

Advanced innovative development of the agro-industrial complex based on the patent information resource

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Abstract. Relevance. The article is devoted to the issue of activation of the domestic agro-industrial complex's (APC) patent and licensing activities as the most important resource of its advanced innovative self-development and effective adaptation to new realities caused by patterns of the large-scale transformational changes in the processes of changing technological setups, as well as the need to minimize unfriendly states' unprecedented sanctions aimed at restricting access to goods and technologies with a high intellectual component. The study relevance of the forced transfer issue of the agro-industrial complex of rural areas to the intellectual development vector increases sharply due to the insufficient development of methodological tools for assessing the use effectiveness of its intangible assets in terms of achieving strategic goals of ensuring food security and sovereign self-development of the Russian Federation regions. **The purpose** of the research is to assess the current state and prospects for the transition of Russian APC to an intellectual development vector based on the information resource patent. The main **research methods** are the following: 1) scientometric analysis of the research's publication field; 2) data economic and statistical analysis on the state of agriculture in the Russian regions; 3) rating method for assessing agriculture in the Russian regions; 4) ecosystem approach to evaluating the patent activity effectiveness. **Results.** Special attention in the methodology of the author's research was paid to the issues of increasing the regional agro-industrial clusters' patent potential based on an ecosystem approach to intellectual property management. The proposed methodological tools of the study make it possible to timely clarify the priority directions for the new structure formation of the intellectual property ecosystem in the agro-industrial complex of the Russian regions, transfer from managing import substitution processes to proactive import substitution projects management, strengthen territorial integrity and expand the institutions' range of coordinating high-tech projects and supporting the development of highly intelligent entrepreneurship networks. **The scientific novelty** of the research results lies in the application of an ecosystem approach in the assessment of the effectiveness in patent activities of APC and agriculture of the constituent entities of the Russian Federation, as it makes it possible to determine the monetary and institutional factors of their uneven access to competencies of intellectual property management.

Keywords: agro-industrial complex, innovative self-development, intellectual property, patent potential, advanced competitiveness.

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Introduction

In the context of the transition to new technological structures, the fourth industrial revolution, the boundaries of human knowledge are significantly expanding, and the level of intellectualization of production is increasing. The global competition for human capital, its intellectual competence, as a factor in ensuring the sustainable competitiveness of the national economy, is intensifying [1; 2].

The large-scale sanctions of Western countries aimed at destroying the Russian economy are largely focused on restricting the access of Russian enterprises to real knowledge and the results of intellectual activity.

The sanctions had a mixed effect on the agro-industrial complex (AIC). On the one hand, they destroyed the existing partnership business chains, which reduced

the sustainability of the country's food security. First of all, this was reflected in the ban on the supply of high-tech equipment, smart agricultural machinery (energy-saturated tractors, grain and forage harvesters, sprayers, fertilizer machines, self-propelled mowers, seeders) and software (agronavigators, precision farming system, automatic driving system). The ban on weather data has affected successful irrigation rationing and water use planning, and GPS failures lead to errors in plant nutrition. Seeds for a number of imported crops are in the embargo risk zone. The sanction mainly affected advanced highly intelligent technological solutions protected by intellectual property: agricultural machinery – by industrial patents, software – by copyright, seeds of agricultural crops – by patents for breeding achievements.

On the other hand, the unprecedented pressure from unfriendly countries increased the impetus for the development of local companies, intensified the process of import substitution, which became a powerful factor in preserving and strengthening the technological sovereignty of Russian farmers. The strategic goal of the domestic agro-industrial complex is the elimination of dependence on imported technologies and the comprehensive development of the production of products with a high intellectual component, the creation of new intellectually protected technologies in the agricultural sector, and innovative infrastructure in agricultural municipalities.

The urgency of the problem of accelerating the transition of the agro-industrial complex and agriculture to an innovative vector of development, increasing the effectiveness of intellectual property is increasing due to the exceptional importance of the industry in ensuring food security. It is no coincidence that in the recent speeches of the President, priority is given to strengthening the technological and scientific sovereignty of the country's agriculture¹. The actualization of the problem is also due to the unevenness of the existing economic and institutional access of agribusiness and agriculture enterprises to patent information and the development of patent potential.

The purpose of the study is to analyze the causes of low innovation activity and assess the prospects for the forced transition of Russian agro-industrial and agricultural enterprises to the intellectual vector of development based on the resource of patent information.

