

# Modern Tendencies and Perspective Directions of Agro-Industrial Complex Development in Russia

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**Abstract**—The recent changes in the conditions of Russian agro-industrial complex operation have both positive and negative sides. The positive changes include the creation of more favorable conditions for domestic producers because of the introduced counter-sanctions aimed at restricting the import of agricultural products into Russia. The negative side is the unavailability of the agro-industrial complex and a number of supporting industries to sharply changed operating conditions. Further development of agro-industrial complex and effective overcoming of the problems are possible on the basis of creation and use of innovations and new technologies. In the paper, considerable attention is paid to the identification of innovation activity points of growth that are understood as activities for which either the growth rate or the average level of development exceeds the corresponding average characteristics for Russia as a whole. The level of development of export-oriented production in the domestic agro-industrial complex is considered as one of the indicators of success of innovative development of the industry. The positive effect of reorientation from the sale of raw materials to the sale of deep processing products is shown. Such a replacement is beneficial in terms of increasing the domestic agricultural production of valuable components for domestic consumption, and, accordingly, obtaining higher revenues from the sale of deep processing products. The results of the study can be used to determine the main guidelines for the development of the industry in the near future.

## I. INTRODUCTION

Russia's agriculture occupies an important place in the country's economy. First, it ensures the food security of the country by ensuring food independence, physical and economic accessibility of food. Secondly, agriculture contributes to the growth of the country's gross domestic product. Thus, the share of agriculture in GDP amounted to 4.5 % in 2016, and more than 5 % in 2018, and its absolute value raced up to 5119 billion rubles. Thirdly, more than 7% of the total number of people employed in the economy work in agriculture, and more than 25% of the country's population live in rural areas. Fourth, every ruble invested in agriculture gives a return in related industries in the range of 5-6 rubles. Fifth, agricultural raw materials, products and food are an important component of Russian exports. So the share of this component in exports amounted to 5.8 % in 2017, and to 5.5 % in 2018. The change in indicators was not due to a decrease in exports of agricultural raw materials, products and food, but due to an increase in the share of mineral goods in exports in 2018. These numbers clearly demonstrate the importance of the development of agriculture and its sub-

sectors (activities), both in terms of food security of the country and in terms of improving the level and quality of life of the population.

The success of Russia's penetration into the world food markets directly depends on the innovative orientation of agricultural activities, on the level of knowledge and competencies of workers in this field, the possibility of knowledge absorption, the speed of response to technological changes occurring around the world. Russian entrepreneurs in the near future will inevitably face serious challenges due to, on the one hand, the opening prospects of promoting their products to foreign markets, and on the other hand, the danger of losing previously established positions in the domestic market. In this regard, the study of innovative directions of agricultural development will allow assessing the possible effects of the innovative economy development, which in the future will ensure competitiveness at the international level.

## II. METHODOLOGY

### A. *Literature and data source review*

The analysis of current research on innovation activities development shows that in modern economic conditions, the state policy of many foreign countries has a regional orientation.

Agricultural research are supported by different structures such as National agricultural research systems (NARS), the agricultural knowledge and information system (FRIS), and the Agricultural innovation system (AIS). Each system is characterized by its goals, factors, results, organizational principles of construction, the role of the policy, as well as the mechanism of innovations implementation. According to the ranking compiled by the Organization for economic cooperation and development (OECD), the agricultural innovation system is presented by three main groups:

- the system of agricultural knowledge, research and development (R&D), and education;
- social and economic environment,
- users.

Agriculture Science and Technology Indicators (ASTI) can be considered as a source of information for the research of investments in creation new knowledge in agriculture. Indicator of agricultural R&D intensity in public sector is a

measure of investments in knowledge creation in this sector of economy. Global, regional and national instruments, such as barometers, indices and rankings, which best meet the requirements of efficiency, utility and market orientation of the results obtained, deserve special attention.

Lots of studies are focused on the problems of agricultural development. The development and implementation of international food and agriculture policies aimed at achieving food security in developing countries and meeting food needs in low-income countries are presented in [1], [2], [3], [4], [5], [6], [7], [8].

