Industrial production in the bioeconomy: directions and prospects

Aminat Khagaeva*,[1], *Laura* Karaketova[2] and *Svetlana* Chernova[3]

[1]Kadyrov Chechen State University, Grozny, Russia
[2]North Caucasus State Academy, Cherkessk, Russia
[3]Dagestan State University, Makhachkala, Russiaand

Abstract. The modern innovative economy is characterized by global transformation processes caused by revolutionary changes in the natural sciences, and, above all, in biological science. This is explained by the fact that biology has reached the molecular and subcellular level due to inter- and transdisciplinary approaches to its development, where a synergistic effect is achieved through the scientific cooperation of biology, economics, physics, chemistry, mathematics, cybernetics and information technology. Ultimately, this symbiosis led to the formation of a new direction in science - bioeconomy. The new direction is based on biotechnologies, which, as scientists note, are characterized by scientific diversity, since the development of biotechnologies depends on fundamental knowledge, practical skills and innovative technologies in other fields of science.

1 Introduction

The main prerequisites for a bioeconomy are: food shortages due to population increased in the world; minerals, raw materials and energy resources are finite. Accelerating the pace of technology development in conditions of singularity is accelerating the pace of technology development, accelerating the pace of. In addition, scientists have identified the main prerequisites for the development of an ecosystem: space research is underway, quantum computing will change man's mental model by transforming science, rapidly develop biotechnology as a field of science, quickly expand the pace of technology development in conditions of singularity. The factors that are important for the development of an ecosystem: food shortages due to population growth in the world; finiteness of minerals, raw materials and energy resources; environmental pollution and environmental harm; acceleration of space exploration; quantum computing will change his mental model by transforming science, rapidly develop nanotechnology as a field of science, transformation of science, rapidly develop biotechnology as a field of science, transformation of science, rapidly develop biotechnology as a field of science, transformation of science, rapidly develop biomedicine and nanotechnology as a field of science, transformation of science, rapidly develop biotechnology as a field of science, transformation of science, rapidly develop nanotechnology as a field of science, accelerating the pace of technology

*Corresponding author: khagaeva.amina@mail.ru

development in conditions of singularity. You can expect an improved quality and length of human life. This will lead to an improved quality and length of human life. Almost all academic and scientific economic economists think that the fifth (and main) factor in economic growth, development and modernization of modern states is knowledge. By 2030-2050, only those countries that actively use new knowledge and are knowing about the world's development will be capable of gaining economically develop by 2030-2050. Only those countries that actively use new knowledge and are knowledge-intensive will be capable of gaining economic. The above conditions (circumstances) oblige modern society to move into mechanisms for managing balance in terms of resources that are limitably used and the consequences from this, as well as with respect to waste that is responsible for causing an environmentally harmful effect. In bioeconomics, the new paradigm is called “bioeconomics”, and it solves this problem. The human use of natural potential on renewable basis will be included in the bioeconomy transition. It is planned to protect nature's resources, that is, its protection (conservation) will be included in the transition to bioeconomy. At the moment, there is no consensus on the definition of bioeconomy or, as it is also used in other languages: “green” economy. More than a lot of work by both Russian and European researchers has been devoted to the definitive aspect of bioeconomics, but despite this, at present there is no consensus on the definition of bioeconomy or, as it is also used, “green” economy.

2 Research Methodology

The experience of economic development in Russia has shown that the Russian economy has significant shortcomings in the implementation and development of innovative technologies, in particular in the field of biotechnology. Awareness of this fact came very sharply during the last global financial crisis. However, what prerequisites for this situation can be identified? Division of science into academic and applied. Unfortunately, this division is still widely used not only by scientists, but also by organizations funding various scientific projects. All this leads to the fact that it becomes impossible for the project to move from the stage of scientific research to the implementation stage, because funding is “targeted” only for fundamental research. In addition, most classical universities “profess” only an academic approach to science, putting the student on the path of a classical scientist with the impossibility of using his knowledge in any other way. Until now, even interdisciplinary programs are a rarity in classical universities, but it is precisely they that lead, first of all, to promising innovative projects. Lack of basic skills in the basics of project management. Scientists' knowledge of the elementary fundamentals of economics and project management will significantly increase the likelihood of identifying innovative projects. At the moment, the situation is developing: people who are interested in innovative technologies do not know where to find them, and scientists involved in such technologies do not even realize that their developments can be successfully implemented. Lack of a logical structure for identifying and financing innovative projects. At the moment, there are many effective tools for the implementation of modern biotechnologies, such as venture funds, private investments, grants from enterprises, etc.