Methods

The scientific research was based on the ecosystem approach, the research process used statistical data from the Federal State Statistics Service, data from the Federal Customs Service, data from the bibliographic and abstract database of publications in scientific jour-

¹ Decree of the President of the Russian Federation of March 16, 2022 No. 121 "On measures to ensure socio-economic stability and protection of the population in the Russian Federation". URL: <http://publication.pravo.gov.ru/Document/View/0001202203160012?index=0&rangeSize=1> (date of reference: 20.05.2022).

nals and patents. Applied research was based on the use of statistical methods for collecting and processing data, there were used methods of comparative, abstract-logical, scientometric analysis.

Results

Theoretical studies have proved that in the new economy, the innovative vector of development of the domestic agro-industrial complex is based on intangible assets (IA), including intellectual property, however, the existing methodological tools for studying its creative, creative potential require in-depth development and adaptation to the realities of hybrid wars in which the intellectual property of the agro-industrial complex of the Russian regions plays the role of a key factor in ensuring their sovereign competitive self-development.

In connection with the need for a deeper consideration of the economic essence of the term "intellectual property", the authors are faced with the task of analyzing the properties of the described phenomenon as widely as possible, including their interpretation in scientific publications. To solve this problem, there was made a selection of the most relevant scientific literature on this topic and was carried out a scientometric analysis of the publication field of research. Publications were identified using a bibliographic and abstract database and a citation tracking tool for articles published in scientific journals. The search was conducted by title, abstract, keywords, retrospective – 10 years (Figure 1).

A review of recent scientific publications has shown a wide range of areas of study of the problem. So, E. M. Voloshchenko and N. S. Belokurenko propose to consider the management of intangible assets at agribusiness enterprises based on an object-oriented approach to the formation of an intelligent management system, without focusing on the need to account for and analyze external intangible assets of current and future stakeholders [3].

A. K. Daribaeva, F. A. Shulenbaeva, K. M. Madenova considering the methods for assessing the innovative activity of agricultural enterprises, determining the factors affecting the innovative activity of the agro-industrial complex, and the criteria for evaluating innovative-active agricultural enterprises, note the heterogeneity of the innovative activity of economic entities depending on their regional affiliation, and to solve the problem, they propose to create a system for the dissemination and implementation of knowledge scientific, technical and innovative activities for rural producers [4].

Mabiala Gilbert reveals the issues of the systemic deterioration of the state of affairs in the country's agro-industrial complex and the role of managing the innovation process in ensuring the conditions for the systematic development of production. The author in the article identified the determinants that negatively affect the development of the agro-industrial complex

and offered recommendations on the formation of an adequate system for managing innovative development in the agro-industrial complex, without disclosing the importance of partner entrepreneurial networks for the sustainable outstripping development of the agro-industrial complex [5].

M. S. Petukhova proposes a mechanism and structure for the formation of an ecosystem of scientific and technological development of the agro-industrial complex of the region, functioning on the basis of the interaction of institutions of science, education and business in her article. The key element of the proposed ecosystem is the Center for Forecasting and Monitoring of Scientific and Technological Development of the Agro-Industrial Complex, which, through foresight research, is able to determine promising areas of research and development for research institutes, the most demanded competencies and specialties for educational institutions in the future, and critical technologies for business. A feature of the article is the study of the influence of intellectual property on the final result of research work, without analyzing the use of patent information as a tool for early detection of potential competitors and ecosystem stakeholders [6].

I. V. Velikanova, T. A. Rozhmina, R. A. Popov touch upon the issues of stimulating innovative and inventive activities of the agro-industrial complex in relation to the procedure for calculating and justifying the amount of royalties paid for the creation and use of patents for a selection achievement, concluding that that as an element of the management of intangible assets, license agreements are the key to the development of an innovative environment for the agro-industrial complex, allowing the dissemination of advanced technologies across the country's regions and stimulating innovative research in the field of agricultural production [7].

Justice A. Tambo et al. highlights the problems of innovation and protection of intellectual property rights of small agricultural enterprises, the possibility of using intellectual property by innovative farmers based on the creation of a system of open agricultural innovations [8].

Tuan Nguyen-Anh et al. consider internal and external factors of the development of intellectual property of small and medium-sized enterprises in the agricultural sector, giving examples when intellectual property reduces the efficiency of enterprises due to the lack of a favorable innovation environment and strategically effective incentives for making breakthrough changes [9].