Some aspects of food security and food security in the context of the theory and practice of Russian regions sustainable economic development are presented in [9], [10], [11], [12], [13], [14]. Social and environmental parameters of agricultural economy have significant income on the development of food markets and the organization of effective food supply systems. The importance of innovation infrastructure development in agricultural sector is shown in [15], [16], [17], [18].

A number of researchers focus on the study of threats to food security. For example, in [7] the author considers the issues of exceeding the threshold values of saturation of the domestic market with imported food, price imbalances, lack of infrastructure development of the agricultural and food market, the shortage of qualified personnel for certain professions and specialties in agriculture, low effective demand for food, underdevelopment of the monitoring and forecasting system of the food market.

In numerous works authors study the food security of the state and its determinants. In [5], [6], [11], [13], [19] the food security is dependent on such factors as resource security (providing agriculture with qualified personnel, land, material and technical resources), the safety of the natural environment and the technogenic sphere of agriculture. Generally, food security is considered to be determined by three factors: the presence of food suppliers (supply), income (demand) and the population's access to food supplies.

Analysis of regulatory measures and the agricultural and food sector of economy support, along with the food system and the safety and quality of food products characteristics in Europe, USA, and Canada is represented in the works of Capone et al. [20][21]. In particular, in the works of Gill et al. [22], Grace et al. [23], Weikard [24] the authors note that the increase in food production while intensifying agriculture has its limits and leads to the adjustment of food production to a level sufficient to feed the world's population in the long term.

Despite the diversity of existing concepts and models of food security assessment, many of them are focused on the assessment of individual aspects of food security. For example, the numerical model of the general economic equilibrium analyzes food security as a result of the impact of customs and tariff policy on the agricultural and food market of Russia. Most models are applicable exclusively for food security analysis at the national or international level. For example, there are several predictive models (EPACIS, BLS, Aglink) for assessing food security at the macro level. The first model is based on modeling of partial equilibrium in agricultural markets, considerable attention is paid to foreign trade of the CIS countries. The second model reproduces the goals of market participants and limiting

factors in the form of a mathematical programming problem. The third is a recursive dynamic model of partial equilibrium across countries and regions of the world. The authors use simulation and forecast models, which allow to determine the activities of agricultural and food policy, ensuring the achievement of the set goals, for example, self-sufficiency of certain types of food at a certain level; that allows identifying possible directions of imbalances in food supply.

At the same time, despite a significant number of works devoted to the study of various aspects of the agro-industrial complex, there are no studies that offer a comprehensive assessment and development of methodology and methodological tools for the analysis of sustainable agriculture development. That confirms the relevance of the study.

### *B. Methodology of measuring the Russian agriculture development*

In the context of sanctions and the decline in economic activity in Russia, a significant interest is the study of the structure and main indicators of agriculture, their reaction to the changes. Dynamic can be measured using indices of the overall agricultural products and services along with the indices for separate types of activity in agriculture. First of all it concerns plant growing and animal farming.

As an indicator of the success the corresponding international trade indices may be used, and the export of the particular kinds of agricultural products should be considered as an indicator of this product sufficiency to provide food safety of the country in this respect.

Innovation activity as a base for sustainable economic growth has its specific indices. Output of innovative products and services is considered to be the most transparent measure of innovation activity effectiveness. As indices for it we can use a share of innovative agricultural products and services in the resulting output of agriculture as a whole. The share of enterprises involved in innovation activity in the overall number of enterprises is also widely used as an indicator of innovation activity spread. It can be calculated for separate types of activity in agriculture.

Comparison of the mentioned above indices for agricultural products and services with indices for all Russian economy provides benchmarking for corresponding types of activity. It can be useful, from one hand, in finding growth points in agriculture as the most innovative ones and, from the other hand, in identification the types of activity with the highest growth potential.

## III. RESULTS

### *A. Structure and dynamic indicators of agriculture development*

The analysis based on data of Russian Federal State Statistic Service shows that, despite the decline in innovation activity in a number of economic activities, the agro-industrial sector demonstrates, although insignificant, but the growth of production (Fig. 1).

