Scientific and educational institutions as a basic element of the innovative environment in the agricultural sector

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Abstract. The article formulates a model of the innovative development of Russia and analyzes the strategic and program documents that determine the state policy in the field of supporting innovative activities. The state and areas of development of the science and education system as the main component of the innovative environment in the agricultural sector are discussed. The country has accumulated significant scientific and technological reserves for accelerated technological development. The main problems that hinder their widespread implementation are identified. It has been proposed to create innovative departments based on educational institutions that participate in the educational and production process. The subject of the study was organizations that were able to conduct research and development in the field of agriculture. The purpose of the study was to assess and systematize the scientific potential of these organizations in the framework of achieving the goals set by the state. Abstract-logical and economic-statistical methods were used in the study.

1. Introduction

In the Russian Federation, a model of innovative development has been formed, in which there is a predominant borrowing of foreign technologies, equipment and breeding achievements with low costs of agribusiness for their development. To eliminate dependence on foreign technologies and advanced experience, the state pursues a policy that stimulates the transition of the economy to a model that includes a system for long-term forecasting, national strategic planning and programming, as well as the development of an organizational and economic mechanism that creates innovations and ensures their implementation to ensure import independence. This model is based on the Forecast of the Long-Term Socio-Economic Development of the Russian Federation for the Period up to 2030, the development of national projects, partnership, cooperation and integration of the state, science, education and business, the upgrading of production, the concentration of human, financial and material resources and the widespread introduction of breakthrough technologies of the sixth technology revolution [1].

Thanks to a set of measures aimed at the formation and development of an innovative environment (IE), state strategic planning documents have been elaborated that correct the development of innovations in promising areas, as well as key infrastructure components for supporting innovation activities (IA) have been formed, namely: engineering centers; prototyping centers, technology...
transfer centers, etc., and a system of development institutions that provide assistance at all stages of development and implementation of innovations.

The program-targeted form of IA state regulation implies co-financing within the framework of state targeted support programs. Target programs in the agricultural sector are focused on providing specific tasks at the sectoral and zonal levels with the involvement of existing or developed results of scientific research [2].

Currently, agriculture is characterized by low innovation activity. Against the background of the existing lag behind industrial production and the food industry, innovative activity in agriculture amounted to 5.4% in 2018 (3.4% in 2016). The innovative activity of the mixed agriculture sector (without specialization, in which the share of crop or livestock production is less than 66% in the gross profit structure) is 16.3% and that of the seedling production sector is 14.3%. These sectors are the most innovatively active [3] (figure 2).

Industrial manufacturing
- In general in agriculture
  - Growing annual crops
  - Growing of perennial crops
  - Growing seedlings
  - Livestock
  - Mixed farming
- Supporting activities

In general in food industry
- Foodstuff production
- Beverage production
- Tobacco goods production

Figure 1. Structure of innovative activity in the agricultural sector of the Russian Federation in 2018 (Source: HSE University)

World experience shows that the state socio-economic development that provides for competitiveness in the external market is ensured, first of all, by the presence of a developed innovative environment (IE) and the formation and effective interaction of all its components, which is a necessary stage in the construction of a post-industrial society, the economy of which is based on obtaining and using new knowledge [4, 5, 6, 7, 8].

The main IE components have been created in Russia in recent years. A large number of organizations, scientists and entrepreneurs are involved in innovation activity (IA). However, this has little effect on the development of the agribusiness economy, which is due, among other things, to insufficient IE efficiency, IE components and their weak interaction [9, 10].

In this regard, the analysis of the state of the system of science and education as an integral IE part and IE structural elements capable of solving the tasks facing the industry for the IA growth is an urgent task.

2. Methodology

The informational basis of the study was the official data of Rosstat, the Ministry of Agriculture of Russia, regional governing bodies of the agricultural sector, materials of scientific and practical conferences and research institutions, the papers of leading domestic and foreign scientists in the field of IA research, as well as the IA regulating legal and regulatory acts setting strategic guidelines for the development of the country and the industry were used.