The main conclusion of the scientific publications dynamics analysis' over the years can be considered that in the domestic space there is a stable interest in all the requests under consideration, with a small peak in scientific interests in 2016–2017. However, the number of articles that touch upon the difficulties of the agro-industrial complex and the municipality is much less than publications that reveal the problems of enterprises. The stable but insignificant interest of the scientific community in the implementation of intellectual property in the agricultural sector and the agro-industrial complex is a threat to achieving the strategic goals of innovative advanced development of regions in the new realities of the sanctions economy. The lack of an extensive scientific study of understanding the development of innovative processes in the agro-industrial sectors makes it difficult to stimulate the development of advanced technologies, which seems to be relevant for the Russian economy.

Following the scientific community, agro-industrial enterprises paid little attention to the innovative development of their own production. The level of innovative activity of agricultural organizations is three times behind the industrial ones (Figure 2).

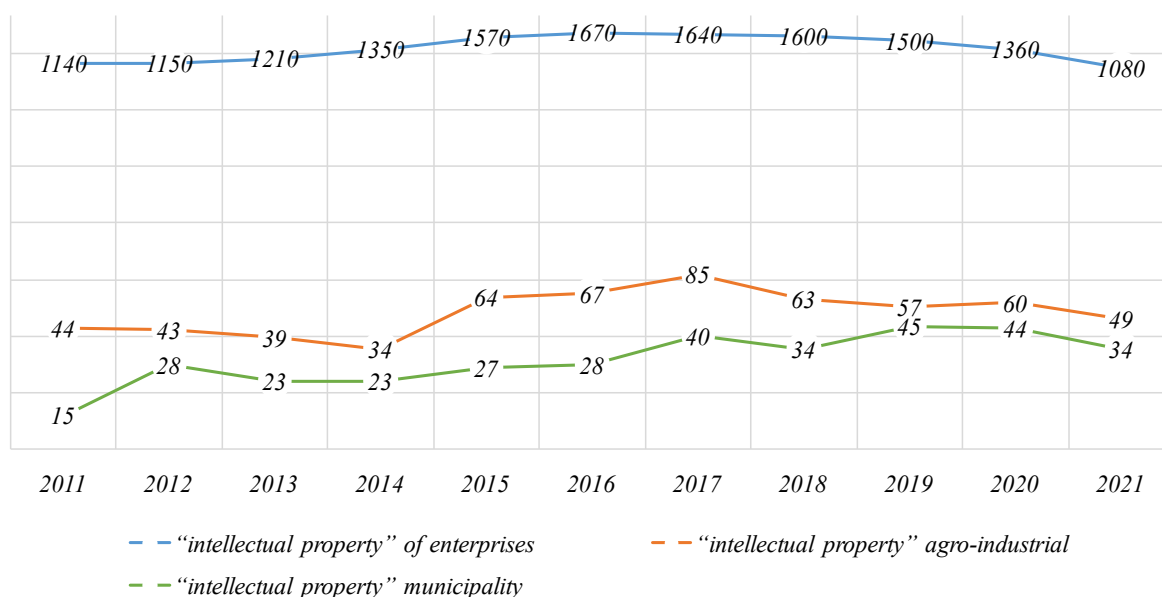


Fig. 1. Dynamics of the number of scientific publications

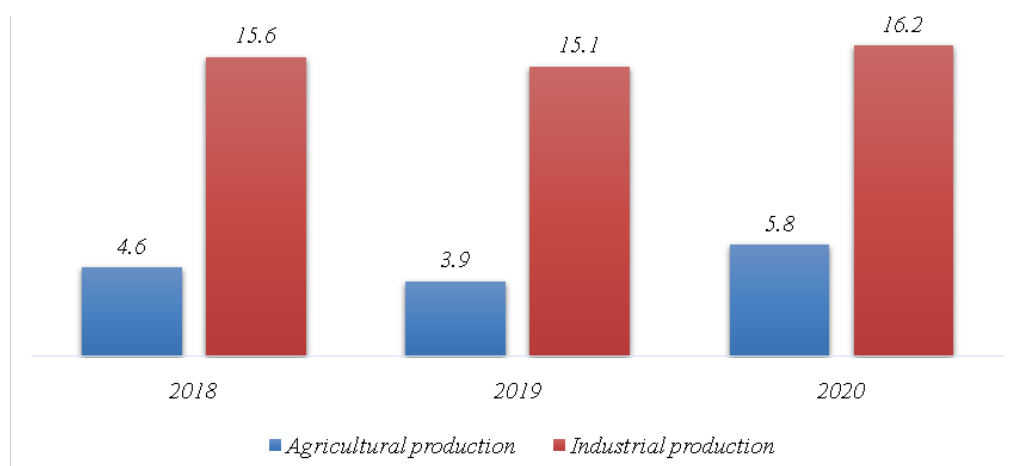


Fig. 2. The level of innovation activity of organizations

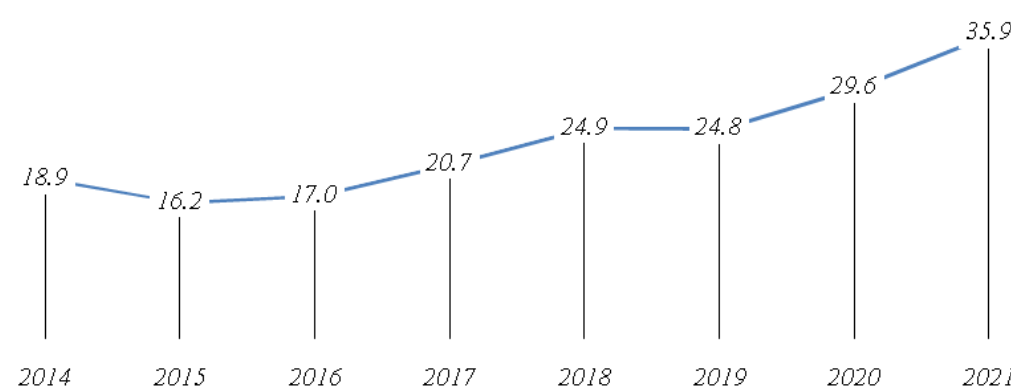


Fig. 3. Export of agricultural products (\$ billion)

Understanding the development of processes in highly intelligent industries is important for creating an innovation-driven environment. Russia in 2020 took 45th place in the Global Innovation Index with a share of spending on R&D of 1 % of GDP, while China spent 2.2 % on R&D, the USA – 3.1 %, Germany – 3.2 %, Sweden – 3.4 %, and Israel (world leader) – 4.9 %².