At the same time, it is worth noting that the activities of the agro-industrial complex are specific and significantly depend on climatic conditions, which in the last decades have not been always favorable. Nevertheless, the manufacturing of agricultural products, raw materials and food is developing dynamically. Crop production

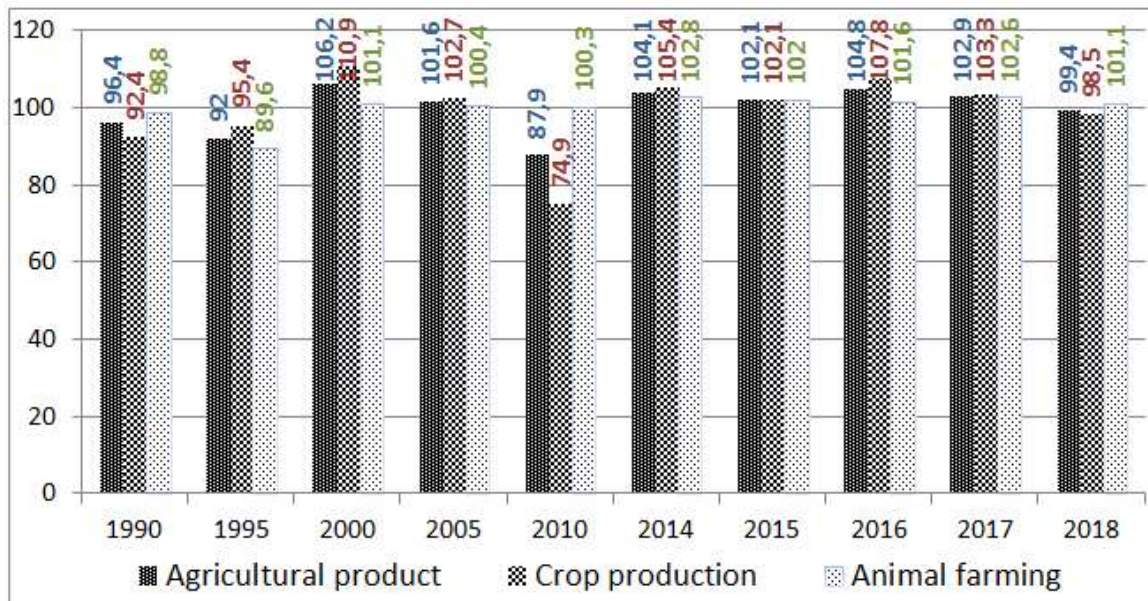


Fig. 1. Indices of agricultural production for the period from 1990 to 2018 (in comparable prices, as a percentage of the previous year) (Source: own elaboration based on data of Russian Federal State Statistic Service)

demonstrates higher rate of development in comparison to other activities. The crop production index was ahead of the livestock production index almost throughout the analyzed period. It should also be noted the higher rate of development of this type of activity in comparison with the national level. Thus, in 2016, the growth in crop production amounted to 7.8 %, in 2017-3.3%, which is generally higher than the GDP growth of the country and suggests the important role of agriculture as a socio-economic buffer, mitigating the impact of negative factors on the national economy development.

In general, positive growth in agriculture was observed in 2011 and in 2014, when sanctions and counter-sanctions were introduced, which stimulated the development of domestic agriculture.

The growth of indicators in agriculture is achieved due to the increase in efficiency in the agricultural sectors. In animal farming milk yield per cow increased from 2243 to 6478 kg at the period from 1992 to 2018, the average annual egg production of laying hens increased from 224 to 307 pieces, production of livestock and poultry for slaughter (in slaughter weight) changed from 8260 to 10585 thousand tons per year, respectively.

In crop production, there is a positive dynamics in the growth of grain and leguminous crops. The yield changed from 18.3 quintals per hectare in 2000 to 29.2 quintals per hectare in 2017. Its value decreased (to 25.4 quintals per hectare) only in 2018 due to unfavorable weather conditions.

