Analysis of the innovative development of the agro-industrial complex

V I Bunkovsky

Irkutsk National Research Technical University, 83, Lermontov, Irkutsk, 664074, Russia

Abstract. The article analyzes statistical data on the innovative development in agriculture. Theoretical aspects of the application of innovations in agriculture are considered. Algorithms for implementing innovations in agriculture are described. Statistical data show that the level of innovative activity in the agricultural industry in Russia is only 3.8%. When compared with the European countries, this is a tenfold difference, which indicates the low efficiency of the Russian industry. The key reason is the level of government’s activity in stimulating the industry. The article also analyzes the methods and tools used by the Russian government to stimulate the innovative activity of Russian agricultural enterprises.

1 Introduction

In the era of globalization, agriculture is becoming an increasingly important industry. A sharp increase in the number of population and an associated increase in demand for food products pose new challenges for agricultural producers. They have to be sure that they will be able to produce enough food, while making a profit. Russian agro-industrial enterprises are searching for new means aimed to improve their efficiency, including innovation activities.

Agriculture in Russia is in search for new ways of development. It is experiencing difficulties, making attempts to solve problems that have accumulated during the transition period. Nevertheless, in recent years, Russia has entered the TOP-15 countries with the largest number of IT start-ups in the agricultural industry. The implementation of innovations has increased the volume of grain crops collected over 2016–2021. The Russian Federation participates in the world grain exchanges [1].

The world agricultural industry produces more food than humanity can consume. At the same time, every ninth inhabitant of the planet goes hungry, and every third suffers from malnutrition. The UN has developed the World Food Program “Zero Hunger” and suggested measures prescribed in the document. The program is designed to improve the situation by 2030, primarily due to the sustainable development of the world agricultural production. Russia plays an important role in this process, being among the leaders in the exports of food and agricultural raw materials [2]. The innovative development of the agricultural industry is a prerequisite, since the gradual transition from the traditional to precision farming based on high technologies is taking place. The foreign experience shows

* Corresponding author: chigir-1981@mail.ru
that the agricultural industry uses new technologies to improve accuracy, efficiency, and even remote management [1].

2 Materials and methods

Statistical data are presented and analyzed in the article. Important strategic directions for the development of agriculture and the agricultural industry are research progress and innovative processes that allow for the continuous renewal of production based on the scientific and technological achievements. The innovative approach is a systematic process of qualitative changes in products, means of labor, objects of labor, technology, production organization and management [3]. The goal is to improve the competitiveness and efficiency of the agricultural industry.

3 Results

Agriculture is one of the most important sectors of the national economy, which is slowly but steadily improving its indicators. While in the 1990s, the agricultural policy was not successful, starting from the 2000s the situation has changed.

By value added produced in the Russian agricultural sector, at the beginning of 2022, Russia has ranked fifth in the world (4.4 trillion rubles); it ranks seventh by direct investments in the agricultural industry. According to Rosstat, in 2021 Russian farms (agricultural companies, farmers, personal subsidiaries) produced products in the amount of seven trillion 572 billion 344.5 million rubles. Nevertheless, Russian agricultural experts speak of an extensive type of development of the agricultural industry. The comparison by years is presented in table 1.

Table 1. Indicators of the development of the agricultural industry in Russia.

<table>
<thead>
<tr>
<th>Index</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales by industry (billion rubles)</td>
<td>5801.40</td>
<td>6110.80</td>
<td>7572.3</td>
</tr>
<tr>
<td>Share in gross domestic product (GDP), %</td>
<td>3.4</td>
<td>3.6</td>
<td>4.5</td>
</tr>
<tr>
<td>Return on assets</td>
<td>4.7</td>
<td>6.1</td>
<td>6.6</td>
</tr>
<tr>
<td>Investments in the fixed capital of the agro-industrial complex, billion rubles</td>
<td>844.2</td>
<td>855.9</td>
<td>769.3</td>
</tr>
</tbody>
</table>

Table 1 shows that the volume of production of the Russian agricultural industry shows an annual increase associated both with the development of the national economy and the volume of consumption and the import substitution of foreign food products [4].

In the agricultural sector large agricultural companies which account for the largest percentage of production (more than 59% in 2021) prevail. At the same time, the cultivated area and the number of agricultural machines are gradually decreasing, which may be due to the economic difficulties as a result of which the farms are not able to use all available land and other resources [5]. The main indicators of the agricultural industry in Russia are presented in table 2.

Table 2. Main indicators of the state of the agricultural industry in Russia.

<table>
<thead>
<tr>
<th>Index</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of agricultural products by categories of enterprises</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farms of all categories, %</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Of which agricultural organizations, %</td>
<td>55.2</td>
<td>56.5</td>
<td>57.7</td>
<td>58.2</td>
<td>59.1</td>
</tr>
</tbody>
</table>
Over the past five years, the low level of innovation activity with a slight increase in economic indicators was observed in the agricultural industry.

