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**Conference on Land Economy and Rural Studies Essentials****IMPROVING THE SUSTAINABILITY OF AGRICULTURAL  
ENTERPRISES BASED ON BIOLOGICAL INNOVATIONS**

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**Abstract**

Sustainable development of agriculture is one of the areas contributing to the solution of food and environmental problems. Bioeconomy is the most high-tech innovative part of the economy that is becoming widespread throughout the world due to the transformation of value guidelines of new generations, the transition from the production of traditional food raw materials to products that meet the requirements of safety, origin, technology and ethics. Despite the obvious importance of the problem, the level of use of innovations in the country remains extremely low. The research is based on the works by foreign and Russian scientists dealing with theoretical and practical aspects of sustainable agricultural development based on innovations, official statistics and documents of targeted programs for the development of agriculture in the Russian Federation. The systematic approach has become the methodological basis for studying the problem of sustainable development of agriculture. The monographic and economic-statistical methods as well as the comparative method were used. It is obvious that sustainable development of agriculture requires innovations, in-depth research. The task of the government is to create an effective innovative environment that allows all participants in the agricultural market to implement innovations. One of the elements of the mechanism for increasing the innovative activity of agricultural organizations is public-private partnership (PPP). Public-private partnership is economically beneficial to both parties to the project. For the government, economic efficiency is reduced budgetary funds and high quality products and services. The private investor minimizes project implementation risks.

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## **1. Introduction**

Sustainable development of agriculture is becoming one of the areas contributing to the solution of food and environmental problems. The modern development of the agricultural industry is determined by technological changes based on the wide use of innovative products and services. Agribusiness needs innovations to increase the rate of production, strengthen the position, and eliminate the impacts of negative external factors. The use of biotechnology in agriculture makes it possible to increase the competitiveness of the industry by optimizing energy and resource costs, as well as to reduce the negative impact on the environment. The role of “sustainability” factors is increasing in the context of the need to ensure the safety of food products. Strict requirements are instruments of international trade regulation, limiting the sale of low quality and unsafe products.

Value guidelines of new generations are being transformed, due to the transition from the use of traditional food raw materials to products that meet safety, origin, and ethics requirements. Therefore, bioeconomy is becoming the most high-tech innovative part of the economy.

## **2. Problem Statement**

The report made by the Bruntland Commission defines the term “sustainable development” as the satisfaction of urgent needs of the population, taking into account the needs of future generations (Shchurina, 2020). The needs of the modern generations must be met in such a way that the future generation is not at risk, and the quality of life does not deteriorate.

Sustainable development of agriculture should be aimed at integrating the production, environmental and social approaches in innovation activities, where responsibility of entrepreneurs, preservation of the environment and high living standards of the population should be priority areas (Rodionova et al., 2019).

In this regard, biotechnological innovations can become the basis for priority national projects that can contribute to the production of high-quality food products, development of alternative sources of energy, medicines, improvement of the environmental situation, creation of new jobs and reduction of economic tensions in depressed regions (Vasilyeva et al., 2018).

The sustainable development strategy acts as a catalyst for the irreversible process of positive transformation of agriculture, and the basis of breakthrough innovations lies in the convergence of technologies at the junction of related branches of knowledge (Truba et al., 2020).

## **3. Research Questions**

The possibility of using biotechnological innovations in agricultural enterprises through the use of public-private partnerships is dealt with in this article. When using biological innovations, special attention should be paid to the issues of government participation in projects and programs.

#### **4. Purpose of the Study**

The aim of the article is to study the problem of sustainable agricultural development based on biological innovations. The study analyzed works by foreign and domestic scientists devoted to the theoretical and practical aspects of sustainable agricultural development based on innovations, as well as official statistics and targeted programs aimed at the development of agriculture in the Russian Federation.

#### **5. Research Methods**

The systematic approach was the methodological basis for studying the problem of sustainable development of agriculture.

The following methods were used:

- the monographic and abstract logical methods were used to study international experience in using biotechnology in agriculture;
- the economic and statistical methods were used to substantiate trends in the government support;
- the comparative method was used to study foreign experience in stimulating innovation.

