.

**Key words:** bioeconomy, renewable biomass, sustainable production, smart bio-based products, economic and social development.

**Problem of investigation.** Over the coming decades, Europe must ensure a safe, healthy and prosperous environment for current and future generations. Successfully addressing major environmental, social and economic challenges will change the way we live and work. The bioeconomy will make this a change for the better if its potential for sustainable production and conversion of biological material is fully exploited. The mature, sustainable bioeconomy will help deliver global food security, improve nutrition and health, create smart bio-based products and biofuels, and help agriculture, forestry, aquaculture and other ecosystems to adapt to climate change.

**Analysis of the latest researches and publications.** There are a lot of works both of the Ukrainian and foreign authors devoted to the bioeconomy formation and development. For example, Shubravskaya O. analyses the world experience of the bioeconomy development [1], Ryabchenko O. [2] emphasizes the social element and forms the definition of the bio-social economy as a form of economic activity based on interaction of three systems – economic, ecologic and social that is defined by processes of mutual exchange by renewal bio-resources with the aim of saving of ecological balance for the next generations. Potapenko V. makes organizational and economic mechanisms which allow instilling the principles of “green” economy [3]. Researches of the European project «Systems Analysis Tools Framework for the EU Bio-Based Economy Strategy» (SAT-BBE) [4] make the systematic analysis of the bioeconomy, define its role, place and impact on the other sectors, particularly economic, ecologic and social impacts with developing of conceptual instruments, identify and analyze main effects of feed-back between the bioeconomy and other parts of the system.

**Unsettled problem.** There is a lack of investigations devoted to the financial aspect of the bioeconomy development. Such problem causes the aim of this paper.

**The aim of the investigation** is analyze the bioeconomy sectors financial support.

**Results.** The concept of the bioeconomy covers the agricultural economy and all manufacturing sectors and associated service areas that develop, produce, process, handle, or utilize any form of biological resources, such as plants, animals, and microorganisms [5]. This spans numerous sectors, such as agriculture, forestry, horticulture, fisheries and aquaculture, plant and animal breeding, the food and beverage industries, as well as the wood, paper, leather, textile, chemicals and pharmaceutical industries, and aspects of the energy sector. Bio-based innovations also provide growth impetus for other traditional sectors, such as in the commodity and food trade, the IT sector, machinery and plant engineering, the automotive industry, environ-mental technology, construction, and many service industries.

The bioeconomy – the sustainable production and conversion of biomass, for a range of food, health, fiber and industrial products and energy, where renewable biomass encompasses any biological material to be used as raw material - can play an important role in both creating economic growth, and in formulating effective responses to pressing global challenges. Nowadays countries all over the world face a range of environmental, social, and economic challenges over the next two decades. By 2030, the global population is expected to increase by 28%, from 6.5 billion in 2005 to 8.3 billion, and average global per capita income by 57%, from USD 5 900 in 2005 to USD 8 600. A larger and a more affluent population will increase world demand for health services that improve the quality and length of life and demand for essential natural resources: food, animal feed, fiber for clothing and housing, clean water, and energy [6].

At the same time, many of the world’s ecosystems that support human societies are already overexploited and unsustainable. Climate change could exacerbate these environmental problems by adversely affecting water supplies and agricultural productivity. Biotechnology offers

technological solutions for many of the health and resource-based challenges facing the world [7]. It can increase the supply and environmental sustainability of food, feed and fiber production, improve water quality, provide renewable energy, improve the health of animals and people, and help maintain biodiversity by detecting invasive species. Yet biotechnology is unlikely to fulfil its potential without appropriate regional, national and, in some cases, global policies to support its development and application.

A bioeconomy can be thought of as a world where biotechnology contributes to a significant share of economic output. The emerging bioeconomy is likely to involve three elements: the use of advanced knowledge of genes and complex cell processes to develop new processes and products, the use of renewable biomass and efficient bioprocesses to support sustainable production, and the integration of biotechnology knowledge and applications across sectors.

There are three main sectors where biotechnology can be applied: agriculture, health, and industry. While primary production includes all living natural resources, such as forests, plant crops, livestock animals, insects, fish and other marine resources, the main current uses of biotechnology are for plant and animal breeding and diagnostics. Human health applications include therapeutics, diagnostics, pharmacokinetics to improve prescribing practices, functional foods and nutraceuticals, and some medical devices. Industrial applications include the use of biotechnological processes to produce chemicals, plastics, and enzymes, environmental applications such as bioremediation to clean up polluted soils, biosensors, methods to reduce the environmental effects or costs of resource extraction, and the production of biofuels. Several applications, such as biopharmaceuticals, in vitro diagnostics, some types of genetically modified crops, and enzymes are comparatively “mature” technologies. Many other applications have limited commercial viability without supportive policies (e.g. biofuels and bioplastics) or are still in the experimental stage, such as regenerative medicine and health therapies based on RNA interference. This will not come easily, other forces are driving the bioeconomy globally. The future bioeconomy will be global.

