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## Features of International Cooperation and Development of Bioeconomics and Natural Resource Economics.

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### ABSTRACT

In connection with the change of technological orders reaching as always parallel to the instability in the external environment, global economic problem of creating an effective system of control bio-economic cooperation at the international level has recently become even more relevant. The main purpose of the system was the structural analysis of bio-economic cooperation between Russia and Germany in the development of the biotechnological branch of science in the European Union. In this paper the generalized economic analysis of the development and the growth prospects of international cooperation in the bioeconomics and Natural Resource Economics on the basis of a literature review and the authors' calculations is presented.

**Keywords:** biotechnology, policy, environmental economics, bioeconomics

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## INTRODUCTION

Problems of a financial crisis in the world economy in 2008 for a period of time slowed down its development, partly transforming its structure [1-2]. But by 2010, after the recession of the early years, it began a slight rise in most countries of the world economy. Bioeconomic branch in the years in the leading countries of the world has come into a new stage of development [3].

This study continues the analytical retrospective review of the processes, which have taken place in this period. The particular interest in the frame of this work presented the works aimed at the effective inter-state development. The issues are both interesting within the analysis of the introduction bio-economic problems in the educational sphere of higher education, the real economy and the financial sector [4-17].

## METHODS

In this paper, by using abstract logical, economic and statistical, monographic, deductive-inductive and other economic research methods different aspects of international cooperation in the field of bio-economic cooperation are analyzed, the most effective systems

## THE MAIN PART

### International experience in the development of biotechnology

In the last pre-crisis 2007, in the whole European Union the number of biotech companies amounted to more than 1 700 of which publicly traded are only 180 and which income is the total amount of 13 bln. \$. The major centers of generation of biotechnology in Europe have been in those days, and remain today, the UK and Germany, and only partially France. The UK is a leader in terms of funding attracted to the industry - about a third of the volume invested across Europe. Germany is ahead of its neighbors on the investments of venture capital in the biotechnology industry - this figure is 2 times higher than the average in the region. Also in Germany relatively to other EU countries there is a large number of institutions and research institutions specializing in the field of biotechnology. Therefore, in this paper more attention will be given to the development of the bioeconomics in this country.

In general, despite the fact that the economy of the biotechnology industry in the EU is developing a significant period of time, the theme of the development of biochemical products in the EU research programs for a long time played a minor role, but starting from the 7th Framework, Framework (FP7), and subsequently in within the Horizont 2020, the situation has changed significantly.

During the early years of its development have been financed projects to identify integrated concepts in matters of processing biological substances amounting to more than € 70 million. The contents of these projects were extremely varied, but for the most part involved the development of new processes for the processing of biological substances and products, the optimization and upgrading of existing conversion processes and industrial-scale demonstration of research results.

During the reporting period of time the countries of the European Union observed the rapid development of biotechnology, especially in such areas as 4: production of biopharmaceuticals (proteins, enzymes, antibodies) for humans and the correction of the genetic code ("red"); development and introduction to the culture of genetically modified plants ("green"); biofuels, enzymes and biomaterials for various industries ("white"); academic and government research.

In the development of biotechnology in Germany at that time took part 678 enterprises, including 126 large transnational corporations (mainly pharmaceuticals and chemicals, producing a wide range of products, one of the species of which are biotech products) and 552 - companies that are specialized solely on biotechnology and genetic engineering (in 2011 their turnover totaled \$ 2.6 billion €, while 1.8 billion € had to biopharmaceutical companies).

From 552 dedicated biotechnology companies, only 30 companies had at that time in the state of more than 100 employees, 8 - more than 250, remaining - from less than 10 to 50 employees. These

businesses are based mainly in Bavaria, Baden-Württemberg, Berlin, Brandenburg and Westphalia. In general, during this period the number of employees in German biotech averaged about 16-18 thousand people. The largest enterprises are "Qiagen" (more than 1.4 thousand employees), "Miltenyi Biotec" and "Rentschler Biotechnologie".