The gross grain harvest shows a positive trend since 2014, when 105.2 million tons of grain were collected (in weight after completion). Further, this indicator increased to 120.7 million tons in 2016 and 135.5 million tons in 2017. The exception was 2018 year when the harvest was only 113.3 million tons because of weather conditions.

The increase in grain harvest had an impact on the growth of grain exports. For example, in the 2016/2017 season, the volume of grain exports amounted to 35.5 million tons, and in 2017/2018 it increased by 50 % (to 53.3 million tons).

The main export agricultural crop is wheat, its supplies to other countries in the 2017/2018 season increased to 44 million tons (an increase of 1.5 times compared to the previous year).

Thus, Russia in a short period of time from an importing country turned into a grain exporting country, took a leading position in the list of the International Grain Council (IGC) and pushed previously traditional suppliers from the United States, Europe and Australia.

All of the above states that the agriculture production in Russia is growing along with the exports of food products, agricultural raw materials and food.

*B. Directions of the agriculture innovation development*

Development of agriculture is one of the important directions to provide the development of the country and to improve the population living standards. The majority of tasks to provide it are reflected in the national project on support of export and cooperation and are connected with doubling of agricultural products export by 2024. The solution of this problem largely depends on the transition of agriculture to an innovative path of development associated with the use of new materials, methods of soil cultivation, and advanced technologies.

The development of the economy on the basis of innovation is not in doubt. Examples of the rapid development of a number of Asian countries through the use of innovative technologies and breakthrough technological solutions are well known around the world. Russia is also guided by them when developing an innovation development strategy. At the same time, the analysis shows that innovation activity in Russia, despite all the measures taken, has been falling in recent years.

The study of the dynamics of the main indicator characterizing the enterprises innovation activity results as a share of innovative goods, works, and services in the total volume of shipped goods, performed works and services, has an unstable oscillatory tendency. Thus, while the period from 2010 to 2013 was characterized by an increase in innovation

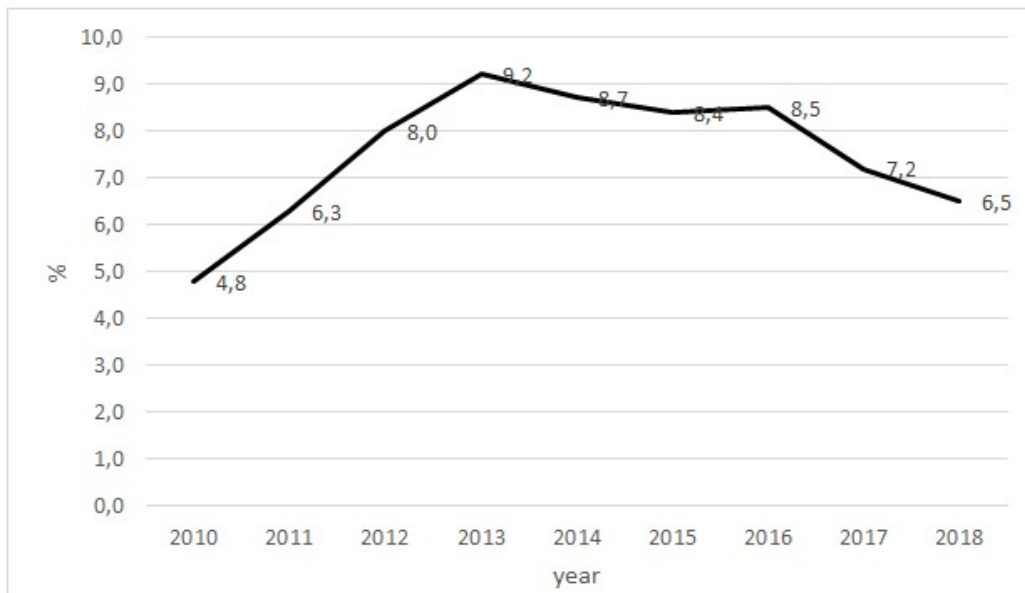


Fig. 2. Share of innovative goods and services in total amount of goods and services in Russia in 2010-2018 years (Source: own elaboration based on data of Russian Federal State Statistic Service ([www.gks.ru](http://www.gks.ru)))

activity in the country, when the share of innovative goods, works, services in the total volume of shipped goods, performed works and services reached the maximum value in the considered interval, amounting to 9.2%, then from 2014 there was a decline and in 2018 the value of the analyzed indicator was only 6.5% (Fig.2).

