

## Instruments of International Scientific Cooperation in the Field of Bioeconomy as Driver of Emerging Economies. The Experience of the EU-Russia Cooperation

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### ABSTRACT

The article reflects undertaken worldwide steps to build the bioeconomy. Bioeconomy is a set of industries, from the point of view of economy, and a plurality of cross-industry research, in terms of global science. All this leads to difficulty in understanding the boundaries of bioeconomy, developing within the traditional economies. The article also presents the main instruments of support and development of biotechnology and bioeconomy in Russia, such as the National Technology Initiative (NTI), the Federal Targeted Programme for Research and Development in Priority Areas of Advancement of the Russian Scientific and Technological Complex for 2014-2020 (action 2.2). The influence of the international scientific and technological programs (Horizon 2020, ERA-NET) on the regional economy was also estimated.

### KEYWORDS

Bioeconomy, grants, foundations, international scientific cooperation, research and development, coordinated calls, emerging economies, the EU, US, BRICS, Russia, biotechnology

### ARTICLE HISTORY

Received 22 September 2016  
Revised 15 October 2016  
Accepted 18 November 2016

## Introduction

Nowadays, a number of countries have a structured system of organization and support of scientific research, including the field of biotechnology (United Nations Development Programme, 2001; Juma, 2001). There is also a tendency in the direction of the global bioeconomy that ensured the participation of States in various forms of international cooperation. The process of integration of industrial enterprises into global value chains actively contributes towards bioeconomics trend (Amsden, 2001; InterAcademy Council, 2003; Kim & Nelson, 2000; Liu & Wang, 2003). The integration process is determined by the acute

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need for interdisciplinary research, the creation of consortia and joint efforts and capabilities (World Trade Organization, 2002).

In many areas today there is a noticeable trend of increasing prevalence of private sector in R&D funding (Calof, Richards & Smith, 2015). However, the biotechnology and bioeconomy, historically characterized by state funding. So, it should be noted National Institutes of Health National Fund (NIH) - the largest of the individual entities involved in the financing of biotechnology research in the United States. In the period from 2000 to 2008, the annual NIH budget grew from \$ 18 to 29 billion. Today, that amount is about \$ 32 billion.

Among European countries, Germany is ahead of its neighbors on the investments of venture capital in the biotech industry - this rate is 2 times higher than the average in the region (Biorefineries Roadmap as part of German Federal Government action plans for the material and energetic utilization of renewable raw materials, 2012). In addition, Germany is ahead of other countries in the number of institutions, research institutes and universities specializing in the field of biotechnology (BÖR, 2012).

More recently, it was difficult to talk seriously about the prospects for the development of biotechnology in Russia (Lavrova & Sharova, 2016). Neither the state nor the large business was interested in the industrial, agricultural, forest and environmental biotechnology (Luksha et al., 2013; 2015). The situation began to change dramatically in the last decade and today there is a creation of a common international research space, the establishment of bioeconomy among the priorities of public policy and economic development of Russia (Ufa Declaration of the BRICS Ministers for Science, Technology and Innovation, 2015).

## Materials and Methods

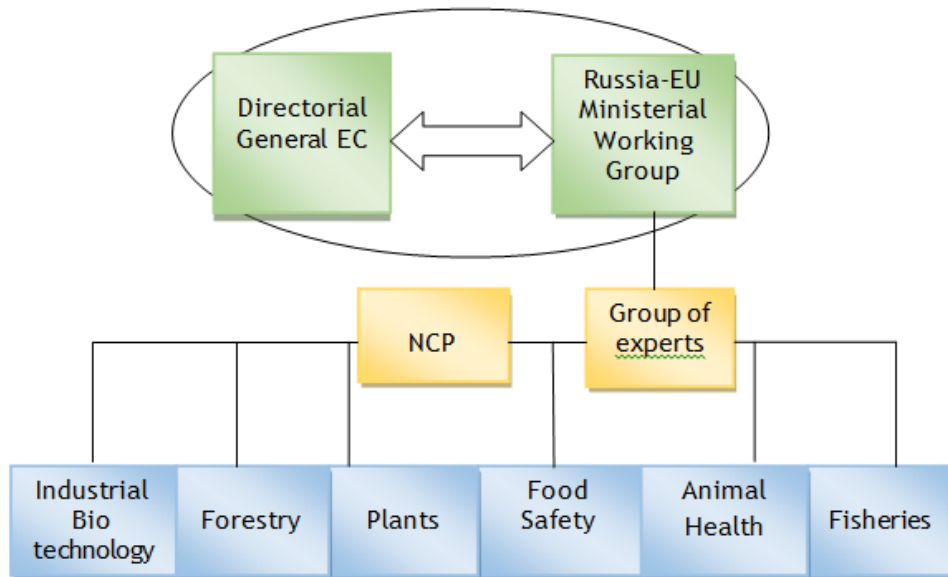
In order to identify trends the sectoral associations, government programs, funds and statistical information were analyzed from open sources.