The promoting of scientific and practical work in the field of biotechnology, the German government has developed a national program of development of the industry "BioIndustrie 2021", which aims to reduce the time of implementation of the research results into production.

During this period, investment in the sector under this program were at an average of 60 million €, but according to the findings of the forecasts of the government program in the coming years it should expand 150 million €.

In addition to the "BioIndustrie 2021" strategy was developed "Nationalen Forschungsstrategie Bioökonomie 2030", in which were carried out numerous actions, including the "Industrial Biotechnology Innovation Initiative" (investment in that over the next 5-10 years, in accordance with the said plan should reach 100 million €), "Global food security", "Security of Biological Research", as well as projects for the study of bio-processing of raw materials.

Enterprises engaged in research and development in biotechnology, Ministry of Education and Research of Germany in the years were provided by financial support in the amount of 30 million € per year. In 2010, according to the Ministry, the total investment in biotechnology has reached a record 700 million €, after which there was a sequestration: 83% of them were sent to the "red" biotechnology. In 2011, according to the ministry, the investment in the biopharmaceutical industry totaled 975 million €, of which 46 million fell to private companies (2010 - 59 million.).

Much of the research on biotechnological processes is carried out at universities in Germany (in 2010 - 2015), more than 65% of which have the capacity for the implementation of the results in industrial production.

Along with the university complex in the scientific sector another 36 research centers are employed, including the "Max-Planck", "Helmholtz", "Leibniz", "Fraunhofer". Centers, specializing in research on genetic engineering, are based mainly in the cities of Bielefeld, Goettingen, Greifswald, Marburg and Braunschweig in the field of industrial biocatalysis and fermentation - in Hamburg, in the food industry - Vayenstefane, Giessen and Stuttgart.

In the last years of the analyzed period, biotechnology and genetic engineering are playing an increasingly important role in the manufacture of pharmaceutical products, as well as in the fields of diagnostics and therapy in Germany and in the world in the whole. According to the Ministry of Education and Research, 48% of enterprises in the sector has been involved in this period in the "red" biotechnology, and 84% of universities has been developing at least one of its destinations.

The highest percentage of drugs designed on the basis of biopharmaceuticals, applied in areas such as the treatment of immune system diseases (74%), as well as cancer (32%) and hematology (23%). They are also administered in the treatment of cardiovascular diseases, infectious diseases, veterinary medicine and other sectors.

Scientific and technological development, even in a country like Germany, is impossible without international cooperation. In this article the authors examined the analysis of the interaction within the framework of Germany and the Russian Federation.

#### **International cooperation in the field of biotechnology**

Despite the significant amount of the measures aimed at developing international cooperation in the field of biotechnology in Russia in the 2000s, only in the first years of the 2010s in this area tangible effect was obtained [18-24].

The result could be achieved largely due to the effective implementation and the development of mechanisms to enable foreign scientists in research projects and innovative programs in Russia, which in turn was implemented by the state to support the functioning of technological platforms biotechnological nature [25-27].

When the currently existing instability in international relations of the Russian Federation with most of the leading countries of the world, the situation of international cooperation in the field of biotechnology in Russia remains stable, as evidence to which is the composition of the regularly scheduled events on the subject of the Russian Federation [28]. The dominant point in the framework of these relations over the years is Russian-German cooperation.

As formulated Gabrielle Gortska, coordinator of German-Russian biotechnology cooperative union, "Cooperation in the field of science, technology and innovation (scientific and technical cooperation) between Germany and Russia has a long tradition that was born more than twenty years ago, which was given additional impetus in 2005 due to the "Initiative on strategic partnership between Russia and Germany in the field of education, research and innovation". [29]

Contractual and legal basis of Russian-German cooperation in the field of science and technology today is the "Agreement between the Government of the Russian Federation and the Government of the Federal Republic of Germany on scientific and technical cooperation" from December, 28, 2008, which replaced the previous agreement in force from July 22, 1986

In order to coordinate activities related to the implementation of this Agreement, the Parties have established the joint Russian-German Commission for Scientific and Technological Cooperation, whose objectives were:

- review and approval of recommendations and proposals on issues related to the creation of favorable conditions for the implementation of the Russian-German scientific and technological cooperation;
- analysis of the results of cooperation undertaken under this Agreement;
- clarification of the priorities of cooperation undertaken under this Agreement, development of cooperation programs;
- consideration of measures aimed at promoting cooperation and enhancing its effectiveness in accordance with this Agreement;
- discussion of other issues related to the implementation of this Agreement.