The results of the review of domestic practice show that the direct economic effects obtained through the implementation of innovative activities are primarily expressed in improving the quality of products and preserving traditional sales markets. More than a third of large and medium-sized industrial production organizations indicated them as the main result (37.6 % each). Over 36 % of companies noted the expansion of the range of goods and services, a quarter – the growth of production capacity. Every fifth organization has achieved compliance with modern technical regulations, rules and standards. Another 16.9 % assessed the impact of innovation on improving information links within the organization and (or) with other organizations [10].

According to Rosstat, the domestic intellectual property market of agricultural production is character-

ized by a low share of innovative goods, works, services in the total volume of shipped goods (2 %), an average share of costs for innovative activities in the total volume of shipped goods, works, services (3.3 %), low share of organizations implementing technological innovations (9.4 %)³. These factors do not allow forming the image of the agro-industrial complex as a high-tech cluster capable of abandoning foreign goods and creating their own advanced technologies. Therefore, in order to achieve import independence and industrial security of the country, it is necessary to develop our own innovative solutions in the field of agricultural production.

The agricultural production sector plays a key role in creating a sustainable Russian economy. The agro-industrial complex is responsible not only for the country's food security, but also is an important export product of the Russian Federation to the CIS countries and far abroad. The share of exports of food products and raw materials for their production in the commodity structure of exports in 2021 amounted to 7.3 %. Over 6 years, the foreign trade turnover of the agro-industrial complex increased 2.2 times from \$ 16.2 billion in 2016 to \$ 35.9 billion in 2021 (Figure 3).

² Global Innovation Index 2021. URL: <https://www.wipo.int> (date of reference: 20.03.2022).

³ Federal State Statistics Service. URL: <https://www.rosstat.gov.ru> (дата обращения: 13.05.2022).