The Ministry of Education and Science of Russia is supporting Russian researchers in coordinated projects on a competitive basis through the FTP Action 2.2 and 2.1. The main Russian Foundations (Russian foundation for basic research, Russian Foundation for Assistance to Small Innovative Enterprises from the Russian side) and the State Council for Scientific and Technological Development on the part of Brazil; the Department of Biotechnology on the part of India; the Ministry of Science and Technology and the State Foundation of Scientific Researches on the part of China; the State Research Foundation on the part of RSA take part in the BRICS Framework Programme in the area of science, technology and innovation.

The pilot call of the BRICS Framework Programme has been launched. The Russian side agrees upon the procedures for the call launch, the scope of financing on the basis of Call Secretariat rights. Financing of the Russian participants is in the frames of the FTP Action 2.1 (Balashova et al., 2016).

There is the scheme of the Russian R&D Community on the figure 1.

EU-Russia Ministerial Working Group (WG) comprising leading Russian scientists established in 2006 provides a mechanism for decision making. NCP (National Contact Point 'Biotechnologies, agriculture, forestry, fisheries, food security and the bioeconomy') advises to and implements WG decisions.



**Figure 1.** Scheme of the Russian R&D Community

As the result of multilevel communication the Ministry of Education and Science of the Russian Federation approved the list of priorities in Local Russia country page (Agricultural Knowledge and Innovation Systems Towards 2020, 2014).

### Results and Discussions

According to the strategy for 'Innovating for Sustainable Growth: a bioeconomy for Europe', the term 'bioeconomy' is defined as the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy (National Research Strategy BioEconomy 2030, 2011; Vision 2050, 2010). Its sectors and industries have strong innovation potential due to their use of a wide range of sciences, enabling and industrial technologies, along with local and tacit knowledge (BIO 2020, 2012). Today we are talking about the second generation of the bioeconomy - the knowledge economy (The Bioeconomy to 2030, 2009).

Bioeconomy encompasses a wide range of technologies and industries, accompanied by a multitude of value chains. At the same time, biomass is the basis for all biotechnological products and processes, and thus is the starting point of the entire bioeconomy, linking the value chain (VDI-Guideline 6310, 2016).

Comprehensive information about the value of the European bioeconomy is presented in a new study of the biotechnology industry consortium (Bio-based Industries Consortium (BIC) A, 2015). In the study, the macroeconomic effects of the economy (trade, jobs, etc.), identified the amount equal to 600 billion EUR. The study affected the same industry and markets of renewable biological



resources - sea, forest and livestock, such as crops, forests, fisheries, animals and micro-organisms as well as other sector 'bio' orientation - chemical industry and plastics (Kircher, 2012).

An analysis by Eurostat in 2013 reveals the total turnover of bioeconomy data, including beverage and primary sectors of agriculture and forestry, is 2.1 trillion EUR in EU-28. Approximately half of the turnover comes from the sector of food and beverages, is provided almost a quarter of the primary sector, agriculture and forestry. The remaining share is in the chemicals industry, plastics, pharmaceuticals, paper and paper products, wood industry, textile industry, biofuels and bioenergy.

Today packaged solutions to support research, training for industry, supporting innovative enterprises in different countries are designed and launched.

It is very important when implementing new support tools R&D and innovation to take into account the experience of developed countries. So, over the past ten years, the field of agro-industrial complex (and that means a whole range of research, including agricultural biotechnology, food and processing industry) went through several support programs in the EU, some of them will be continued in 2016-2017.

In the period from 2008 till 2013 Thematic EU Environment program and sustainable management of natural resources, including energy (ENRTP - Thematic Programme for the Environment and Sustainable Management of Natural Resources, including Energy) has been implemented, focused on research in the field of agriculture, fisheries, industry, cooperatives.

Training program for controlling authorities on EU legislation in the field of food, feed, animal health and welfare and plant 'The best training to improve food safety' has been launched. According to the updated February 8, 2016 data, the estimated annual budget of EUR 15 million. The initiative was launched in 2005 with the aim of training professionals in the field of food law, feed production technology, animal health and animal welfare rules, as well as phytosanitary standards. Enroll training centers will be able to participate, as an international organization of developing countries, the EU and around the world.