Thus, in comparison with the level of 2013, when the maximum surge of innovation activity was noted in the considered interval, the value of the indicator in 2018 decreased by 2.7 percentage points and amounted to 6.5. This trend of innovation development of Russia cannot but cause fears for its future and the possibility of meeting a number of targets for economic development.

In this regard, it is of great interest to identify points of growth of innovation activity in Russia, which can become

flagships of Russia's exit from the crisis and refraction of the emerging downward trend. To identify such growth points, the types of activities of manufacturing industries that are the basis of innovation activity in Russia in the creation of innovative goods, works and services were considered. The analysis showed that the innovation activity of domestic manufacturing organizations in general is not high enough and averages about 8-9 percent. The greatest innovation activity of organizations is noted in such economic activities as the production of tobacco products (low-tech manufacturing) - 47.1%; production of medicines and materials used for medical purposes (high-tech manufacturing) - 33.3%, as well as in the production of computers, electronic and optical products-32.9%; research and development-29.8%; production of electrical equipment-25.7%. That is, innovation activity is more inherent in high-

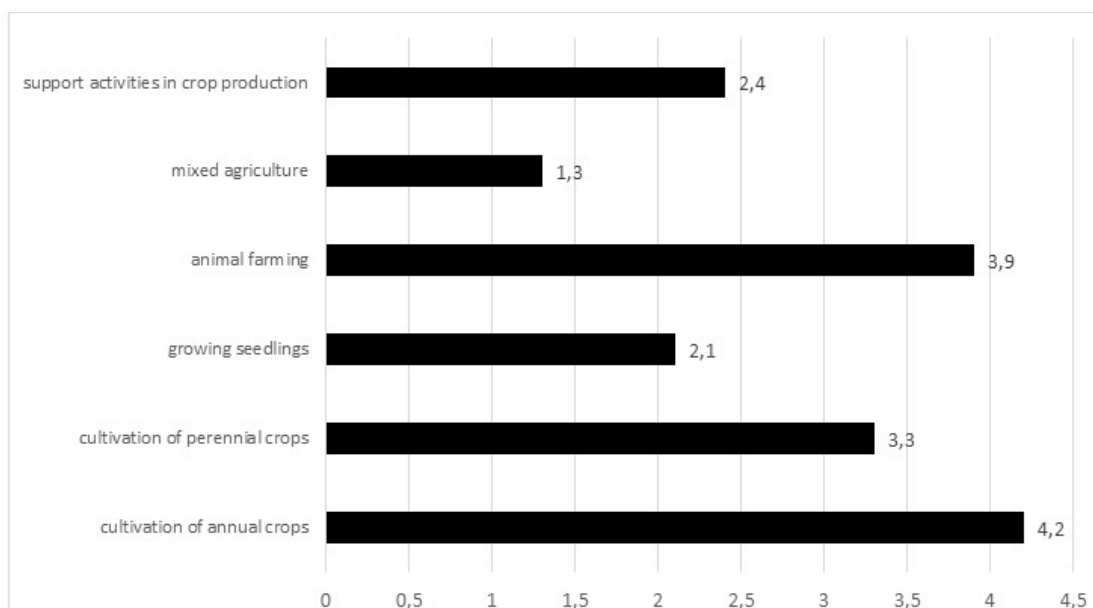


Fig. 3. Share of organizations involved in innovation activity for some types of activity of Russian agriculture in 2018 year (Source: own elaboration based on data of Russian Federal State Statistic Service ([www.gks.ru](http://www.gks.ru)))

