The trend for environmental engineering in agribusiness: leaders and prospects

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Abstract. The article discusses global shifts in the global agricultural development market, as well as in Russia. One of the main conditions for the development of agribusiness at the present stage is the formation of an effective innovation environment. The main negative trends in the development of agribusiness in Russia are revealed. A low level of technologicalization and digitalization of agriculture is noted. The main priority areas for taking measures to protect and strengthen the development of agribusiness have been identified. Among which are considered the main components of the concept of environmental engineering of agribusiness. The paper analyzes the data on the production of organic products in Russia and the countries of the world. Examples of the development and implementation of advanced environmental engineering solutions in Russian agribusiness are given. According to the results of the study, the authors identified the TOP-10 trends in the development of environmental engineering in the agribusiness of Russia, as well as the main directions in the development of agribusiness. Ecological engineering will help realize the idea of sustainable development of agribusiness, which can simultaneously reduce the harmful effects on the environment and increase the efficiency of technological processes.

1. Introduction
A lot of scientific work has been devoted to the problems of the development of the food market. The global shifts in the world market, factors determining the development of agricultural production and changes in food consumption trends are studied [1, 2, 3, 4, 5, 6].

One of the main conditions for the development of agribusiness at the present stage is the formation of an effective innovative environment [7]. But, unfortunately, the agro-industrial complex of Russia continues to remain a fairly closed area for the introduction and diffusion of innovations. At the same time, on the world market, agribusiness is becoming the focus of interests of global investors and acts as a rather significant instrument of international politics.

Changes occur both in the agricultural market and in the organization of agricultural production, in the structure of consumption, changes in consumer values, in the system of agricultural technologies, and the explosive growth of innovations.

2. Research methodology
Crop production is the largest branch of agriculture, which provides about 70% of world food. The leading crop sector in Russia is the cultivation of grain crops [8, 9]. These include rye, wheat, barley, corn, rye, oats. World wheat exports in 2018 amounted to approximately $ 201.2 billion, a decrease of
-13.8% over the past five years, starting in 2014. From 2017 to 2018, world wheat exports grew by 5.7% [10].

Among the exporters of wheat, Russia occupies a traditionally leading position. The positive trade balance of Russia for this type of product confirms the country’s competitive advantage in the production of one of the priority categories of food products (table 1).

Table 1. Top 15 countries leading global wheat exporters in 2018 [11].

| Exporting country | Export volume ($ Billion) | Share in total wheat exports (%) |
|-------------------|---------------------------|---------------------------------|
| Russia            | 8.4                       | 20.5                            |
| Canada            | 5.7                       | 13.8                            |
| United States     | 5.5                       | 13.2                            |
| France            | 4.1                       | 10.0                            |
| Australia         | 3.1                       | 7.5                             |
| Ukraine           | 3.0                       | 7.3                             |
| Argentina         | 2.4                       | 5.9                             |
| Romania           | 1.23                      | 3.0                             |
| Germany           | 1.16                      | 2.8                             |
| Kazakhstan        | $965.4 million            | 2.3                             |
| Bulgaria          | $849.7 million            | 2.1                             |
| Hungary           | $482.1 million            | 1.2                             |

Net surplus of wheat exports in Russia increased by 57.2% since 2014. At first glance, it might seem that a trade surplus is an optimal scenario for the development of Russia's agro-industrial complex. On the one hand, this state of affairs can be regarded as a positive trend due to the fact that it is an indicator of the demand for Russian agricultural products on the world market. In addition, a significant amount of export is a source of budget revenues, including in foreign currency. But on the other hand, it is necessary to think about a new quality of export; a surplus of net grain export alone is not enough. Russia should start producing and supplying products with higher added value to the world market.

In the structure of Russia’s exports, grains occupy the third place in the structure of total exports from Russia – 2.3% (figure 1).

Figure 1. Russia’s Top 10 Exports [11].
Of course, wheat production depends on the climatic conditions of the country. But if we analyze the export structure of the top 10 countries producing wheat, we will see that far from all countries, cereals occupy a leading position in the export structure. In countries with sufficiently developed economies, cereals do not predominate in the structure of exports (France, Canada, USA, Germany) (figure 2). They are characterized by non-primary high-tech exports.

![Figure 2. Export Structure of Leading Grain Exporting Countries (developed countries), %](image1)

Countries with a high share of commodities in the export structure are facing serious economic problems (Russia, Ukraine, Romania, Argentina) (figure 3).

One of the strategic problems of these countries is the small number of grain processing plants in the domestic market, which in turn creates a strong dependence on world trends.