3 Results and Discussions

Thus, innovations in biotechnology have significantly changed many things in the life of modern society - from food to medicines and cosmetics, from packaging to industrial production technologies used in veterinary medicine and the agro-industrial complex, as well as medicine, pharmaceuticals and the industrial complex. Today, biotechnology is a

powerful branch of production that has changed the quality of life of modern people, structured the sectoral diversity of the national economies of countries around the world in a new way and created a new economic vector of development - the bioeconomy. In international practice, a color classification has been established for the use of biotechnology methods in industry, reflecting the global scale of biotechnology penetration into the world economy [1]. The color classifier of innovations in the economy based on biotechnology is presented in the most popular areas of growth of the modern economy and its individual sectors: “white” - industrial production; “red” - medicine and pharmaceutical industry; “green” - agriculture, including veterinary medicine and animal husbandry; “gray” - the branch of natural resource and environmental protection, bioremediation (the use of living organisms for detoxification and reducing the concentration of pollutants); “blue” – artificial cultivation and processing of aquatic organisms [2]. Such a wide coverage of biotechnologies in sectors of the national economy in the world today forces experts to talk about the formation of a bioeconomy. The breadth of the use of innovative biotechnologies in the economy is confirmed by the fact that a classifier for the use of biotechnological products in various spheres of human activity has been added to the classifier for the sectoral division of biotechnologies. Thus, in addition to the main sectors of the national economy that use biotechnological products, the biotechnology industry is also divided according to the use of special types of innovative products [3]. The first and most popular type of innovation in the modern bioeconomy is called bionics. The main task of this innovative direction is the use of the properties of living organisms in the technical devices of modern machines and equipment, materials and designs of various devices and buildings. Innovations of this kind can be found in modern metallurgy, modern technologies in industrial design. Today, no one will be surprised by concerns that use the achievements of the natural evolution of the animal and plant world in technical devices. For example, the structure of the wings of modern aircraft and the similarity of the principles of flight and the structure of the wings of birds; 3000 thousand years ago in China they borrowed biotechnologies for making silk from insects, and today, based on the DNA of insects, scientists have created an artificial analogue of a silk-like web (Kevlar). Modern bionics is engaged in the search and copying of natural know-how, which, having undergone evolution over millions of years, turned out to be more effective than engineering and scientific technologies. Thus, deer antlers are much stronger than ceramics, although the molecular and structural composition are similar. Today in design, ceramics using various catalysts imitate the millennia-old achievements of nature, making design and engineering structures many times stronger. The principle of the honeycomb structure is taken as the basis for the production of durable architectural structures in construction. The golden ratio is used not only in construction, but also in physics, mathematics and engineering. The following example of the effective use of bioresources (waste-free production) is R. Fücks's example of the effective use of bioresources (waste-free production): a chemical plant in Bavarian Straubing uses an electroreactor that produces wheat and wheat gas from wheat straw, which is capable of processing 4,500 tons of straw per year and producing 1,000 tons of ethanol: a chemical plant in Bavarian Straubing uses a bioreactor that produces cellulosic ethanol from wheat straw, which is capable of processing 4,500 tons of straw per year and producing 1,000 tons of ethanol by reusing straw for years and producing 1,000 tons of ethanol. In order to build a new economic system, the systemic (biosystemic) approach to building an unified living organism is assumed that man and nature form one mechanism in which all activities, like puzzles putting together mosaics, create itself as single living organism. . The truth is that in the construction of bioeconomy, it should not be limited to systematic approaches, since the organization of waste-free production is possible both on the basis of a systematic approach and a synergistic effect. They are interrelated. This two principles are interrelated. R. The

work of R. Fuchs in his work gives a classic example of the combined systemic and synergetic effects, that is eco-agriculture: an ideal example of this kind of combination of systemsic and synergetic effect with one other – it is ecological agriculture. A basic basis of bionics (which is, the translation of biological process and structure into new products or technology) consists of learning from nature. It is possible to study simple biotechnological transformations in substances that occurring in nature itself, as well as the transfer of natural processes into real production.