Table 1

Assessment of inequality of access to the patent information resource as a factor of advanced innovative self-development of the agro-industrial complex and the population of rural areas⁴

	Patent Activity Index (2018–2019)	GRP in 2020 (Agriculture, forestry, hunting, fishing and fish farming)	Agro-industrial complex exports in 2020 (Vegetable products)	Information on the use of breeding achievements for 2020
I	Differs from the leader's result by no more than 20 % Ivanovo region; Moscow; Moscow region	Differs from the leader's result by no more than 20 % Krasnodars krai	More than \$ 1 billion Rostov region; Moscow; Krasnodar krai	More than 100 patents Krasnodar krai; Rostov region; Stavropol territory; Republic of Tatarstan; Moscow
II	Differs from the leader's result by more than 20 %, but not more than 40 % St. Petersburg; Tomsk region; Kursk region; Voronezh region	Differs from the leader's result by more than 20 %, but not more than 40 % Rostov region; Belgorod region; Republic of Tatarstan	More than \$ 150 million, but less than \$ 1 billion St. Petersburg; Kaliningrad region; Smolensk region; Altai krai; Novosibirsk region; Voronezh region; Lipetsk region; Primorsky krai	More than 20 patents, but less than 100 patents Sverdlovsk region; Saratov region; Moscow region; Tver region; Altai krai; Primorsky krai; Tambov region; Astrakhan region; Omsk region
III	Differs from the leader's result by more than 40 %, but not more than 60 % Republic of Tatarstan; Ryazan region; Vladimir region; Kaluga region; Novosibirsk region; Mari El Republic; Krasnoyarsk krai; Rostov region; Republic of Bashkortostan; Yaroslavl region; Samara region; Republic of Kalmykia; Republic of North Ossetia – Alania; Sverdlovsk region; Tver region; Perm region; Omsk region; Volgograd region; Penza region; Belgorod region; Nizhny Novgorod region; Sevastopol	Differs from the leader's result by more than 40 %, but not more than 60 % Voronezh region; Republic of Dagestan; Volgograd region; Saratov region; Tambov region; Republic of Bashkortostan	More than \$ 50 million, but less than \$150 million Stavropol krai; Amur region; Omsk region; Saratov region; Tambov region; Kursk region; Krasnoyarsk krai; Tula region; Oryol region; Bryansk region; Volgograd region; Orenburg region; Republic of North Ossetia – Alania; Moscow region; Belgorod region	Less Than 20 Patents Vladimir Region; Voronezh Region; Krasnoyarsk Krai; Amur Region; Republic Of Bashkortostan; Kurgan Region; Chelyabinsk Region; Republic Of Sakha (Yakutia); Bryansk Region; Ryazan Region; Republic Of Crimea; Sakhalin Region; Kursk Region; Perm Krai; Republic Of Mordovia; St. Petersburg; Tomsk Region; Khabarovsk Krai; Lipetsk Region; Republic Of Komi; Smolensk Region; Republic Of Karelia; Volgograd Region; Karachay-Cherkess Republic; Udmurt Republic; Kirov region; Nizhny Novgorod region; Tyumen region
IV	The remaining 56 subjects of the Russian Federation	The remaining 75 subjects of the Russian Federation	The remaining 59 subjects of the Russian Federation	The remaining 40 subjects of the Russian Federation

⁴ Compiled by the authors according to the following data:

1. Rating of innovative development of subjects of the Russian Federation. Vol. 7 [11].

2. Federal Customs Service. Export and import of the Russian Federation by goods for 2020. URL: <https://customs.gov.ru/folder/502> (date of reference: 14.05.2022)

3. Federal State Statistics Service. Information on the use of intellectual property objects by constituent entities of the Russian Federation for 2020. URL: <https://rosstat.gov.ru/statistics/science> (date of reference: 14.05.2022)

4. Federal State Statistics Service. Information on the use of intellectual property objects by constituent entities of the Russian Federation for 2020. URL: <https://rosstat.gov.ru/statistics/science> (date of reference: 14.05.2022)

Table 1 and Figure 4 present a comparative assessment of the inequality of access to a resource of patent information. The results of a comparative analysis show that regions with a high level of export activity of agricultural products (more than \$ 1 billion per year)

are more interested in the use of highly intelligent solutions, being, in particular, leaders in the use of patents for breeding achievements. The created leading competitive advantages based on intangible assets are one of the reasons for successful export activity.