![Figure 3. Export Structure of Leading Grain Exporting Countries (developing countries), %](image2)

Export plans occupy one of the priority places in the forecasts of the Ministry of Agriculture of Russia, since, according to the May decree of President Vladimir Putin, the export of agricultural products by 2024 should increase to $ 45 billion. Among the main priorities for the development of Russia's agricultural sector in 2019 should be increasing exports.

But when developing a development strategy for the agro-industrial complex, it is necessary to take into account that the price dynamics in the grain market is based on world grain production and stock quotes. To reduce dependence on the foreign market, it is necessary to raise domestic grain
consumption through the development of livestock and deep processing of grain with a parallel expansion of exports of products with a higher degree of redistribution.

Russian grain in terms of price/quality ratio is the most competitive in the world market. Product competitiveness is largely determined by the low cost of labor and land in Russia. Low labor costs do not stimulate the Russian market to create and implement new technologies in agribusiness to reduce labor costs.

Grain is, in fact, the same raw material as oil and gas. By supplying grain to the world market, we allow profit from its sale to be received by foreign companies and states. Since it is there, in the end, that added value is created, and as a result, new high-tech jobs are created, the quality of life of the population is growing, budgets receive additional taxes. At the same time, there are a large number of countries in the world that are ready to import starches, amino acids, molasses and various food ingredients and animal feed from Russia. For the development of the national economy, export of high-margin products is more advantageous than supply of agricultural raw materials to the world market. The development of grain processing in the coming years should become one of the main directions of development of agribusiness in Russia.

3. Results of a research
The development of grain processing will provide Russian agribusiness products with stable sales markets, with a sufficiently high degree of predictability and a sufficiently high price for its products. In addition, the development of domestic grain processing will reduce the dependence of the Russian economy on global market development trends. So, according to the forecast of the Analytical Rating Credit Agency, there are external risks that can affect the Russian economy, including the endogenous recession in the USA and the debt crisis in China [12].

Products of deep processing of agricultural raw materials are promising goods for export and will stimulate the development of the national economy. But most Russian enterprises today are not ready for competition in the global market - there is simply not enough technology. The level of development and implementation of innovations in Russian agribusiness is extremely low.

So, despite the leading position in the supply of grain in the world market, the development of agribusiness in Russia is characterized by a number of negative trends. The main ones are:

- the lack of financial resources from agricultural producers for investment for investment, including in innovative developments;
- a high degree of borrowing by agricultural producers;
- the functioning of individual sub-sectors of the agro-industrial complex is largely import-dependent (supply of seeds, genetic material, new technologies, agricultural equipment);
- the presence of significant imbalances in the structure of the agro-industrial complex: “one-sided” development of the grain economy and an increase in grain exports, led to a break in technological ties between crop production and livestock;
- instability of the domestic currency;
- falling living standards, lower incomes;
- extremely low rates of structural and technological modernization of the agro-industrial complex.

In the Global Innovation Index for 2016, Russia occupied 43rd place, and in 2018 - 46th, losing 3 positions [13]. The share of costs for technological and marketing innovations in the total volume of goods shipped, work performed, and services is characterized by negative trends (table 2).
| Types of economic activity | 2017 Technology innovation | 2017 Marketing innovation | 2018 Technology innovation | 2018 Marketing innovation |
|---------------------------|---------------------------|---------------------------|---------------------------|---------------------------|
| Total                     | 2.4                       | 1.4                       | 2.1                       | 1.3                       |
| of which by type of economic activity: | | | | |
| annual crop               |                          |                          |                          |                          |
| cultivation               | 1.5                       | 0.3                       | 2.0                       | 0.4                       |
| cultivation of perennial crops | 0.8                       | -                         | 0.2                       | 0.3                       |
| seedling cultivation      | 0.6                       | -                         | 5.2                       | -                         |
| animal husbandry          | 0.7                       | 0.8                       | 0.6                       | 0.7                       |
| mixed farming             | -                         | -                         | 5.0                       | -                         |
| auxiliary activities in the field of crop production and post-harvest processing of agricultural products | 5.9                       | 0.3                       | 6.4                       | 0.3                       |

The share of costs for technological and marketing innovations in the total volume of goods shipped, work performed, services by type of economic activity.

Trade in grain as a raw material only hinders the promotion of processed products and restrains the domestic market. Hence the low level of technologicalization and digitalization of agriculture.

According to the Ministry of Agriculture of Russia, out of 1000 agricultural workers there are only 5 IT specialists, investments in digital technologies are no more than 10 rubles / ha, while in the European Union (EU) - 25 IT specialists and 350-500 rubles / ha. Russia ranks 15th in the world in terms of overall digitalization, 45th in terms of the penetration of information technology into agriculture, and only 10% of arable land is processed using digital technology.