The research was based on a general scientific methodology using monographic, comparative, factorial and logical analysis methods, as well as an expert-analytical method for processing initial information.
Currently, a holistic approach to defining the essence of the innovation environment and its structure has not developed yet. There are several IE definitions, such as an existing definite socio-economic, organizational, legal and political environment in which IE is implemented, which is subdivided into external and internal environments [11], a set of mechanisms, tools, processes, infrastructural components and human capital that provide IE [12], etc. The author understands IE as a set of basic systems that form IA: innovative entrepreneurship; technical and technological developments; education and science system. Together, they ensure the full functioning of the overall system of innovative production, and also create a system of innovative products (figure 2).

**Figure 2.** The structure of the innovation environment

Such a view leads to the need to organize the interconnection of the systems of science, education, engineering and technological developments and entrepreneurship, which are the basis for the IA development. The presented environment is the first level of formation of the national state innovation system. In this environment, the main IA subjects and all other systems that create the surroundings, which, according to most researchers, can be classified as infrastructure, are formed [1]. The IE key function is to provide favorable conditions for the development and subsequent implementation of innovations, as well as improving the quality of life.

The system of education and science is an integral part of the innovation process and IA fundamental factors that have a direct impact on the IE quality. They are inextricably linked with each other: educational programs are being implemented based on scientific institutions, at the same time, educational institutions conduct research and development, therefore it is necessary to consider them together [13].

### 3. Results and discussion

The main strategic documents that determine the ID development areas include the Forecast of the Long-Term Socio-Economic Development of the Russian Federation for the Period up to 2030, which includes the section titled "Development of Science, Technology and Innovation", the Forecast of the Scientific and Technical Development of the Agricultural Sector of the Russian Federation for the Period up to 2030, etc. The Federal Scientific and Technical Program for the Development of Agriculture (FSTP) determines the current priorities for scientific and technological development of the agribusiness. This program, however, limitedly supports the processes of innovative transformation of the industry, since it initially sets somewhat different goals (reducing import dependence in clearly defined areas), but supports advanced research and the creation of infrastructure for it, which means it contributes to the IE creation in the industry.
Within the FSTP framework, it is planned to implement more than sixteen subprograms structured according to key segments of crop production, animal husbandry, aquaculture, animal health and fodder production, including: development of breeding and seed production of potatoes and sugar beet; creation of domestic competitive crosses of meat poultry; development of breeding of cattle dairy and meat breeds; etc.

The FSTP implementation tool is actions that involve the coordination of the activities of all IA participants starting from the creation of innovations to their implementation, namely: "Creation of scientific and / or scientific and technical results and products for the agricultural sector", "Transfer of scientific and /or scientific and technical results and products for practical use and advanced training of participants in scientific and technical support for the development of agriculture," and "Commercialization of scientific and / or scientific and technical results and products for the agricultural sector."

The implementation of the "Creation of scientific and / or scientific and technical results and products for the agricultural sector" actions is provided through fundamental and applied scientific research, as well as experimental work [2].

The Russian Academy of Agricultural Sciences together with the Ministry of Agriculture of Russia performs the planning and coordination of scientific research in the agricultural sector. Scientific support of the industry is currently carried out by:

- Research organizations of the Ministry of Education and Science of Russia, of which 194 are state scientific institutions, 5 are independent experimental stations, 160 are agricultural federal experimental production farms;
- Organizations subordinate to the Ministry of Agriculture of Russia, namely: 10 scientific research institutes (SRI) of the Ministry of Agriculture of Russia; 16 Research Institutes of the Federal Agency for Fishery; 3 Research Institutes of the Federal Service for Veterinary and Phytosanitary Surveillance;
- Organizations of higher and additional professional education of the Ministry of Agriculture of Russia, namely: 54 federal state budgetary educational institutions of higher professional education and 23 institutions of additional education; 146 small innovative enterprises (SIE); 30 educational and experimental farms.

The SIE main activities are: development and implementation of modern technologies; organization of primary and industrial seed production; introduction of breeding achievements and new drugs for the treatment of farm animals and plant protection; etc.