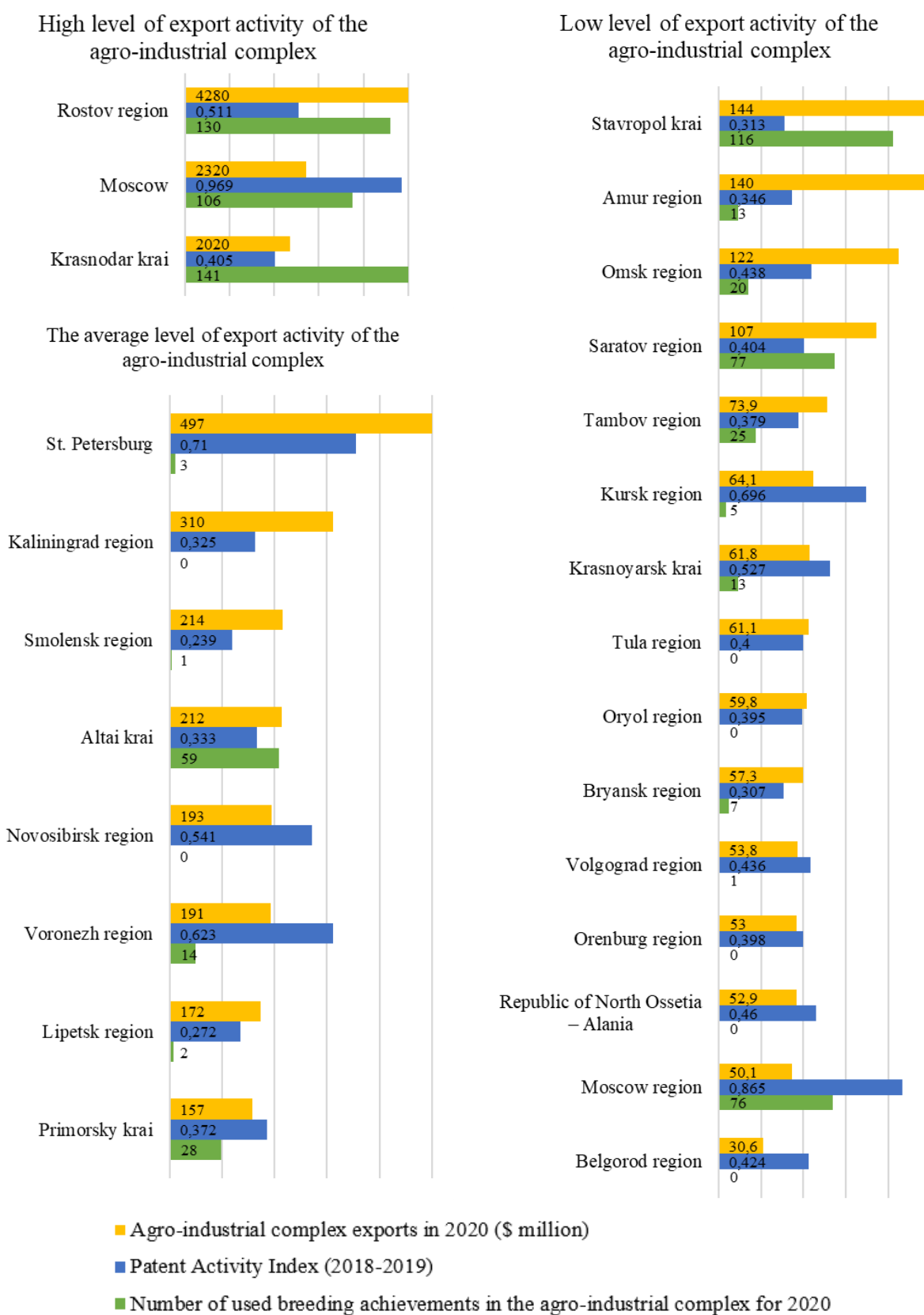


Fig 4. Comparative characteristics of Russian regions

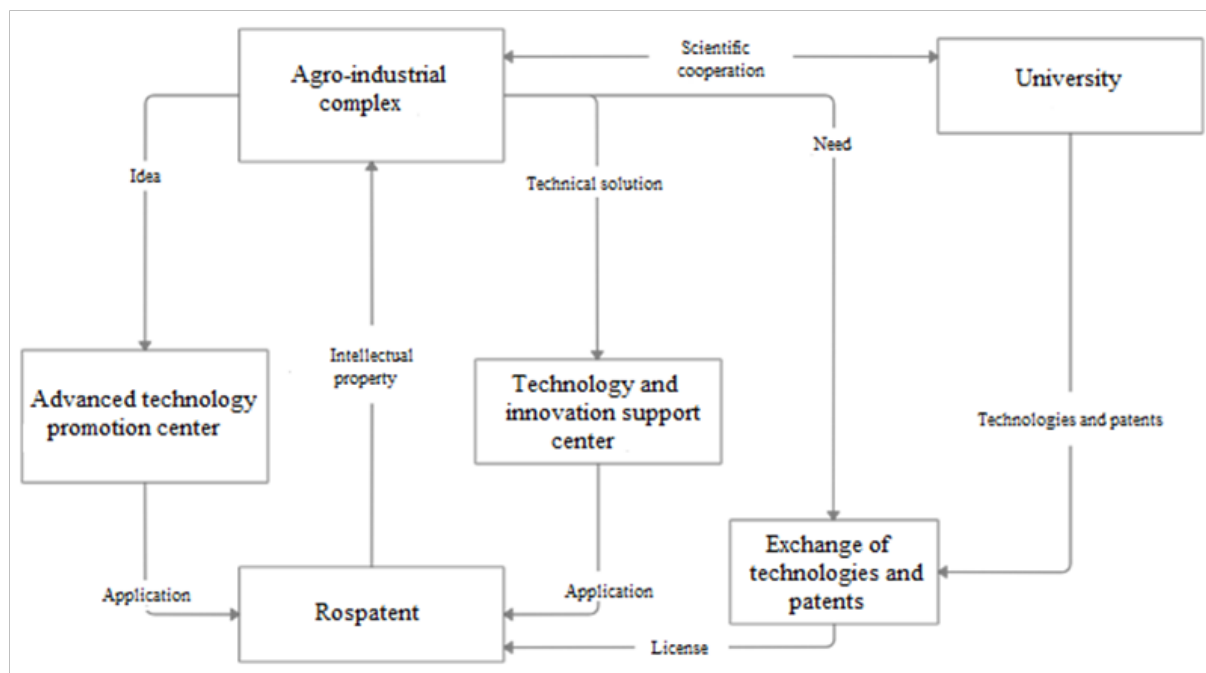


Fig. 5. The model of interaction of the agro-industrial complex with the ecosystem of intellectual property.
Source: compiled by the authors

The situation is somewhat different for regions with medium (more than \$ 150 million, but less than \$ 1 billion) and low (more than \$ 50 million, but less than \$ 150 million) level of export activity. It is noticeable among these agricultural enterprises the existing uneven use of intellectual property objects to achieve the outstripping competitiveness of the agro-industrial complex. Stavropol Territory, Saratov Region, Moscow Region, Altai Territory produce products under patents for selection achievements. The Novosibirsk Region, the Voronezh Region, the Kursk Region with significant patent activity introduce breeding achievements into their production an order of magnitude less. The remaining regions have both weak patent activity and insignificant use of breeding achievements. These indicators indicate uneven access of regional clusters of the agro-industrial complex to patent information due to institutional and financial constraints.

In the face of unprecedented sanctions pressure, Russia urgently needs much more effort and innovation in order to sustainably implement import substitution and increase agricultural productivity, create a new sustainable global partner value chain for creating agricultural products. Therefore, in order to reach an optimistic scenario, it is necessary to rapidly self-develop the agro-industrial complex capable of creating its own business chains in order to achieve import independence in agricultural production.

Last year, in order to meet the realities of the new economy, Rospatent has been expanding the possibilities of using the intellectual property tool through the creation of an intellectual property ecosystem (EXIS). The economic essence of EXIS integrates innovative (creation of new values based on a patent resource),

