Green biotechnologies in the trend of scenario development of the agro-industrial complex

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Abstract. Forecast scenarios of scientific and technological development of the national economy are adaptively written off in the paradigm of technological patterns and progressive development of industries. The AIC becomes one of the supporting industries actively generating and implementing the production process of new biotechnological production solutions in the trend of green development. The tendencies of future forecast of biotechnologies application and growth of demand for products with new qualitative characteristics are considered. The conclusions are drawn about the growth of activity with regard to the search and development of fundamentally new approaches to the production and processing of AIC products.

1 Introduction

The agro-industrial sector of Russia is the leader in the implementation of the National NTD Forecast of the Russian Federation for the period up to 2030, which clearly states the need to develop more detailed sectoral forecasts. The main objective of such work is to inform stakeholders about global changes and transformations in industries and individual spheres of the national economy in the most preventive way possible.

The Ministry of Agriculture of Russia promptly started to develop a sectoral forecast of the national AIC development for the period until 2030. This outlined promising directions of scientific and technical development of agriculture for the subsequent strengthening of national food security and sustainability.

The AIC Forecast plays a significant role in the overall system of strategic planning of the economy, due to the growing external triggers that hinder the implementation of national projects, restrictive sanctions by a number of countries on import-export of goods and

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technologies, as well as changes in the general climatic background. With this Forecast, the country has set a national objective to fully meet domestic needs with food at affordable cost and of high quality. In addition, the volume of agricultural resources allows the country to become a major global supplier of agricultural and food products for many countries of the world. Agro-climatic conditions of the country, vast areas of land fund suitable for agricultural activities, water reserves - these are the competitive advantages that only our country has [1].

The growth of the Earth's population dictates an increase in demand for agricultural products. At the same time, the productivity growth of traditional agricultural production technologies is decreasing, which stimulates the search for new innovative biotechnological solutions to obtain the effects and productivity growth of industries. Activation of new biotechnology's implementation in production depends on a variety of factors of the external business environment that generate and stimulate the development of the potential of enterprises in the industry [2].

The practice of implementation of agrarian policy of the last 10 years has shown that there is a wide range of external threats to the implementation of the strategy of scientific and technological development of agro-industrial complex until 2030. Let us consider the main threats and potentials of the Russian agro-industrial complex in various spheres of social structure (figure 1).