The Stavropol State Agrarian University has been created a Scientific and Innovative Training Center, in which departments of information-analytical and scientific-innovative activities, management and protection of intellectual property are functioning. Technology transfer centers (TTC) at the Bryansk State Agricultural Academy, Kuban, Michurinsk and Don State Agrarian Universities, and other educational institutions have been created and are operating as production components of the regional innovation infrastructure. Educational and demonstration centers created by educational institutions, where samples of state-of-the-art innovative developments are presented, are effective. Consortia and research and production associations are being created that implement joint research and production projects, for example, the East Siberian Research, Education and Production Center of the Siberian Branch of the Russian Academy of Sciences (Krasnoyarsk State Agrarian University), the Biotechnology, Agriculture and Food National Contact Center (Michurinsk State Agrarian University), Soya Chernozemya Consortium (Emperor Peter I Voronezh State Agrarian University), Agrouniverkom Scientific and Production Association (P.A. Stolypin Omsk State Agrarian University), and Association of Continuous Agrarian Education (Orenburg State Agrarian University).

An innovative testing ground has been created in the East Siberian Scientific, Educational and Production Center, where projects for the reconstruction of livestock facilities with advanced equipment and technological facilities for processing agricultural products are demonstrated. The testing ground is also an educational platform for training students in the current energy-saving
technologies. Using the Technical Park as a base, seminars on new equipment and energy-saving technologies are held for managers and specialists in agriculture.

The Federal Scientific Agroengineering Center VIM and the N.P. Ogarev Institute of Mechanics and Energy of the Research Institute of Mordovia State University have created an educational, research and production center, which includes SIE, a scientific laboratory and two experimental production sites, that develops and implements new energy and resource-saving technologies for the repair of agricultural equipment while providing 90-100% post-repair life time at a cost of no more than 30-50% of the cost of the new unit. The center also develops and upgrades bench diagnostic equipment, elaborates laboratory and practical work and implements it into the educational process, and performs information and analytical services on the problems of restoring machine parts. [1].

The I.V. Michurin Federal Scientific Agroengineering Center, Michuring State Agrarian University and Federal Scientific Agroengineering Center VIM have organized the All-Russian Scientific and Technical Center called Industrial Machine Technologies of Intensive Horticulture, which is engaged in innovative developments in the field of mechanization of intensive horticulture.

To accelerate the involvement of scientific developments in the economic turnover, it is proposed to create innovative departments as the organizational structure of the educational and production process that is continuously developing under the influence of the scientific environment and the system of scientific and technological forecasting of the agricultural sector. The options for the interaction and integration of scientific efforts can be schematically represented by the following diagram presented in figure 3.

![Figure 3. The structure of multi-level Science and Education System cooperation](image)

Fundamental research is funded from the federal budget and applied research is financed from the federal budget and partly from the budgets of the constituent entities of the Russian Federation. The research programs are based on the short-term and long-term forecast of the agribusiness development, the approved priorities of scientific research, and progressive scientific domestic and foreign achievements. Agrarian national research universities work according to the Perspective Plan of Fundamental Research in Priority Areas of Development of Science, technology and technique for the Period up to 2025 of the Ministry of Education and Science of Russia, which includes priority areas for the development of agricultural science and scientific support of the Russian agricultural sector. Any order for scientific research awarded to organizations subordinate to the Ministry of Agriculture of Russia is executed in the form of a state assignment for the implementation of applied scientific research on a subject to be jointly determined by specialists of the Ministry and scientists in
accordance with the current challenges of the sectoral strategy. Scientific institutions also perform research and development commissioned by enterprises, including those from the other industries.

To improve the quality of education, the Ministry of Agriculture of the Russian Federation has planned programs to improve the international rating of universities and strengthen their scientific research association, including these being within the framework of the FSTP implementation and international cooperation. These actions are aimed at synchronizing the implementation of innovations and training of personnel capable of working with them.

Thus, the scientific research association of educational institutions is a factor influencing the quality of personnel training and contributes to the scientific support of the agribusiness IA. The vector of research activities is formed taking into account the tasks of scientific support for the country modernization, as well as State Program and FSTP implementation [14].

At the same time, the interaction between developers and consumers is still insufficiently developed. Science, education and implementation structures operate in isolation, without IA coordination and unified focus. More than 50% of domestic projects remain unclaimed annually [1].

