

Review paper

DOI: 10.7251/AGRENG1603097K

UDC 338.43:316.422

INNOVATION DIRECTIONS OF EFFECTIVE AGRO-INDUSTRIAL ACTIVITIES

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ABSTRACT

The bodies of the Russian Federation's state management, scientific society, agri-business face the challenges of searching for new directions to provide effective development of agro-industrial activities in the modern conditions of increased competition. Severity of problems in development of the Russian agro-industry is caused by the complex of climatic, historical, economic factors. The need for creation and justification of conceptual alternatives based on forming innovative directions for support of effective development causes application of both new and improved management decisions technologies and updated basis criteria and parameters of their introduction with appropriate adoptive mechanisms on territorial levels and in the industry. The objective of the paper is to justify innovative directions of provision effective agrarian activities. The analysis of economic literature, regulatory basis shows the certain reserve with potential to increase the efficiency of domestic agro-industrial production. Analysis of the Russian Federation's agro-industrial complex condition allows assuming that the main hindrance factor in extended introduction of innovations is persistent non-solvency of agrarian enterprises and lack of required means at research institutions to promote their developments. Implementation of innovative directions for effective development of agro-industrial complex enables proving conceptual alternatives and forecasting result capacity of their use for aspects of rural development, improving mechanism of reducing negative anthropogenic influence on environment and ecosystem rehabilitation.

Keywords: *agro-industrial complex, innovations, sustainable development of rural areas, biotechnologies, import substitution.*

INTRODUCTION

The problems of agrarian production were considered by classical economists, Smith (2008) and Ricardo (2008). The works of A. Marshall contain the detailed analysis of their views on this issue (Marshall, 2008). The leader in the study on qualitative changes in the sphere of economy caused by introduction of different technological, innovative, management and consumer innovations into various economical activities is I. Schumpeter. In 1911 in his work "The theory of

economic development” the pioneer of the scientific direction described the influence of market demand and supply on innovations. Under latter he understood qualitative changes characterizing and determining the appropriate stage of production relationships in society (Schumpeter, 1982). Later this theory, applying to agriculture, was developed and complemented by many outstanding economists; among them we can point out McConnel and Brue (1992).

The current state of agro-industrial complex enables us to suggest that the main inhibitory factor for large-scale innovations introduction is persistent non-solvency of agrarian enterprises and lack of required means at research institutions to promote their developments.

In the regions there are no or undeveloped management structures whose functions are to supervise the bank of innovative products and their state appraisal, marketing assistance for agricultural producers, paperwork to purchase and pay for innovative technologies and stuff to enter grant competitions, scientific and technical maintenance. There are no mechanisms and tools of close interaction between agrarian business community and regional government.

At the same time at the federal level, executive authorities identified and set down in normative documents main directions for development of agro-industry taking into account innovation component, their financial maintenance. Thus, the Russian Federation Food Safety Doctrine determines risks for stable functioning of agro-industry, among which low investment appeal and technological lagging behind developed countries, as well as agro-ecological risks caused by unfavorable climatic conditions, and low innovation and investment activities in agrarian production.

One of the most important supportive directions for effective development of the industry is forming of favorable investment climate as a main factor for competitiveness of agrarian economy enabling the sector to apply advanced technologies (Zvyagina, 2014). Under conditions of economic uncertainty, forming of such climate is a necessary requisition for import substitution and food sovereignty, and transition to new technological modes.

MATERIALS AND METHODS

After the time of intensive agriculture, biotechnologies belong to innovation directions of development of agro-industry. The innovation projects aimed at biologization and ecologization of the agricultural activities in Permskii krai were investigated in 2012-2016. Permskii krai is a subject of the Russian Federation with the total area 160,600 square kilometers with moderate continental climate, rich on forest and water resources. Empirical, analytical and statistical methods were used in the investigation. Combination of fundamental and methodological knowledge, theories and results of interdisciplinary and applied Russian and foreign scientific society’s research on institutional environment formation and effective development of agro-industry, placement of productive forces in agro-industrial territorial-economic systems served as theoretical and methodological basis for the investigation.

RESULTS AND DISCUSSION

Existing scientific results in the field of improving technological processes in agro-industrial complex can be grouped in the following categories in general: breeding and application of highly productive sources including seed, youngster, embryo transplanting technology, feeding technology; improvement of logistics, storage and transport infrastructure, pre-sale preparation and marketing; engineering-technical technologies based on energy-saving and increasing energy efficiency of agro-production; deep processing of agricultural raw materials, non-waste production and environment-friendly technologies; soil and water cleanup by biotechnological processes; organization of agro-clusters; financial support of innovative directions; training of innovative human resources, etc.