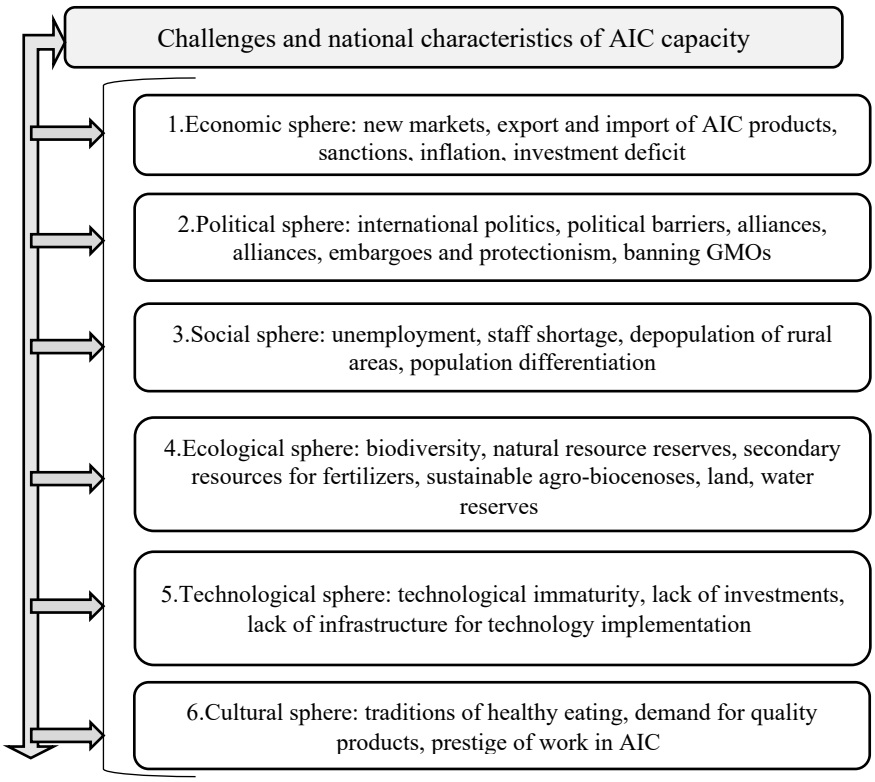

Fig. 1. Challenges and opportunities for realizing the development potential of Russia's AIC.

The potential of Russian agriculture will expand in the current complex geopolitical environment. In every sphere of the social structure, there are both external threats and new prospects [3]. For this reason, it is necessary to improve the practiced technological solutions and actively implement them in production.

2 Materials and methods

The principles of green transformation of economic development were laid down in international supranational normative acts of the UN, which acted as the main basic sources of information. Studies of domestic and foreign economists gave directions for revising the paradigm of linear production.

Using the methods of foresight forecasting and mathematical modelling, forecasts of scientific and technological development of the agro-industrial complex of Russia were made and the place of biotechnology as one of the driving factors of transition to a new way of life was determined. The experience of implementation and introduction of biotechnology in the production processes of AIC enterprises was assessed by methods of comparison, analogy, logical and graphical analysis. The conclusions obtained as a result of the study were summarized, systematized and substantiated.

3 Results and discussion

Today, large agricultural holdings are scaling their business to the maximum extent possible, while actively investing in innovative biotechnological solutions to intensify and increase the productivity of agricultural production. In this context, there is a constant search for new agrochemicals, revision of the paradigm of transition to organic agriculture, application of AI in obstipation of processes that will not only solve the production task, but also reduce the anthropogenic load on nature.

Co-operation between small businesses and large agricultural holdings gives rise to new business models in the AIC industries, and the share of foreign holdings is quite high. Partnership in this case should be mutually beneficial rather than resource-oriented. An open national agro-industrial sector should not generate new risks and violate the rights of the country's citizens or interfere with the work of national companies. Therefore, an effective system of protectionism and protective intellectual and resource legislation should work. Foreign companies entering the AIC sector should, first, not extract and export, but produce, process and sell [4].

The intensification of agriculture today follows the path of symbiosis of practice and science, on the basis of which new techno parks, bio-clusters and bio-laboratories are being built.

For example, in the Belgorod Region, Efco Group plans to launch a new biotechnology cluster for the production of Russian fermented feed preparations for farm animals by 2027. The main economic effect of this project is an increase in the share of domestic lump ferments in livestock farms from 15% to 61%, with a production volume of 2,000 tonnes per year. Today the consumption of enzymes is 5.34 thousand tonnes, with 85% imported. This biotechnological cluster has a large market for the sale of its own products, as the capacity of the domestic market will be 42% free [5].

Large holdings are the drivers of "green", organic and technological transformation of AIC in the regions. Having significant investment resources, they can stimulate the development of entrepreneurship in depressed regions traditionally specializing in agriculture [6]. At the same time, the capacity of such corporations allows small agricultural producers to function with them in co-operation within the framework of implementation of 1 technological operation (fattening, breeding, slaughtering or processing of secondary raw materials). The inclusion of small farms in the production process gives large businesses a certain flexibility and mobility in some complex operations. Small businesses receive a stable sales market and timely payment for their services and work.

The growing global climate challenges generate the search for resource-saving and precise technologies. A certain technological lag of the Russian AIC from the world leaders

stimulates the creation of innovation growth points and development of new biotechnological solutions on the basis of scientific laboratories and educational institutions.

From the point of view of academician of the Russian Academy of Sciences Glazyev S.Y. today the economy is undergoing the next wave of its progressive development, in which nanotechnology is the dominant factor [7] (figure 2).