Table 1. Indicators of beneficial use of raw materials in the production of final products

Raw materials (biomass)	Production of final products	Beneficial use of raw materials, %	Rest biomass
Woody biomass	Cellulose	30	Black alkali containing lignin and hemicellulose is burned
Sugarcane biomass	Sugar	17	The cementitious substance suitable for the production of gypsum fiber sheets is burned
Plant biomass (palm oil)	Biological detergents	5	The rest of the biomass goes to waste
Fish biomass (caught fish)	Useful fish catch	70	The rest of the dead fish are thrown away as useless catch

From the perspective of the symbiotic approach, it is important that the bioeconomy combines phenomena that have hitherto been incommensurable: business and sustainability, ecosystem services and industrial use, biomass and products for mass consumers, etc. The basis of a country's sustainable economy is effective industrial symbioses, hybrids, new raw materials, as well as biologically based processes. According to the symbiotic approach, at the center of the bioeconomy are biotechnologies, the nature of which, according to scientists, is interdisciplinary in nature. The relationship between biotechnology, economics and other sciences is clearly shown in Fig. 1.

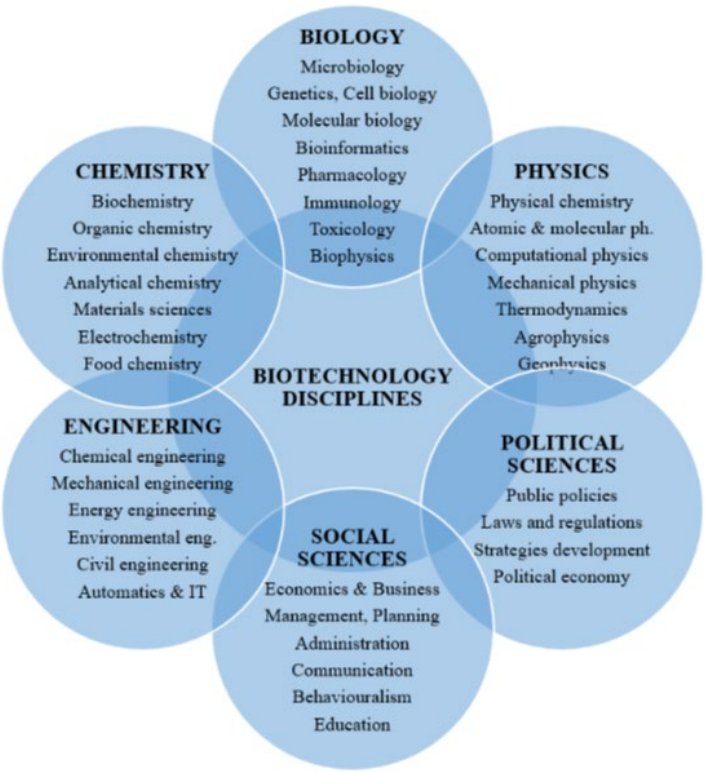

Fig. 1. The relationship between biotechnology, economics and other scientific disciplines

New biotechnologies, such as biopolymers, are also emerging, which can be quickly distinguished into one direction of biotechnology development.

In addition to the development of an integrated bioeconomy based on the principles of interdisciplinarity, transdisciplinarity and multidisciplinarity of biotechnology, other processes have been intensively taking place since the end of the 20th century. For example, global and intensive digitalization has led to a dramatic increase in the general level of people's knowledge. Modern higher education systems face a dilemma: what to prefer - transferring highly specialized (hard) or universal competences to students. In this regard, modern higher education systems face the dilemma of what competencies should be transferred to students: highly specialized (hard) or universal. While the traditional education system was based on highly specialized competencies, the 21st century education system is based on universal and inflexible competencies (cognitive skills, systemic skills and systemic competencies for solving complex problems; the 21st century learning system is based on universal and flexible competencies (systemic skills), skills for managing resources, technological means and methods of learning, as well as social and productive skills such as physical competence). In recent years, according to Moore's law, all production in the world tends to be downsized, which is why the production of nanotechnology, including bionanotechnology, is most active. Most countries in the world are investing heavily in the development of nanotechnology products. Therefore, the share of global investment in nanotechnology development in the 21st century. The whole world is actively investing in the development of priority nanotechnologies, including bionanotechnologies, and Russia, in turn, had only just begun its first attempts to enter this market and invest in nanotechnologies (mainly biotechnology) by 2011. The growth of nanotechnology indicators for the world and Russia is shown in Figure 2.