In December 2015 the European Commission adopted a new package of documents designed to help European businesses and consumers to strengthen the circular economy, where resources are used more efficiently. This decision should help to 'close the loop' of the economy, ie, closure of the product life cycles due to the deep processing of raw materials and recycling, that would be beneficial for the environment as well. The transition to a new type of economy (bioeconomy) will be carried out through the instrument of the European structural and investment funds (European structural and investment funds (ESIFs), as well as the financial component of 'Horizon 2020' program (approximately EUR 650 million), EUR 5.5 billion of structural funds for the management of secondary raw materials and waste, and finally investment at the national level.

USDA (US Department of Agriculture (USDA) in May 2016 announced the allocation of 21 million US dollars to support the development of regional systems for the sustainable development of bioenergy and bioproducts, including

education and training of the next generation of scientists that will expand the availability of renewable, sustainable products and energy. This funding is provided under the agriculture and food research Initiative (agriculture and food research Initiative (AFRI), and managed by the National Institute of food and agriculture of the USA (NIFA National Institute of food and agriculture (NIFA).

Thus, a comprehensive approach to the development of biotechnology and bioeconomy demonstrated Group Research Institute of Sweden. In 2015-2016, the Association of Scientific Research Institutes in Sweden (Research Institutes of Sweden RISE) was developed and presented to eight complementary roadmaps towards bioeconomy for the period 2015-2025 years, aimed primarily at sustainable development of forestry and agriculture:

1. The pulp mill biorefinery;
2. Lignin-based carbon fibre;
3. Materials from nanocellulose;
4. Textile materials from cellulose;
5. Bio-based composites;
6. Food industry and pulp mills in symbiosis;
7. Biofuels for low-carbon steel industry;
8. Sensors for increased resource efficiency.

In the UK, in February 2016 the Minister of Life Sciences, a member of Parliament George Freeman, presented to the Strategic Plan in the field of synthetic biology, 'Bio-Design 2016 for the bioeconomy.'

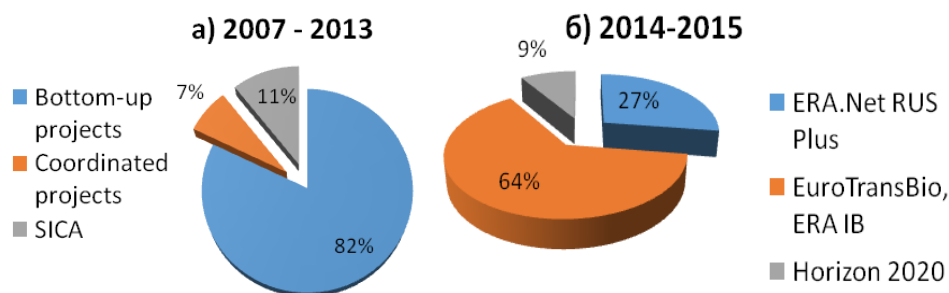
A paper published by the Council for leadership in the field of synthetic biology UK (Synthetic Biology Leadership Council (SBLC), aims to accelerate the commercialization of synthetic biology products and services with a clear benefit for the society, based on the UK research base.

In the Russian Federation, April 18, 2016 was carried the Resolution of the Russian Government №317 'On the implementation of the National Technology Initiative'. In the federal budget for the implementation of key projects of 'road maps' for 2016 STI provides 8 billion rubles. Roadmap 'FoodNet' STI ASI involves the development of personalized nutrition, find cheap and natural sources of raw materials, increasing the efficiency of agriculture. The objectives of the Roadmap must become not only indicators of innovative output, but the identification of new trends and their support.

Over the past two years in Russia were developed and approved ten key documents, including sectoral strategies, roadmaps, government programs that define the vector of development of the bioindustry. In 2007 in Moscow was established National Contact Point 'Biotechnologies, agriculture, forestry, fisheries, food security and the bioeconomy' (Bio NCP), which is part of the European system of national contact points, required for analytical and information support of international programs. From 2007 to 2013 in the largest size of funding of the Seventh Framework Programme (FP7) of the European Union of 36 Russian companies participated in 28 projects in the biotechnology category with the amount of funding attracted more than 110.6 million Euro (EU contribution - EUR 80 million). In addition, during this period of time lining up direct contacts of Russian and European funds.



Figure 2a shows the total number of biotechnology projects with the participation of Russian companies in 2007-2013., including allocated funding received in competitions with obligatory participation of Russia in the competition, fully coordinated and funded by the Ministry of Education and Science (MES). 'Bottom-up' projects - the result of independent research partners in the EU, the financing of the Russian participants held the European side.



**Figure 2.** Experience the participation of Russia a) in FP7 2007-2013. b) in 2014-2015, competitions on biotechnology issues.

In 2014 The European Union has launched a new global program Horizon 2020 (2014), under which Russian organizations which do not receive funding from the EU. In the field of international cooperation biotechnology began to actively develop local competitions in which financial flows are not 'cross the border'.