digital (integration of IP management processes on a single digital platform of Rospatent) and network (formation of national and international innovative business networks based on new knowledge) aspects of the ecosystem approach [12]. Consequently, the emerging intellectual property ecosystem based on Rospatent, which contributes to the technological and innovative development of the Russian Federation, can accelerate the creation of protected domestic agricultural technologies and the discovery of new partner networks, both international and municipal. Figure 5 shows a model of interaction with the Agro-industrial complex with EXIS to create new agricultural technologies.

A special role in the intellectual property ecosystem is played by the quality and availability of services to support and support innovative activities in the region. Technology and Innovation Support Centers (TISCs), as an element of EXIS, accumulate resources, experience, prospects, communications, create a developing space for working on innovative projects: from an idea, search for technological solutions, registration of applications and license agreements to implementation in regional production [13].

The task of the TISC is to intensify inventive and innovative activities in the regions of Russia, to promote the creation of intellectual property objects and their use in economic circulation. These Centers provide access to patent databases and other scientific and technical resources, conduct consultations and patent research, assist in the registration and licensing of intellectual property. More than 170 existing centers for technology and innovation support, being an important element of the EXIS, are able to accelerate the growth of intellectual resources of the agro-industrial complex

and municipalities to ensure the outstripping competitiveness of the country's agriculture.