On the world market, many resource factors, primarily cheap labor or land, no longer determine the competitiveness of agricultural products. The determining factor in influencing the level of product competitiveness is modern technological solutions and digitalization of agribusiness.

The set of professional competencies of agribusiness specialists is also being transformed. The competency portfolio today includes biotechnology, bioinformatics, chemistry, physics, and geographic information systems.

In the framework of the agricultural policy of the European Union, three priority areas have been identified for taking measures to protect and strengthen the development of agribusiness:

- conservation of biodiversity and the development of “natural” systems of agriculture and forestry and traditional agricultural landscapes;
- rational use of water;
- consideration of impacts on climate change.

These areas make environmental requirements the basis for developing the concept of sustainable development of agribusiness, not only through the introduction of technological and digital innovations, biotechnologies and new materials, but also the development of agricultural practices aimed at preserving the environment. This is fully consistent with the concept of environmental engineering agribusiness.

The share of organic products on the world market is relatively small, but the market for organic products is growing rapidly and subsequently the market will only grow. Analysts at SBS Consulting
in the study predict that the growth rate of demand for organic products is accelerating and will reach 16% by 2020. As organic products are gaining popularity in the world, Russia, having enough agricultural land, should occupy an existing niche. In Russia, the demand for organic products is growing faster than worldwide - by 23% per year. But organic products in Russia account for only 0.1% of the country's total food market [14].

Organic land accounted for 7% of the total agricultural land of the European Union in 2017. On average, the share of such land in developed countries reaches 10% of all farmland. According to the statistical service of the European Union, TOP-10 countries can be distinguished by the number of farmland under organic farming (figure 4) [15].

![Figure 4. TOP 10 European Union countries by organic area.](image)

According to the Ministry of Agriculture of the Russian Federation, Russia ranks 15th in the world in terms of digitalization, in the country only 10% of arable land is processed using digital technology. Nevertheless, innovations come to Russian agribusiness. The most successful examples of the development and implementation of advanced environmental engineering solutions are given in the table 3.

| Developer | Development Examples | Effectiveness of implementation |
|-----------|----------------------|--------------------------------|
| Scientific and technical center «RoboProb» | Automated system for collecting soil samples | Allows you to reduce the cost of monitoring the state of arable land |
| Company «Agronout» | The project of differentiated, based on an objective assessment of the condition of the soil, fertilizer | Improving soil fertility, rational land use |
| Company «Proagrotech» | ExactFarming cloud efficient crop management service | Allows to significantly increase economic efficiency in crop production |
| Company «Agrosignal» | A system of operational and fully automatic online control of all elements of the production cycle and management of the Agro-business: equipment, fields, personnel, weights, warehouses. Visual information in any convenient section | Profitability of agricultural production increases by 20% |
| Rostselmash Group of Companies | Artificial Intelligent Robotic Combine Harvester | Significant economic effect |
Despite some positive examples, the target setting of the roadmap for the development of the Russian agro-industrial complex by 2019 has not been achieved. So, the share of Russian enterprises using digital solutions should have reached 30%. But the share of domestic developments did not come close to achieving this indicator. The share of developments in the field of ecoengineering is about 10%.

4. Conclusions
According to the results of our study, we identified TOP-10 trends in the development of environmental engineering in agribusiness in Russia (figure 5).

**Figure 5.** Top 10 trends in the development of environmental engineering of agribusiness in Russia.

According to the results of the analysis, the following main directions in the development of agribusiness can be distinguished:

- the need for a faster, avalanche-like implementation of technological and digital environmental innovations, biotechnologies and new materials, and as a result, a change in the structure of employment in agribusiness;
- change in the value chain in the structure of the agro-industrial complex, transition to the production of high value-added products, product differentiation taking into account international requirements;
- transformation of the existing business model in agribusiness, transition to the development of the domestic market with a simultaneous change in the structure of exports;
- expanding the development potential and methods of organic farming as a sustainable model of agribusiness.

At the same time, the development of the main directions should ensure not only the growth of investments in agribusiness, but also as an indispensable component of their innovative “occupancy”, taking into account the development of the entire value chain when changing the agribusiness business model with a focus on organic agriculture as a sustainable agribusiness model.

The priority area for the development of the agro-industrial complex will be environmental engineering. The development of innovative technologies in agribusiness will be actively developed in the direction related to environmental protection and the use of renewable energy sources. It is
environmental engineering that will allow us to realize the idea of sustainable development of agribusiness, which can simultaneously reduce the harmful effects on the environment and increase the efficiency of technological processes.

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