International co-operation among Third Countries (Countries outside the EU) in 2014 EU H2020 Societal Challenge 2 was very intensive. 363 participants from 57 different third countries were submitted proposals.

72 participants from 20 TC countries were retained in H2020. Average success rate was 20%, the response by third countries was 8%. The top 5 countries by the amount of retained proposals was Switzerland, China, Canada, USA, Brazil.

Since 2014 Ministry of Education finances Russia's participation in European programs through the Federal Target Program 'Research and development on priority directions of scientific-technological complex of Russia for 2014-2020'. Already conducted 16 contests for biotechnology topics, including bilateral with Germany, France, Slovakia and multilateral with the UK, Sweden, Finland, Norway, competitions on the work program of Horizon 2020, including the ERA-NET initiative (Measure 2.2). Below are the main mechanisms for financing international projects of Russian companies:

**Bilateral calls** based on direct interactions agencies: Ministry of Education - Federal Ministry of Education and Research (the BMBF) (Russia-Germany), Ministry of Education - Ministry of National Education, Higher Education and Scientific Research, the Ministry of Foreign Affairs and International Development of France (France-Russia), MES - Ministry of education, science, research and sport of the Slovak Republic (Russia - Slovakia).

The Department of Biotechnology (DBT) is in the constant cooperation with Russian Ministry of Education and Science. DBT is an Indian government department, under the Ministry of Science and Technology responsible for administrating development and commercialization in the field of modern biology and biotechnology in India. The Ministries of Russia and India carry out annual Calls in the field of Life Sciences, including biotechnologies.

It should be noted that the filing date in the two countries may differ significantly, examination of projects carried out in accordance with the internal rules of the national authorities.

**ERA-NET** - a contest conducted by consortia of funds. Depending on the composition of the consortium are formulated competitions conditions. For example, the ERA consortium - NO ENG + consists of organizations from 16 countries: Russia, Germany, France, Austria, Belgium, Switzerland, Finland, Slovakia, Israel, Turkey, Estonia, Moldova, Romania, Latvia, Poland, Greece. ERA-IB (European Research Area Industrial Biotechnology) - ERA-NET in the field of industrial biotechnology (Bioeconomy ERA-NET Actions, 2014). ERA-IB consortium consists of 19 partners and seven observers from 18 countries: Austria, Belgium, France, Germany, Spain, Latvia, the Netherlands, Norway, Poland, Portugal, Romania, Russia, Turkey, Finland, Denmark, Lithuania, Croatia, Italy . EuroTransBio consortium consists of 10 organizations of 8 countries and regions in Europe: Austria, Belgium (Flanders and Wallonia), Finland, France (Alsace), Germany, Italy, Russia. The ERA SME consortium in the field of application of biotechnology include: Russia, Austria, Belgium (Flanders), Belgium (Wallonia), Czech Republic, Germany; Russian small businesses are funded by the Foundation for Assistance to Small Innovative Enterprises in Science and Technology. Figure 2b shows the projects with the participation of Russia in the period 2014-2015.

**Cooperation with the BRICS countries.** The Ministry of Education and Science of the Russian Federation applies successful experience of interaction with EU countries also to BRICS countries. So, the second year in a row undergoes the tender of scientific developments realized by participants of the countries BRICS.

In 2014 in Russia the new EU co financing schemes in the field of bioeconomy were formed, including at the level of the funds and agencies. The Russian side has formed thematic priorities within the Program Horizon 2020 (2014).

## Conclusion

Today we can confirm that the instruments of international scientific cooperation in the field of bioeconomy appear to be a driver for the development of the bioeconomy and hence the global economy. The high cost of organizing and carrying out research stimulates the formation of cross-national consortia. For the development of the bioeconomy it is the most appropriate way of active institutional interaction and exchange of knowledge and cross-industry research. On the basis of this experience in creating support tools and stimulate research Russia and the EU, we can speak of a positive result in a competition aimed at interaction between small businesses and academic institutions. Despite the difficult political situation of recent years, the international scientific cooperation in the field of biotechnology in Russia continues to grow.



Formed and actively developing cooperation of financial institutions and agencies of Russia and European countries, which allows to add just the mechanisms to support biotechnology research, contributing to the development of the Russian bioindustry.

### Acknowledgments

This study was supported by The Federal Targeted Programme for Research and Development in Priority Areas of Advancement of the Russian Scientific and Technological Complex for 2014-2020 (the Ministry of Education and Science of the Russian Federation), grant № 14.601.21.0002, the Unique identifier of the agreement: RFMEFI60114X0002

### Disclosure statement

No potential conflict of interest was reported by the authors.

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