Developing all sectors of the bioeconomy in concert will provide global food security, improve nutrition and public health, make industrial processing cleaner and more efficient and make a significant contribution to the effort to mitigate climate change. The integrated bioeconomy we envisage is not simply about science, but is rather an integration of science with business and society. The dynamics of this are shown in figure 1.

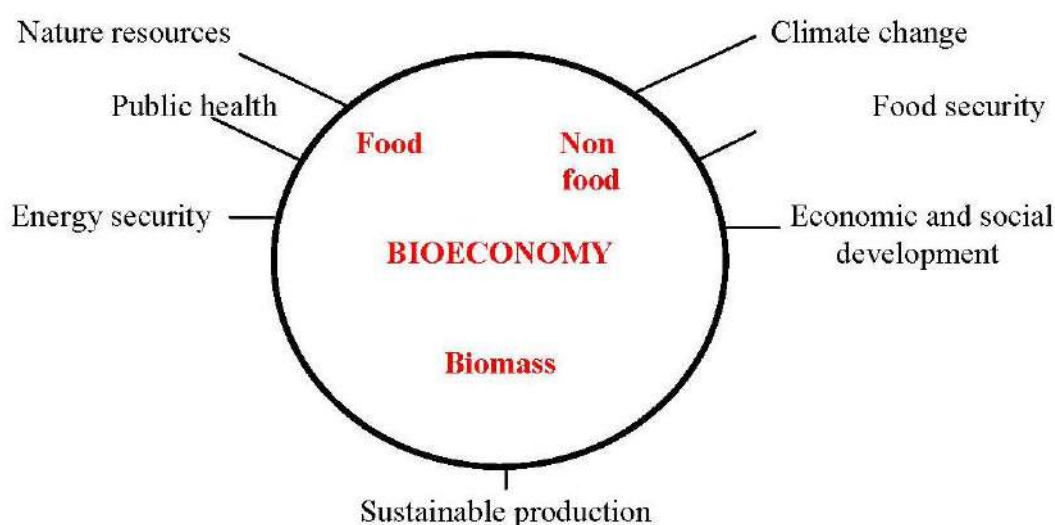


Fig.1. The bioeconomy concept\*

\*Source: [6].

The development of the bioeconomy requires successful innovation. Biotechnologies R&D must be performed, paid for, and result in commercially viable products and products. This process is influenced by many factors, including regulatory conditions, intellectual property, human resources, social acceptance, market structure, and business models. Social, economic and technological factors will create new business opportunities for biotechnology, requiring new types of business models.

The main business models to date have been the small, dedicated biotechnology firm (DBF) that specializes in research and sells knowledge to large firms, and the large integrated firm that performs R&D and manufactures and distributes products. This structure characterizes the health sector, where there are six times as many DBFs than in agriculture and ten times as many as in industry. In agriculture, gene modification technology has created economies of scope and scale that have driven rapid corporate concentration. Only a few DBFs have been active in industrial biotechnology, as profitability depends on the ability to scale up production. This requires specialized engineering knowledge and large capital investment. Both DBFs and large integrated firms will continue to play a role in 2030.

The two fictional scenarios extend technology trends to 2015 up to 2030, assume a multi-polar world, and include plausible natural and political events that could influence the bioeconomy. An analysis of the scenarios showed that two factors will be key in shaping the future bioeconomy: the quality of governance (defined as the system of regulations and policies that influence the development of the bioeconomy) and the economic competitiveness of biotechnological innovations.

The fictional scenarios describe how a change in the funding system for health therapies could encourage rapid innovation in regenerative medicine. In another fictional scenario, public attitudes result in some biotechnologies not reaching their potential. An example is predictive and preventive medicine, where the advance of this technology is limited by public resistance to poorly planned and intrusive healthcare systems. The fictional scenarios also explore different technological outcomes such as growing competition between biofuels derived from biomass, algal biofuels, and electrical transport systems. Problems with the competitiveness of environmentally sustainable technologies are exacerbated by insufficient long-term, credible support for promising technologies.

One lesson from the scenarios is that the future development of the bioeconomy will be shaped by how governments react to future crises (e.g. those caused by finance, food scarcity or pandemics). The future will also be influenced by international co-operation, especially with developing countries, and incentive structures for research and markets. Incentives influence the types of biotechnologies that are commercially viable and the distribution of its benefits. The structure of incentives can also support environmentally sustainable technologies over less benign alternatives – or the opposite.