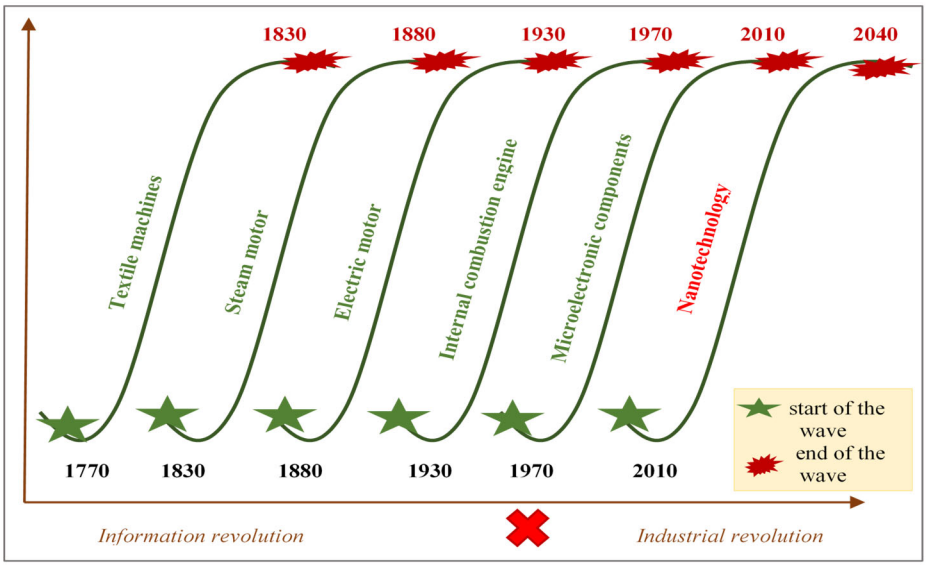

Fig. 2. The Theory of Technological Patterns by Academician of the Russian Academy of Sciences S.Y. Glazyev.

According to the theory of technological modes, the economy is currently undergoing the 6th mode (wave) since 2010. Development is rapidly gaining momentum, and the driving factor of this wave is nanotechnology, which in the agro-industrial complex economy is taking the form of biotechnology [8].

The green course of the world economic system, first voiced in 1992 at the UN Conference in Rio de Janeiro, for 30 years has been implemented by the states in accordance with their resource capabilities. At the same time, the combination of the 6th technological mode and green vector of development is superimposed on biotechnological projects in the field of increasing the intensity of agricultural production [9, 10].

Nanotechnologies, which serve as a driving factor of the 6th pattern, are harmoniously adapted to all supporting or basic sectors of the national economy. The agro-industrial complex as a producing industry is actively implementing projects to develop biotechnologies aimed at improving the quality and economic efficiency of food raw materials produced [11, 12]. At the same time, biotechnologies are successfully integrated into the trends of green development and are actively used in advanced countries, transforming traditional goods and production processes. Green technologies constitute one of the core segments of the sixth technological mode, producing maximum economic, environmental and social effects for society [13]. Let us consider in more detail the structure of the 6th technological wave (mode) (figure 3).