#### **6. Findings**

Biotechnological innovations play a special role in the sustainable development of agriculture. According to experts, by 2030 they will provide 2.7% of the GDP in the developed countries; therefore, the agricultural business is involved in the development of biotechnology. According to the "Global Impact of Biotech Crops: Income and Production Effects 1996-2007" report, the effect of biotechnology on farming amounted to 10.1 billion dollars in 2007, and 44.1 billion dollars 12 years later. At the same time, farm profitability of 46.5% was ensured by increasing crop yields based on the use of biotechnology and cost optimization (Global Impact of Biotech Crops: Income and Production Effects, 2009).

The first stage in the development of biotechnology was the studies of plant cell tissues for vegetative propagation and breeding virus-free planting material, molecular diagnostics of diseases of agricultural plants and animals, and embryo transplantation.

The second generation relied on molecular biology, which uses genomes to obtain information about individual genes for the acquisition of specific properties by a living organism. This made it possible to develop molecular markers for the selection of appropriate line improvements for traditional breeding (Vlasova & Asmyaryan, 2017).

Genomic technologies are actively used in animal husbandry. The European Fund for Guarantee and Development of Agriculture developed a program for implementing genomic technologies in animal husbandry. The program aims to achieve two goals: increasing the efficiency of cattle breeding and reducing greenhouse gas emissions. In 2014-2017, the genetic profit increased by 25 million euros (Mozhaev et al., 2020) Foreign researchers believe that the use of genomic selection has a prolonged economic effect. According to the American Association of Aberdeen Angus Cattle Breeders, genomic breeding can increase profits (Zhiganova, 2011).

Modern methods of genomic selection are also being used in Russia. In 2019, the livestock breeding was represented by 2,540 breeding herds, including 16 breeding and genetic centers and 416 breeding plants. The high economic efficiency of genomic selection proves the feasibility of biological innovations (Table 1).

**Table 1.** Economic efficiency of genomic selection in comparison with the traditional strategy of dairy cattle breeding in the Central Federal District

| Indicator                          | Value, million rubles / year |
|------------------------------------|------------------------------|
| Growth of pedigree livestock sales | +11,1                        |
| Additional volume of milk          | + 30,8                       |

The most controversial part of biotechnology is transgenic engineering, or production of genetically modified organisms (GMOs). Genetic engineering technology is the largest innovation in the agro-industrial complex, which allows for the production of agricultural products that are resistant to external factors.

The greatest innovations in biotechnology and genetic engineering were developed in the United States, Canada, Brazil, and East and Southeast Asia (James, 2013). Various forms, varieties and transgenic plants have proven their economic efficiency and occupy more than 185 million hectares of arable land. Moreover, it is planned to expand the areas for transgenic crops.

The USA is the leader in the production of genetically modified plants. Currently, 39.0% of all the area occupied by GM crops belongs to this country. In 2018, 94.0% of soybeans and cotton, as well as 92.0% of corn were grown using biotechnologies. New transgenic lines of alfalfa, peas, and sugar beets are being developed.

Despite the fact that biotechnologies are actively used in the United States, each new GM crop is assessed according to strictly regulated criteria for the potential risk of possible adverse environmental impacts. Thus, the US National Research Committee has identified the following categories of potential risks:

- associated with the transfer of a transgene and its subsequent expression in another organism or species;
- associated directly or indirectly with the GM plant itself;
- the effect of the gene expression product on non-target organisms;
- the emergence of resistance in the target population.

For a long time, there has been opposition to the use of genetic engineering technologies in the EU countries. However, over time, public and state attitudes have changed. The system for regulating the production of genetically modified products is being developed under the influence of both external (e.g., the need for unified rules and compliance with the international legal acts) and internal factors. Of great importance are the contradictions that have developed between manufacturers of genetically modified products and their consumers, scientific organizations and government agencies. A wide range of commercial, medical, environmental and philosophical interests are affected. A unified concept for assessing the impact of GMOs on the environment and humans has not been developed; risks have not been identified and classified. The issue of excluding the possibility of unintentional spread of the impact of GMOs on the environmental elements after their appearance on the market remains unresolved. An example

is a Bavarian beekeeping farmer whose products were recognized genetically modified by the court. The farmer did not use GMOs to produce honey, but his bees “inadvertently” pollinated the GM corn company Monsanto (Antoine, 2011).