In the EU, it is already worth more than €2 trillion annually and employs over 21.5 million people, predominantly in rural areas and often in SMEs [6]. As the bioeconomy develops, some parts will become more efficient and employ fewer people, but this will be more than compensated for by new jobs that are created by other emerging segments, so making the integrated bioeconomy a sustainable provider of employment. Although Europe is one of the largest economies in the world, most activities aimed at supporting the development of the bioeconomy have until now been conducted at a national level. While they may have been individually successful, a lack of coordination has not enabled synergies and economies of

scale to be exploited. The result is that Europe is at a competitive disadvantage compared to other major economies and is in danger of falling behind in terms of basic research, education, innovation and investment. A more cooperative approach must be taken if a strong bioeconomy is to grow, capable of addressing the societal grand challenges.

Table 1

The EU bioeconomy sectors\*

Sector	Annual turnover, bln. €	Employment, (thousands)
Food	965	4400
Agriculture	381	12000
Paper/ pulp	375	1800
Forestry/ Wood Industry	269	3000
Fisheries and Acquaculture	32	500
Bio-chemicals and plastics	50	150
Enzymes	0,8	5
Biofuels	6	150
Total	2078	22005

\*Source: [9].

The EU bioeconomy already has a turnover of nearly €2 trillion and employs more than 22 million people, 9% of total employment in the EU (Table 1). It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries.

The successful bioeconomy needs coherent and integrated policy direction, with key areas being:

Investment in relevant research areas, both within each of the sectors and by encouraging multi-disciplinary programs;

Encouraging innovation to make sure that more of the knowledge developments reach the commercialization stage;

Making entrepreneurship within the bioeconomy a desirable career option;

Providing a skilled workforce by making the various sectors of the bioeconomy attractive career options through secondary and tertiary education;

A streamlined and innovation-friendly regulatory framework which balances both risks and benefits;

Good two-way communication with the public embedded in R&D projects to ensure societal appreciation of research and innovation [6].

Table 2

Action plan of investment support of bioeconomy sectors\*

Action	Time-frame	Actors
Increase EU public funding for research and innovation related to the bioeconomy, with dedicated and enhanced efforts on food security, sustainable agriculture, forestry, fisheries and aquaculture, and bio-based industries (e.g. FP7 and Horizon 2020). Encourage sufficient national public spending on bioeconomy research and development	Short-to long-term	EU, MSs
Strengthen coherence and synergies between EU and national/regional programs that support research and innovation relevant to the bioeconomy, through EIPs and specific public-public partnering initiatives (e.g. ERA-Nets, Joint Programming Initiatives)	Short-to long-term	EU, MSs, Regional authorities
Boost the bio-sciences knowledge base, related emerging technologies and biological research infrastructures, through relevant activities in FP7 followed by Horizon 2020 "Excellent Science Base". Support research and innovation to address bioeconomy-related challenges in FP7 and then Horizon 2020, particularly under "Food security, sustainable agriculture, marine and maritime research, and the bioeconomy" and parts of other relevant societal challenges. Establish close interactions among the respective activities in Horizon 2020	Continuous: Short- to long-term	EU
Cooperate with the EIT and relevant KICs in the area of the bioeconomy, including entrepreneurship promotion activities	Continuous: Short-to-long term	EU
Establish close interactions between the relevant parts in Horizon 2020 and other related EU programs in areas such as education, technology and knowledge transfer and acquisition, competitiveness and SMEs, development aid as well as structural funds - Cohesion policy Funds, Rural Development funds, Regional funds, European Fisheries Funds, etc.	Continuous: Short-to-long term	EU
Outline the main research and innovation concepts and priorities for sustainable agriculture and forestry and for marine and maritime activities under Horizon 2020	Short- term	EU

\*Source: [12].

The EU budget for Europe 2020 proposes an EU Framework Program for Research and Innovation "Horizon 2020" (2014-2020) with an associated budget of € 87.7 billion. It aims to boost Europe's smart, sustainable and inclusive growth by increasing excellence in the science base, promoting competitiveness and industrial leadership, and tackling societal challenges identified in Europe 2020 [10]. Horizon 2020 is expected to address several aspects of the bioeconomy. Research and innovation under several Horizon 2020 societal challenges are clearly related to the bioeconomy, in particular under «Food security, sustainable agriculture, marine and maritime research, and the bioeconomy» – for which a dedicated budget of € 4.1 billion has been proposed – but also under parts of other challenges such as «Climate action, resource efficiency and raw materials», «Secure, clean and efficient energy», «Health, demographic changes and wellbeing» and «Inclusive, innovative and secure societies». This will be complemented by actions to promote «Industrial Leadership and Competitive Frameworks», through the development of various enabling technologies including several relevant to the bioeconomy (biotechnology, nanotechnology, ICT, advanced materials, manufacturing and processing, and space), as well as by supporting innovation in SMEs and providing access to risk finance. The European Institute of Innovation and Technology (EIT) with its Knowledge and Innovation Communities (KICs) in different areas will also address questions related to the bioeconomy. This applies in particular to the theme «Food4future», which has been suggested for one of the KICs to be selected after 2014. Finally, Horizon 2020 research and innovation under «Excellent science base» has also a high potential to contribute to progress across various bioeconomy sectors – through general support to frontier research, future and emerging technologies, research infrastructures and to research training and career development [11]. Recognizing the need for increased coherence among research and innovation funds and in order to achieve the greatest possible impact of EU funding, Horizon 2020 will also aim at developing closer synergies with national and regional research and innovation programs (e.g. through public-public partnering), as well as with other EU programs (e.g. in education, competitiveness and SMEs) and funds, such as the structural and Cohesion Policy funds. This will help strengthening national and regional research and innovation capacities and skills, also in the context of the bioeconomy.