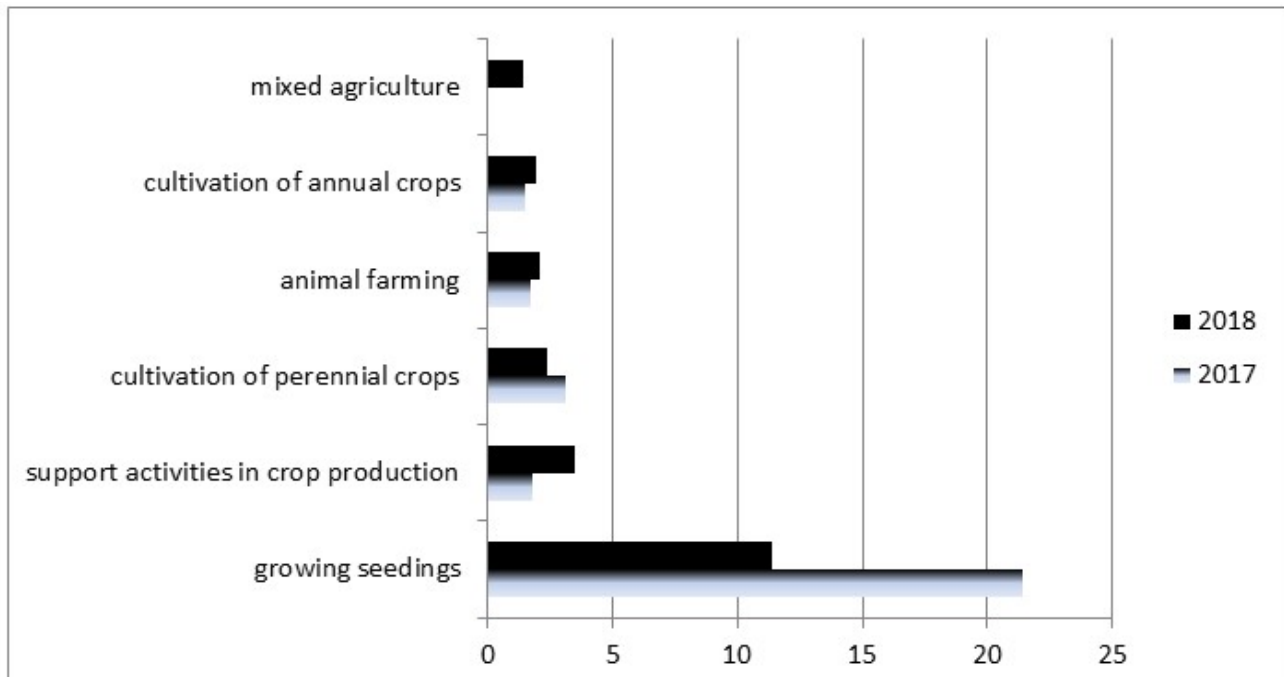


Fig. 4. Share of innovative goods and services in total amount of goods and services in some types of activities of Russian agriculture in 2017 and 2018 years (Source: own elaboration based on data of Russian Federal State Statistic Service ([www.gks.ru](http://www.gks.ru)))

tech industries. As for innovation activity of agricultural business organizations, it is much lower than the average level in Russia and ranges from 1 to 4.2% depending on the type of activity (Fig. 3).

The most innovation activity is shown by the organizations on cultivation of annual crops (4,2%) and animal husbandry (3,9%). An interesting fact is the entry Seedling cultivation into the top ten (7th place) on innovation activity, the share of innovative products in the shipped products for this type of activity amounted to 11.4% in 2018, which exceeds the average level for Russia by almost five percentage points. In 2017, this value was 21.4%, which exceeded the average level for Russia by 14.2 percentage points. So, we can confidently say that this type of activity at the present stage of agriculture development in Russia is an innovation activity point of growth (Fig. 4).