In the spring of 2022, began to function a new element of the intellectual property ecosystem – a specialized center for the promotion of advanced technologies. The new department coordinates science-intensive projects aimed at replacing foreign products and technologies. The main task of the center is to coordinate high-tech projects, including those aimed at replacing foreign goods and technologies, both in the industrial sector and in the segment of consumer products. The center in an accelerated mode brings to the Russian market new domestic products with improved technical and economic indicators in relation to the sanctioned samples. In addition, its task is to develop the practice of comprehensive legal protection of advanced domestic developments for their full-fledged commercial success. The key area of work is to help institutions and enterprises identify innovative science-intensive solutions and bring them to protectability and commercialization.

At the moment, the center is actively using a recognized scientific and technical approach as reverse engineering. The agro-industrial complex, having used the services of a specialized center for the promotion of advanced technologies reengineering, is able to create not only solutions adapted to existing products, but also develop their own competitive technologies based on them.

The EXIS element is the technology and patent exchange that provides an opportunity to purchase innovative solutions protected by a patent for its commercialization. The purpose of creating an exchange of technologies and patents is to create a space for dialogue between business and the scientific community. The technology and patent exchange aims to provide links between researchers interested in promoting their developments and entrepreneurs interested in introducing innovations into their technological processes. The exchange minimizes the time it takes to find common ground between them, and provides a convenient platform for their interaction. Another function of the exchange is the filtering of technical solutions. Due to this, entrepreneurs interested in the implementation of intellectual property objects consider only realizable, affordable and profitable innovative ideas. The advanced technology platform providers are mainly Higher Educational Institutions and Scientific and Technical Institutes.

Agricultural production, implementing innovative technological solutions that are invented at Universities and Scientific and Technical Institutes of Russia, are able to carry out import substitution of key agricultural needs in the shortest possible time. And in the future, take part in the development of advanced technologies in cooperation with scientific organizations.

The emerging intellectual property ecosystem is creating new opportunities for technological innova-

tion in the agro-industry. In the context of the policy of import independence, EXIS can become a key tool and platform for the breakthrough creation of advanced technologies in the agro-industrial complex of the regions and the country.

Discussion and Conclusion

The results of the analysis allow us to draw the following conclusions.

A bibliographic analysis of the literature shows that the issues of intellectual property management related to patent activity in the agro-industrial complex remain insufficiently deeply developed. These issues, first of all, include the development of methodological tools for assessing the effectiveness of the formation and development of the patent potential of regional agro-industrial clusters in the context of new global competition for intellectual creative competencies. The results of a comprehensive evaluation and statistical analysis of intellectual property management in the field of agro-industrial complex and agriculture of the constituent entities of the Russian Federation on the principles of the ecosystem approach revealed the inequality of their monetary and institutional access to patent information, made it possible to propose a methodological approach to designing a typology of regional clusters of the agro-industrial complex, clarify strategic priorities and directions of their social – economic development. The unbalanced formation and development of patent potential in the Russian economic space is a threat to the sustainable development of regions, violation of their territorial intellectual integrity, increases the dependence of agricultural regions on the federal center, and reduces the ability for independent self-development. The identified negative trends affect the level of competitiveness of agro-industrial and agricultural enterprises, increase the outflow of highly qualified personnel from rural areas.

The domestic intellectual property market of agricultural production is characterized by a relatively low level of innovation and patent activity, which hinders the import substitution of high-tech advanced technologies, as well as the formation of a new sustainable partnership chain for the creation of highly intelligent agricultural production. Maintaining a relatively low level of intellectual potential of the agro-industrial complex of the country and its regions, limiting the possibility of acquiring high-tech foreign technologies over time will only increase the technological and intellectual lag behind the foreign enterprises that dominate the global intellectual property markets. Elements of the intellectual property ecosystem involved in the maintenance and support of patent and licensing activities can accelerate the process of forming the import independence of the domestic agro-industrial complex. The services of Technology and Innovation Support Centers, specialized center for the promotion of advanced technologies and the technology and patent exchange

for the coordination of high-tech projects and the intensification of intellectual resources of the agro-industrial complex and municipalities can contribute to the creation and implementation of protected domestic technologies to ensure the outstripping competitiveness of agricultural regions. Ural State Agrarian University can

become a key element of the intellectual property ecosystem in the agro-industrial complex and agriculture of the Sverdlovsk region, combining the functions of a supplier of technologies and patents, a consulting and educational platform for the development of the Technology and Innovation Support Centers system of the Ural region.

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