PPPs will equally be sought, for research and innovation agendas which are of strategic importance to EU competitiveness and to address societal challenges, including in the bioeconomy. Commission services are exploring the possibilities for establishing a PPP on bio-based industries [12].

**Conclusions.** An ability to rapidly innovate within commercial contexts is just one component of the bio-economy. Regulatory and funding environments are crucial components of the system, with government setting priorities by its preferences. But the massive funding supplied by governments should be put in perspective. While significant government support was crucial to the eventual success of aviation and of desktop computers, in both cases commercialization was driven in large part by innovators operating literally in garages.

The development of the bioeconomy requires successful innovation. Biotechnologies R&D must be performed, paid for, and result in commercially viable products and products. This process is influenced by many factors, including regulatory conditions, intellectual property, human resources, social acceptance, market structure, and business models. Social, economic and technological factors will create new business opportunities for biotechnology, requiring new types of business models.

The increasing demand for a sustainable supply of food, raw materials and fuels, together with recent scientific progress, is the major economic driving force behind growth of the bioeconomy in Europe over the last few decades. The bioeconomy – the sustainable production and conversion of biomass, for a range of food, health, fiber and industrial products and energy, where renewable biomass encompasses any biological material to be used as raw material - can play an important role in both creating economic growth, and in formulating effective responses to pressing global challenges. In this way it contributes to a smarter, more sustainable and inclusive economy. It is estimated that the European bio-economy currently has an approximate market size of over 2 trillion Euro, employing around 21.5 million people, with prospects for further growth looking more than promising. In addition to being economically favorable, the bioeconomy can help to meet the most urgent global challenges improving public well-being in general. Areas that it can benefit include social and demographic development and its impact on agriculture, the growing pressure on water, the threat of climate change, the limited resources of fossil fuel, the need for sustainable development, the impact of changes in lifestyles and eating habits, the demand for safer and healthier foods and the prevention of epizootic and zoonotic diseases.

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#### СУЧАСНА ПАРАДИГМА РЕФОРМУВАННЯ СВІТОВОЇ ФІНАНСОВОЇ СИСТЕМИ

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##### Медведкіна Є.О. Сучасна парадигма реформування світової фінансової системи.

Доведено необхідність комплексного реформування існуючої системи міжнародних фінансових організацій в напрямі підвищення їх репрезентативності та ефективності реагування на нові економічні виклики, а також масштабний перегляд основ сучасної глобальної фінансової архітектури та переходу до нової світової валютної системи. Обґрунтована необхідність усунення розривів у міжнародній архітектурі боргових відносин на засадах розробки комплексного механізму регулювання державної заборгованості за умови використання новаторських форм подолання кризи заборгованості, включаючи наступні: формування схем незалежного арбітражу або посередництва або надання додаткової допомоги в організації спеціальних нарад боржника з його кредиторами; надання права на участь в ініціативі відносно бідних країн з великою заборгованістю з метою забезпечення можливості участі в ній будь-якої країни з низьким і більш низьким середнім рівнем доходів, уразливої в плані виникнення боргових проблем.

**Ключові слова:** парадигма, світова фінансова система, реформування, «пекінський консенсус».

##### Медведкіна Е.А. Современная парадигма реформирования мировой финансовой системы.

Доказана необходимость комплексного реформирования существующей системы международных финансовых организаций в направлении повышения их репрезентативности и эффективности реагирования на новые экономические вызовы, а также масштабный пересмотр основ современной глобальной финансовой архитектуры и перехода к новой мировой валютной системы. Обоснована необходимость устранения разрывов в международной архитектуре долговых отношений на основе разработки комплексного механизма регулирования государственной задолженности при условии использования новаторских форм преодоления кризиса задолженности, включая следующие: формирование схем независимого арбитража или посредничества или предоставления дополнительной помощи в организации специальных совещаний должника с его кредиторами; предоставление права на участие в инициативе относительно бедных стран с крупной