It becomes obvious that the existing procedure for the transfer of innovations does not correspond to the changed conditions and requires improvement. The analysis revealed the following main IA problems in the agricultural sector:

− Lack of interdepartmental coordination between the institutions of the Ministry of Agriculture of Russia, other departments and the business sector in planning scientific research
− Low demand for innovations (due to the lack of the own funds with majority of producers, limited budgetary sources of financing, and the practical difficulty of obtaining borrowed funds for these purposes), which does not allow the development of new technologies in the required volumes
− Weak integration of research, development and production activities not focused on the introduction of innovations.

A major role in the development of education and science is currently played by the ongoing "Science" National Project, according to which Russia should take a leading position among the countries of the world carrying out research and development in areas to be determined by the priorities of scientific and technological development.

The national project includes the federal project titled "Development of Scientific and Scientific-Industrial Cooperation", within the framework of which it is planned to create a network of at least 15 world-class scientific and educational centers (SEC) based on the integration of educational and scientific organizations and their cooperation with business. The project also involves the creation of world-class scientific centers, including centers for genomic research.

One of the priority areas of scientific and technological development of the country for which the creation of world-class scientific centers is planned includes the area of "Highly productive and environmentally friendly agriculture and aquaculture and the creation of safe, high-quality and functional food products."

Agrarian educational organizations can become a driver of the innovative development of regional agribusiness, since they are a dynamic system based on: the annual cyclical nature of the process; a wide range of research in various scientific and informational areas; implementation of educational programs, including the development of innovative areas of production, economics and management in the industry. Universities, as a rule, become integrators while combining the innovative activities of educational and research institutes, as well as business due to the presence of conditions for the formation of favorable IE and its infrastructure (research and educational centers, business societies, technology parks, innovation centers, business incubators, etc.)

4. Conclusions

In recent years, positive shifts have taken place in the innovation system of the Russian agricultural sector: key components of infrastructure support for innovations (funds, technological platforms, technology transfer centers, etc.), as well as a system of development institutions that provide assistance to enterprises at all stages of development of innovative technologies and products have
been created. New formats of interaction between IA participants are developing, including those through integration with science. A network of federal universities, national research universities and leading scientific organizations has been created. The state invests in research infrastructure.

An innovative environment is understood as a set of basic systems that form an IA: entrepreneurship; education and science; technical and technological developments. Together, they ensure the full functioning of the general system of innovative production, as well as create a system of innovative product

The transition of the Russian economy to an innovative path of development requires the formation of a globally competitive IE, which is a set of interrelated structures engaged in the production and commercialization of knowledge and technologies, as well as a set of legal, financial and social institutions that ensure the interaction of educational, scientific, entrepreneurial and non-commercial organizations and structures in all spheres of the economy and public life.

The following main IA problems of ID in the agricultural sector were identified: lack of interdepartmental coordination in planning R&D, as well as coordination with business; low demand for innovations; weak integration of research, implementation and production activities not focused on the creation and implementation of innovations.

For the successful solution of the tasks set, it is necessary to create a favorable IE in Russia, stimulate scientific and scientific-practical activities, master the obtained scientific results in economic practice, and train qualified personnel for an innovative economy.

The solution of the indicated problems will largely be facilitated by a mechanism laid down in the FSTP, which implies the active involvement of all IA participants starting from developers through to the final mass consumer. The principle of state financing of a consortium of enterprises united for the implementation of specific projects, including both developers of innovations, approbators, and consumers, allows solving the main problem of up-to-date IA that is the practical implementation of R&D results. Project financing as a tool to stimulate IA should be applied more widely in the practice of state financing. The key goal of the development of such programs reflects their orientation towards overcoming the problems of the IA development, and also fits into the strategic guidelines for the development of the country and the agricultural sector.

One of the IE components can be innovative departments that are part of the educational and production process and dynamically developing under the influence of the scientific environment and the system of scientific and technological forecasting of the agricultural sector. The mechanism presented is based on a market-oriented potential, which ensures the sustainable development of science in the agribusiness taking into account the identified factors of the resource-innovative plan based on the adopted Federal programs, including the FSTP.

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