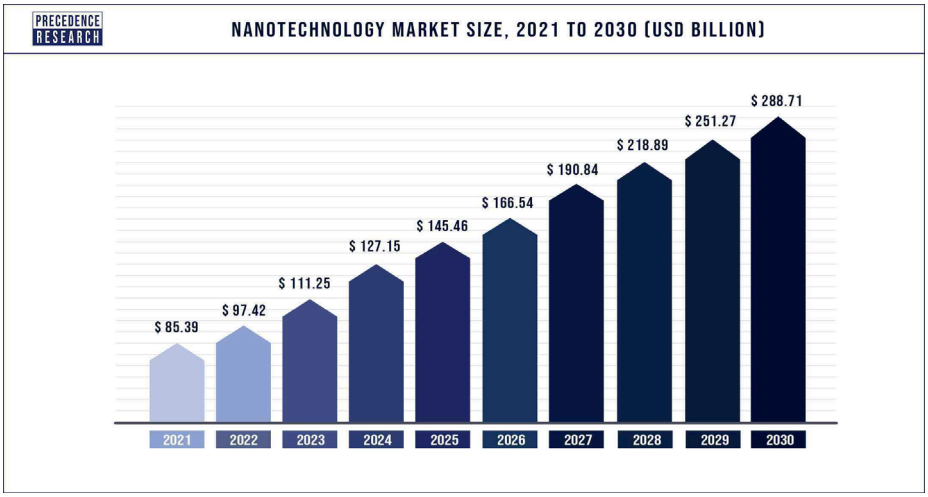

Fig. 2. Nanotechnology Market Size

4 Conclusions

The benefits of bioeconomic development can be seen in various company examples. For example, St1 Biofuels has successfully produced automobile fuel from bio-waste. It is clear that the development of the bioeconomy is positive. However, there are a number of obstacles to this development. These include financing problems and lack of public awareness of the bioeconomy. Most important is the moral dimension. After all, biotechnology involves the use of living organisms and includes genetic engineering, cloning technology and various methods of artificial reproduction. This century will be a century in which new biotechnologies are developed and widely used in the economy. However, it is important not to create new problems while solving existing ones. State control and regulation will play a key role in this regard. It is important to stick to this approach because 'bioeconomics' as an independent scientific discipline does not have a unified theoretical basis. In other words, bioeconomics can be seen as a symbiosis of the theory and practice of various sciences (disciplines). In particular, the knowledge (cognitive) approach sees the knowledge and cognitive concepts of economics as the basis for the formation of a new bioeconomy that integrates and 'builds' around itself all other sciences, especially medicine and biotechnology. Clearly, the authors approach the nature of the bioeconomy from a theoretical or cognitive perspective.

References

1. G. Arnason, Synthetic Biology between Self-Regulation and Public Discourse: Ethical Issues and the Many Roles of the Ethicist. Cambridge Quarterly of Healthcare Ethics, **26(2)**, 3 (2017)
2. K. Bruynseels, Responsible innovation in synthetic biology in response to COVID-19: the role of data positionality. Ethics and information technology, **23 (Suppl 1)**, 1–9 (2020)
3. M. A. Dovletmurzaeva, M. A. Dzhamaldinova, E. S. S. Kukaeva, Management of current assets at industrial enterprises, **4(5)**, 338-341 (2022)

4. M. A. Dovletmurzaeva, Features of regulation of innovation activities of enterprises, **4(28)**, 69-74 (2022)
5. S. D. Zaugolnikov, M. M. Kochanov, A. O. Loit and other, Experimental methods for deter-mining the toxicity and danger of chemicals, 184 (1978)
6. I. E. Ilyin, Study of the toxicity of surfactant transformation products formed in the process of water chlorination, **2**, 11-14 (1980)
7. A. A. Korolev, M. V. Bogdanov, B. R. Vitvitskaya, Hygienic assessment of surfactant degra-dation products during water ozonation, **1**, 16-19 (1975)
8. A. A. Korolev, G. N. Krasovsky, Methods of hygienic assessment of the products of trans-formation of chemicals in the aquatic environment, 48-50 (1979)
9. A. S. Salamova, Socio-economic factors in the fight poverty and hunger in the modern world: the scientific approach of Amartia Kumar Sen, **17(1)**, 237-245 (2023)
10. A. S. Salamova, Global networked economy as a factor for sustainable development, 03053 (2020)
11. T. Yu. Zheleznova, E. D. Weisman, The Manager, **13(2)**, 2-19 (2022)