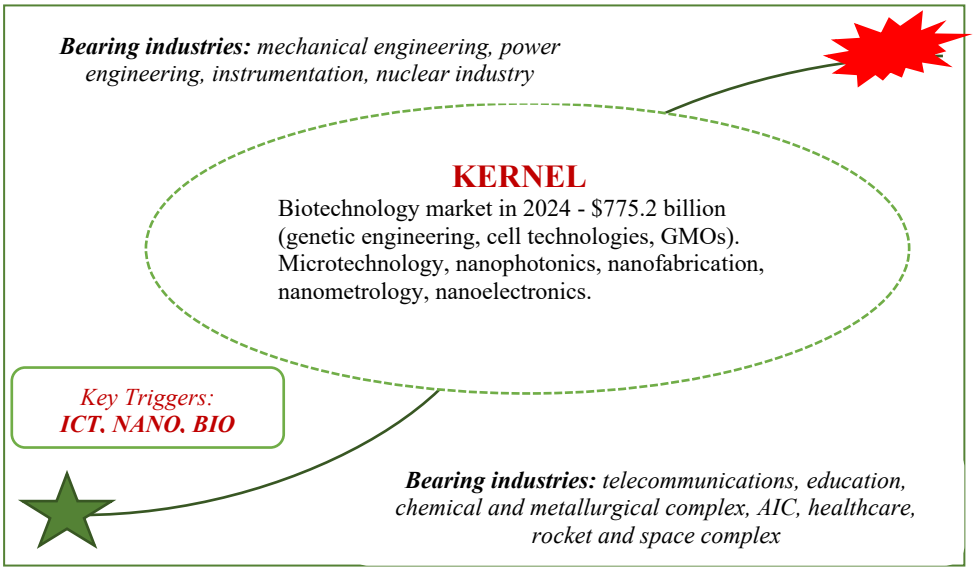

Fig. 3. Structure of the elements of the 6th technological mode [5].

According to the scheme presented in figure 3, we can see that the conjugation of advanced technologies, which act as a driving factor of economic development within this mode, are actively being introduced and expanding their areas of application. In fact, today we can observe many of these technologies in everyday life, which proves the beginning of entry into the 6th mode, but at the same time, periodic spikes in energy prices and crises indicate the end of the 5th mode [6, 14, 15]. Therefore, there is a process of overlapping of the end of the former mode and development of the new one, but in any case a new paradigm of global development of the national economy and its future breakthrough is being formed.

Let us dwell in more detail on the biotechnology market, the volume of which is forecasted to reach $775.2 billion by the end of 2024. On average, over the last 5–6 years, this market has been growing by 9-10% per year. The Russian biotechnology market is minimally represented in this structure [16]. The domestic agro-industrial complex depends on imported seeds and genetic material, has no practice of large-scale application of agro-technologies, there are large losses during harvesting, transport and processing. And as a result of these processes - large losses of profit or lost profits in the export of food raw materials, while the export of products of deep processing costs 3–4 times more expensive.

The existing distortions in the development of Russia's AIC require revision of the entire system of industry management and reformatting of approaches to state support for certain scientific developments in the field of breeding, genetics and formation of the breeding and seed base [17, 18]. Approximate calculations of experts have shown that exports of deep-processed products will bring up to $25-40 billion to the state budget, as well as tens of thousands of new jobs, opportunities for the development of rural areas and improving the quality of life in growth points. It is necessary to develop domestic processing, as the export of Russian food raw materials abroad for processing and production of finished forms is not always technologically safe [19]. As a rule, in order to make production cheaper, companies add GMOs or antibiotics to increase the safety of products and thus saturate the world food market, including the Russian one, with cheap products that do not meet the standards of healthy nutrition [20].

3 Conclusion

The Russian AIC today works quite efficiently and constantly increases the volume of produced food raw materials, which need to be efficiently preserved, transported and processed. At the moment, the growth of AIC production is achieved by extensive methods by increasing agricultural land, increasing state support for the AIC, increasing crop rotations, but new biotechnological and agro-technological solutions in production are practically not used.

The implementation of a new scenario of scientific and technological development of the AIC provides for the assessment of existing challenges to the successful development of the industry and offers new approaches for the activation of biotechnological initiatives in the industry and the transition to new "green" trends. The creation of biotechnology clusters, techno parks and laboratories provides an opportunity to concentrate developments and actively promote them for implementation in practice.

Reducing dependence on imported processing will provide additional income and social effects for rural areas, allow the construction of infrastructure facilities and improve the quality of life in the regions. In addition, own processing complexes will fill the domestic food market with high-quality products made from environmentally friendly domestic raw materials, while reducing imports of cheap foreign products with GMOs and other harmful food ingredients.

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