Target areas of cooperative research groups of the two countries are currently regulated by a number of specialized treaties of the interdepartmental character, such as: information and communication technology; nanotechnologies and nanomaterials; life sciences and biotechnology; ecology and environmental management; marine and polar research; space exploration; energy and energy efficiency; transportation.

These directions are implemented in accordance with the protocols of the Joint Commission of the Russian Federation and the Federal Republic of Germany on Scientific and Technical Cooperation and the protocols of working meetings of representatives of the Federal Ministry of Education and Research of the Federal Republic of Germany and the Ministry of Education and Science of the Russian Federation. Since the signing of this agreement, it is worth noting just a few of the major activities that have been implemented over the past 5.5 years:

Participation in the international project construction and operation of the European X-Ray Free Electron Laser (XFEL).

On November 30, 2009 in Hamburg was signed intergovernmental "Convention on the construction and operation of the European XFEL", which was to determine the procedure and conditions for the construction and operation of the member countries European XFEL (European XFEL).

The corresponding preparatory work was conducted by the interdepartmental negotiating group led by the Russian Ministry of Education in accordance with the Decree of the Government of the Russian Federation

N1025-r "On the participation of the Russian Federation in the construction and operation of a European XFEL".

XFEL project has great potential for the study of chemical and physical processes occurring in the material, will enable a new level of research in physics, chemistry, materials science, life sciences, biomedicine.

In the context of the mentioned problems of particular importance is the development of this program of collaborative research in the life sciences under section of structural proteomics, which at that time were made on the bases of the branch of the European Molecular Biology Laboratory (DESY, Hamburg), and the Russian Research Center "Kurchatov Institute" in conjunction with a number of other institutes of RAS.

A framework agreement on the establishment of the Ioffe Institute - X-rays was signed in February, 2012.

On the German side partners are research centers association named Helmholtz, which include DESY, and on the Russian side - the Kurchatov Institute. Scientific programs and a roadmap of the joint Russian-German Research Institute Ioffe-Roentgen are approved.

Main directions of fundamental and applied research of the National Research Centre "Kurchatov Institute", carried out in priority areas of science and technology in the Russian Federation, to establish a program of joint activities of organizations involved in the pilot project on creation of the National Research Centre "Kurchatov Institute", on 2013- 2017, adopted by the RF Government Decree of 20 December 2012 №2440-d.

#### **Agreements of interdepartmental nature on the sector of life Sciences and biotechnology of the Russian-German interaction**

Turning in more detail on specific agreements, interdepartmental nature of the sector life sciences and biotechnology Russian-German cooperation in these years was carried out in the framework of the "Agreement on Cooperation in the field of biological research and biotechnology."

It is worth noting that this cooperation is an important tool for the acceleration of innovation processes in the emerging VI technological structure, largely biotechnologically-centered. Here, on the one hand we are talking about uniting the efforts and collaboration of leading scientific experts in the fields of advanced biotechnology research, and on the other - on the use of international technology transfer process for the rapid commercialization of scientific results.

Many years of experience in international cooperation has shown that one of the most effective tools to identify joint research priorities and programs for the development and implementation of joint projects is a joint organization of symposia, conferences, seminars and forums.

In those years the main coordinator of this cooperation in the area under consideration, in accordance with the request of the Ministry of Education and Science of the Russian Federation (FASI-number 2046 from 20.08.2008) is the Russian National Contact Point "Biotechnology, agriculture and food" (Institute of Biochemistry RAS named A.N. Bach).