Ultimately, the level of innovative activity in this sector is extremely low. According to the newsletter and the report of the Institute for Statistical Research and Economics of Knowledge of the National Research University Higher School of Economics, in 2021 the level of innovative activity in the Russian agricultural industry was as follows [6]: the share of innovative activity of agricultural enterprises was 3.7% (to compare, in the industrial sector the share was 15.6%); low involvement in innovation processes: the level of technological development was only 3.1%, which is 0.4% lower than in 2022. In general, in 2021, Russian agricultural enterprises spent only 15.8 billion rubles on technological innovations. Compared to other European countries, the gap is tenfold. In Switzerland, for example, the level of innovative activity is 75.3%, in Finland - 55.3%, in Denmark - 49.5%, etc. [6]. In the structure of costs for technological innovations in agriculture, investments in the purchase of machinery and equipment prevail (50.3%), which is typical for industrial production sectors. Expenditure on research and development accounts for only an eighth (in the industrial production sector - 23.6%), reflecting the low demand of agribusiness for the technology [7]. Figure 1 presents the share of costs in the agricultural sector.

Fig. 1. The costs of introducing innovations in agriculture.

Figure 1 shows that a larger percentage of the costs are for the purchase of machinery and equipment, which is most important for agricultural enterprises, since an increase in the volume of agricultural production directly depends on good equipment and machinery.
Most industrialized countries have achieved success largely due to the innovative development of both industries and agriculture. The Russian agricultural sector is creating an innovative system, its scientific and information support. Figure 2 shows an algorithm for implementing innovations by agricultural enterprises.

For the rapid development of innovations, a special innovation market should be created to promote innovations to the Russian and foreign markets of scientific and technical products. The government’s activities should play an important role in stimulating venture entrepreneurship, since the innovation process in the agricultural industry is risky and state guarantees are needed to attract investors [14]. The basis for the development of innovation in the agricultural sector should be the monitoring of needs of the agricultural market for technological achievements [8]. It is necessary to develop products that are important for the real sector of the economy.

The model of innovative development of the Russian Federation should not be based on obsolete foreign technologies. It should be based on its own scientific knowledge and innovations, exports of technologies and finished industrial products [9]. Russia could claim 10-15% of the world market for high-tech products.

![Fig. 2. Algorithm of the innovation process of agriculture in Russia](image)

### 4 Discussion

The main conditions for creating an effective innovation system are:

- Stability of the R&D public administration system.
- Development of an effective state innovation policy, its legal and resource support.
- Participation of science, industry and business in innovation activities.
- Interaction between the federal center and regions in developing and implementing innovations [10].

The innovative development of agriculture involves two blocks - resource and institutional. These blocks are presented in figure 3.
Figure 3. Ensuring innovative development in agriculture.

Figure 3 shows that the innovative system of agriculture is an integral set of interacting social institutions and organizations that transform scientific knowledge into new types of competitive products and services contributing therefore to the socio-economic development.

The problems of financing scientific and innovative activities deserve special attention. In order to turn the existing scientific and technical potential into an effective factor of the economic development, it is necessary to implement a comprehensive support policy for the innovative development of agriculture [11-14]. At the same time, the primary task is to create favorable financial, economic and legal conditions for developing the innovation system in Russia; otherwise, Russia may lose its scientific, technical and innovative potential [15-18].

The current innovative parameters of Russian agriculture are low. Unfortunately, there are no accepted indicators of the innovative level of agricultural production, which would make it possible to quantify it.

Indirect parameters that can be used are agricultural efficiency and agricultural labor productivity [19-22]. These parameters are highly correlated with the indicators of the development of intensive production technologies, the technical level of management, the level of seed production and other factors.

The indicators in Russian agriculture are not high:
- Productivity, for example, of cereals is 22-23 cwt/ha, compared to 32 cwt/ha in developed countries.
- Cow productivity is almost two times lower than in the leading countries of the world.
- Labor productivity is 5-7 times lower than in the agriculture of Canada, which is located in the latitude zone similar to that of Russia.
- Specialists with higher education are only 30-40% of the need.
- Social inadequacy of the rural areas, low wages do not stimulate but hinder innovation processes.
- The entire MTP needs modernization.
- Only 1% of almost 23 thousand agricultural organizations, enterprises and farms work at high innovation and technological level.
• Innovation potential of Russian agroindustrial complex is used by 4-5%, while in the USA it is used by 50%.

All this indicates that the level of innovation development in the agricultural sector does not correspond to the favorable agro-landscape conditions of farming.

5 Conclusion

Thus, to increase the volume of agricultural production, a new technological base, modern technological equipment, productive genetic potential and accelerated development of innovative technologies are required. It is necessary to increase the pace of development of innovations in agriculture in Russia.

References


[19] Sharipov S Production costs in the conditions of innovative development of agriculture. *Agro-industrial complex: economics, management* **9** 22-26