On Fig.4, the growth of innovation activity in the secondary agricultural sector in the field of crop production and post-harvest processing of agricultural products, whose innovation activity increased from 1.8% to 3.5%, is clearly visible. Against the background of a decrease in overall innovation activity from 7.2% to 6.5% at the period from 2017 to 2018 years, the growth of innovation activity in these particular activities can be considered as a favorable trend, which will allow for these types of activity to reach, and under favorable conditions exceed, the average level for Russia.

### C. Prospects of agricultural business development

In recent years, a number of Federal programs have been adopted concerning the development of agricultural industry. The purpose of these programs is to increase the importance of agriculture, which allows solving a number of global challenges related to ensuring food security in the country, ensuring a decent standard of living for the rural population largely through the development and support of farms, increasing the innovation activity of agricultural activities

through the use of advanced technologies and digital development opportunities, as well as increasing the export potential of the industry.

Selection of new cultures is considered to be one of the most important directions of the crop production improvement which in turn is a promising part of agricultural development. Experts also highlight new technologies for growing vegetables in the format of multi-tiered greenhouses, the introduction of controlled technology in crop production, selection of domestic seeds and other areas that can significantly increase the volume of production through the use of modern technological solutions. Another promising direction for the development of agriculture and cooperation with foreign partners is the development of agricultural ecology, which will provide support for the Federal scientific and technical program for the development of agriculture for 2017-2025 years. Some steps in this direction are already underway. There are new agreements of Russian authorities with leading manufacturers of herbicides and genetically modified seeds which include the transfer of advanced technologies in agriculture. A new technology transfer center is establishing at the National Research University Higher School of Economics. It will work directly with companies. According to the decision, the transfer will include the transfer of molecular selection of seeds of corn, rapeseed, wheat, soybeans, as well as vegetables (cucumbers, tomatoes and cabbage). By means of this center several dozen companies will have access non-discriminatory to scientific achievements and to digital farming technologies. These measures will help not only to maintain the competitiveness of Russian agricultural companies, but also to overcome technological backwardness in the agricultural sector. (<https://www.hse.ru/news/science/>).

Considerable attention should be paid to educational programs aimed at training or retraining of personnel with modern knowledge, allowing to conduct research at the level of the best world standards, as well as programs on



intellectual property rights. And here one of the main objects of attention is intellectual property rights in the field of biotechnology.

Thus, there are a lot of directions of development and tasks of the Russian agro-industrial complex. And only a comprehensive solution to a wide range of these tasks will help the industry to rise to the level necessary for sustainable development and ensure food security in the country, as well as the progressive development of the export potential of agricultural products, raw materials and food. Among the consumers of agricultural products, with which Russia can build long-term trade relations, we can distinguish the countries of the Indian ocean and the Persian Gulf, showing significant interest in cooperation in this area.

#### IV. CONCLUSION

The analysis showed that for the sustainable development of the country and improving the quality of life of the population it is necessary to pay significant attention to the development of agriculture in a wide range of areas. Among such tasks, food security, ensuring a decent standard of living for the rural population, and increasing the export potential of agricultural products, raw materials and food come first. In many ways, the solution of these problems depends on the use of modern advanced technologies and innovative solutions.

Certain positive trends have been achieved in agriculture of the Russian Federation. Food security of the country was ensured, the share of the agricultural industry in the gross domestic product is increasing, exports of agricultural products, raw materials and food are growing.

Experts note the prospects for the development of a number of innovative areas of agriculture, including multi-tiered greenhouses, the introduction of controlled equipment in crop production, selection of domestic seeds, agricultural biotechnology, Agricultural ecology systems and other areas that can significantly increase the volume of production through the use of modern technological solutions. In this regard, it is of great interest to identify points of growth of innovation activity in Russia, which can become flagships of Russia's exit from the crisis and refraction of the emerging downward trend of innovation activity in Russia as a whole.

Quite high innovation activity we can see in certain types of agricultural activities such as Growing seedlings and Auxiliary activities in the field of crop production and post-harvest processing of agricultural products. These points of growth can ensure sustainable development of domestic agriculture and solve the issues of food supply not only for the population of the country, but also to the whole population of the world.

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