The forerunner to implement measures in the framework of the agreement can be considered a holding as a part of the V International Symposium "EU-Russia cooperation in the field of biotechnology, agriculture, forestry, fisheries and food in the 7th Framework Programme of the EU" of the Russian-German Forum for Biotechnology (01- 03.10.2008).

The Forum was attended by representatives of ministries and departments in Germany and Russia, the Association of German biotechnology companies (DBU), the Moscow Representation of the Helmholtz Association, the Moscow Representative Office of the German Research Society (DFG), RFBR and other officials.

A significant event was the participation of representatives of Cluster Industrial Biotechnology in Germany CLIB2021 in the Forum. Following the Forum Co-operation an agreement on joint work on the project "German-Russian Cooperation Network Biotechnology Union" was signed.

Cooperation is carried out within the framework of the Inter-Ministerial German-Russian agreement on cooperation in the field of life sciences and biotechnology and prolonged every 3 years until 2014.

The German participants of the project are funded by Federal Ministry of Education and Research, BMBF, in the amount of 1.1 million € for 3 years. During the Forum of 2008 the Russian-German working meeting on the theme of preparation of the inter-ministerial meeting of the Russian-German working group on biotechnology was held.

The working meeting noted the need to develop effective mechanisms for the support and implementation of joint coordinated projects in biotechnology, joint priorities have been fixed. The resolution of the Forum laid a solid base in the said Agreement in the direction of "life sciences and biotechnology."

An important initial step in strengthening the development of cooperation in this five-year period Session of the Joint Commission of the Russian Federation and the Federal Republic of Germany on Scientific and Technical Cooperation held from 11 to 12.03.2009 in Bonn is worth noting. As part of the meetings were concretized identified principles for the development of joint innovation.

In addition, in 2009, the Ministry of Education and Science, Federal Agency for Science and Innovation (Russia) and the Federal Ministry of Education and Research (Germany), taking into account the identified priorities were supported by 5 Russian-German projects in the areas of biotechnology: the technology of bioengineering; biomedical technology and the protection of human life-support; cell technology; genomic and post-genomic technology of medicines; biocatalytic, biosynthetic and biosensor technology.

In the development of the results achieved from 11 to 13 November 2009 (Moscow, Russia) tubing "Biotechnology" (INBI RAS) jointly with the German-Russian cooperation Biotech Union, with the support of the Ministry of Education and Science of the Russian Federation and the Federal Ministry of Education and Research of Germany held a forum "Russia and Germany in the common European space: the German-Russian Cooperation Network Biotechnology Union."

Forum demonstrated the high level of research and a great interest in the activities of the scientific communities of the two countries in particular have been registered 40 European participants (among them - 36 German) and 365 participants from the Russian side.

According to the results of the sessions and meetings have been identified joint research priorities in the relevant areas and joint activities for 2010, as reflected in the following organizational documents signed by the co-chairs of each of the sections, in the Memorandum of Understanding Sessions I «Industrial Biotechnology and biofuels»; the Communication Sessions II «Food biotechnology»; the Communication Sessions III German-Russian workshop on Bioinformatics Network "Computer systems biology".

In addition, within the framework of the said Forum a meeting of the Russian-German working group on biotechnology, in which, based on the agreements reached at the meeting of the working group in October 2008 in Pushchino as the strategic priorities were proposed the following topics: Molecular medicine; Systems Biology and Bioinformatics; Post-genomics and proteomics technologies; Industrial biotechnology.

In accordance with the agreements signed in 2010 by the Ministry of Education and Science of the Russian Federation with the participation of German experts was held joint competition, which resulted in 5 Russian-German projects (4 projects - in "Bioinformatics and Systems Biology" and one project - in "Industry biotechnology") which were supported, respectively, by the Ministry of Education and Science of the Russian Federation and the International Bureau of the Federal Ministry of Education and research.

In the process of carrying out a large amount of important thematic events took place in 2011-2012., the disclosure of which is not possible due to the size of the publication of the regulations, it is worth noting

their resulting, in the form of resolutions, the elements which formed the foundation formed by the State Coordination of development programs for the period up to 2020 "BIO 2020".