The long-term consequences of genetic engineering remain unclear due to the potential risks associated with changes in the environment and human health. As a result, the system of legal regulation of the circulation of genetically modified products has its own features in different countries. The general concept of the EU countries is based on the principle of "strict specific regulation of markets for new types of food"; in the USA and Canada general principles of regulation are used for all food products, regardless of how they were produced (Voronina, 2020).

Accordingly, there are different approaches to ensuring the safety of food products containing GMOs. In the United States, such products do not need special labeling. Labeling is provided only for products containing either a potential allergen, or modified components. In the EU countries, all food products containing GMOs are subject to mandatory labeling. In Russia, it is prohibited to sell GMO products without special labels (Agafonov & Zhavoronkova, 2020). Currently, no country has an ideal regulatory system. We consider it expedient to provide an opportunity for countries to independently create a biosafety system that will be meet national standards.

Modern researchers indicate the inevitability of the use of biotechnology due to the limited availability of resources. In particular, traditional crop production technologies provide for a large application of mineral fertilizers and pesticides whose production is limited by a number of factors, including rising prices and decreasing reserves of raw materials. Scientists believe that the agricultural industry will develop in two directions:

- an increase in the number of farms using biotechnology;
- expansion of production of environmentally friendly products (eco-products).

Russia has required conditions for the further development of biotechnological production:

- promising agrobiological developments;
- high research and production potential;
- intensively growing demand by 20.0% per year for biotechnological products in the domestic market.

Biotechnologies have become an important factor in the development of national economies, but the high science intensity of production, duration and costs require government support measures to be implemented. Industrialized countries support the creation of biological innovations through public research programs, followed by the commercialization of results by the private sector. A system of public-private innovation partnerships is being developed. Public-private partnership is economically beneficial for both the government and businesses. For the government, economic efficiency is reduced budgetary funds and higher quality products and services. The private investor can minimize project implementation risks. The government can also initiate the creation of PPPs in case of high social significance or insufficient attractiveness for businesses. PPP projects have a number of specific features:

- “stable commitments” both on the part of businesses and government agencies;
- development of financial, organizational and technological innovation infrastructure capable of eliminating the existing failures of research and business activities;

- high motivation for innovation on the part of agricultural producers.

Incentive mechanisms and purposes of PPP creation are presented in Table 2.

**Table 2.** Government incentives for the development of PPP in the innovation area

| Purposes  | Incentives  |
|---|---|
| Solution of key government tasks in the innovation area | Government procurements                           |
| Improving the interaction of science and business       | Private Sector R&D Subsidies                      |
| Stimulating regional development in depressed regions   | Networking of industrial research and development |
| Maintaining market equilibrium                          | Private Sector R&D Subsidies                      |

Currently, agricultural public-private partnerships are going through the stage active development. By 2020, 10 projects were implemented in Russia; three of these projects dealt with agricultural biotechnology. The government supports large producers by providing required communications, allocating land plots, and providing guarantees for attracted loans. Small agribusiness receives methodological and legal support, assistance in the searching of markets.

## 7. Conclusion

The interest in agro-technological innovations is increasing all over the world, since they can solve food, social and environmental problems, in particular, reduce the employment rate and improve living standards of rural population. Despite the controversies, it is evident that it is impossible to develop without biotechnological innovations, and only further in-depth scientific research will help resolve arising contradictions. The systematic approach to the study of biological structures is most promising in solving the fundamental problems of biology and creating highly effective fertilizers of for the agricultural industry. The government aims to create an effective innovative environment that allows all participants in the agricultural market to actively use innovations.

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