The most significant events and their results in 2013 in this area it is worth noting the following:

- March 6<sup>th</sup>, 2013 a meeting of experts of the Russian part of the Working Group, chaired by the co-chairman of the Russian-German Working Group on Biotechnology SV Salikhov, director of the Department of Science and Technology Ministry of Education and Science. During the meeting, experts discussed the prospects of the Russian-German projects in the field of biotechnology within the framework of the federal target programs (analysis of joint tender procedures, examination of applications and results of operations), discussed proposals to update the priorities of cooperation and were tasked core technology platforms on the formation of proposals for the thematic priority areas of cooperation in preparation for the meeting of the Russian-German working group on biotechnology.
- July 18<sup>th</sup>, 2013 in Berlin, Germany, a meeting of the Working Group on Biotechnology. The delegation from Russia headed by co-chairman of the Russian-German Working Group on Biotechnology Dr. S. Salikhov, the German delegation was led by co-chairman of the German-Russian Working Group on Biotechnology Dr Henk van Limpt, head of the 617 - bioeconomics Federal Ministry of Education and Research (BMBF).

Of the total set of joint activities in 2014 should be noted last Russian-German seminar on industrial biotechnology and bioeconomics hold on December 5, 2014.

The event was organized by Cluster Industrial Biotechnology CLIB2021, Institute of Biochemistry named A.N. Bach Academy of Sciences, the National Contact Point "Biotechnology" Technology Platform "BioTeh2030" supported by the Ministry of Education and Science of the Russian Federation, Federal Ministry of Education and Research (BMBF), the German-Russian cooperation Biotechnology Union and the German House of Science and Innovation in Moscow (DWIH).

The purpose of the seminar was to discuss the formation of topics and projects and for their subsequent submission in the framework of the program of Russian-German cooperation in the field of industrial biotechnology and bioeconomics, creating consortia for joint participation in the program "Gorizont2020."

The seminar was attended by scientists of leading scientific centers of Russia and Germany, including the Institute of Biochemistry. AN Bach Academy of Sciences, the Center "Bioengineering" of RAS, Institute of Microbiology, Russian Academy of Sciences, GosNII Genetika, Moscow State University named Lomonosov, the University of Munster, Munich, Giessen, Institute of Fraunhofer Society, Joint Research Centre of the Helmholtz Association, representatives of the German Cluster Industrial Biotechnology, Russian Technology Platform "BioTeh2030" small and medium-sized businesses in Russia and Germany, representatives of the German Research Community (DFG), German House of Science and Innovation in Moscow (DWIH), North Rhine-Westphalia, the German Embassy in Moscow. On-line broadcast of the event was organized on the official website INBI RAS. The portal <http://www.fp7-bio.ru/> lined program of the event, a photo report and the presentation from the conference.

## CONCLUSION

Among the last analyzed the spectrum of activities in 2015 is to provide information day "Innovative entrepreneurship in high-tech: from theory to practice", held on April 21 in biotech business incubator at Moscow State University named Lomonosov, in which discussed issues of Russian-German cooperation and technology transfer. The event was attended by organizations such as the CNT "Biotechnology" tubing "Environment" NC "East-West" of the University of Kassel (Germany), HT NP "Technology Platform Bio-Tech 2030", "Non-Profit Partnership" The technological platform "Technology Environmental Development". Among the planned major events the second half of 2015 the authors identify Russian-German forum "Bioeconomics and biomedicine", which will be held in Pushchino (Moscow region) on November 15-18, 2015. In conclusion, it is worth more time to formulate that in spite of all the instability in the international cooperation between Russia and the EU, including Germany on a large number of issues in recent years - the

situation with cooperation in the field of biotechnology remains stable, healthy, working format that allows both countries to systematically and with the acceleration of building an effective biotechnologically-centered VI technological way.

It is concluded that the instability of the environment, including the global economy, international cooperation in the framework of bio-economic policies to share risks between a plurality of participants in the world economy, as well as allowing the use of state guarantees, is the most viable scheme to attract financial resources for the successful implementation of the transition to the VI biotechnologically oriented technological structure.

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