In the scientific literature it is noted that the level of bioclimatic potential in rural areas of Russia constitutes 60 % of European level and 40% of the USA's.

At the same time in a number of West-European countries with analogue climatic conditions and soil characteristics (Scandinavian countries), scientifically justified agrarian politics provides better involvement of natural potential into intensification of rural economy based on ecological paradigm of agro-industrial activities (Balandin, 2015).

The paradigm refers to application of eco-system approach and lies in attainment of reproduction processes efficiency at preservation and improvement of natural potential, i.e. complies with global principles of sustainable development. The understanding of necessity of nature's participation in agro-production, waste recycling and water cleanup, use of natural biomaterial for pollination and fight against agricultural pests in required amounts and at optimal time lies in the ecosystem approach.

Evolutionary transition to organic methods of agrarian production, mainly in EU countries and in Germany particularly, reflects society's attention to issues of ecology and decrease in negative consequences of intensive agriculture and anthropogenic load on environment. Unfortunately, such measures in Russia take place spontaneously and do not have appropriate state support and provision.

The conclusion of scientific community that production and technological modernization of agriculture, social development and profitability of agrarians, ecologization in rural areas and production processes are interconnected and not interchangeable is not embodied (Ushachev, 2015).

The most important criterion of intensification and effectiveness of agricultural production is energy efficiency. Non-renewability of carbon pursued world community to search for new types of fuel. Thus, experts estimate that currently the share of renewable energy sources in the world amounts 2.5% of total energy production. It is forecasted that by 2025 this figure will reach 40%, and in fifty years – 60%. Some EU countries are active in this direction; they implement appropriate programmes enforced with donations and subsidies of the European Union. Cost of energy production using renewable sources decreases, capital investment reduces due to introduction of scientific and technical achievements. But also EU countries are guided by the need for decrease in anthropogenic load on

environment and do not scale back their energetics development programmes even in the periods of sharp price reduction for energy carriers. Expenditures for fuel resources in agricultural production vary from 12% to 40% in the Russian Federation. Exploitation of biological types of fuel, recycled organic and inorganic wastes for biogas, particularly for introduction of means of small-scale energetics and stand-alone energy supply for localities and agro-industrial objects, introduction of energy-efficient technological processes is still not the priority of state agrarian policy. Modernization of domestic agro-industrial complex and its step-by-step transition to innovative way of development are complicated due to degradation consequences and unprecedented retirement of agricultural land.

According to experts' estimation for the entire existence of humankind above two billion hectares of arable land have been irrevocably lost, more than half of land resources undergo degradation processes, and organic matter removal from soil constitutes up to one ton per hectare.

Nowadays, the Russian Federation's share in the production of mineral fertilizers reaches 10%, at the same time domestic consumption constitutes 1-2%. In recent years their application in Russia decreased almost fivefold, calculated per hectare – from 88 to 35 kilograms. Liming of acid soils was 17 times reduced; 50% of land areas irrigated in 1990 are almost not irrigated nowadays, and more than 30% of dried land areas fell out of turnover. Degradation covers more than half of agricultural land; however, in fertile chernozem soils regions ploughed area 1.5 times exceeds ecologically permissible level. That is reason why biodiversity decreases, and organic matter layer reduced almost twice (Balandin, 2014).

The processes are also characteristic for Permskii krai, where one third of population lives in rural areas. Unfortunately, we should confess that post-reform indicators of agricultural areas reduction exceeded average indicators in Russia and reached almost 50% of the level of 1990. And it is connected not only with common systematic tendencies of the Russian agrarian industry but also with the entire complex of mistakes of regional management including issues of ecologization of agrarian production.

Enough to say, that the regional fund of abandoned land has more than 440 thousand hectares and this amount grows continually. Herewith 11 million tons of soil and more than 60 thousand tons of organic matter are carried off annually from agricultural lands (Pytkin, 2012). The volume of liming and manure introduction is reduced continually. The share of areas fertilized with manure constitutes less than 2% of all cultivated areas; only a quarter of all sowings receive mineral top-dressing.

Nowadays agriculture is not possible without irrigation measures reducing the risks of unfavorable climatic conditions and increasing intensity of use of modern land management technologies. And one of the largest in the world water supplies is crucial prerequisite for plant growing development.

Currently, despite the substantial lagging behind the countries with developed agriculture (USA, China, India) on irrigated land share in total agricultural land area – from 36% to 45%, Russian Federation with less than 8% of irrigated arable land has become the largest producer of grain and sunflower. At the same time, reduction of irrigated and drained land area from 11.5 million hectare in 1990 to 9.1 million hectare in 2010 was the cause of additional damage from abnormal

drought in central territories of Russia in 2010. Then experts noted that at the average decrease in grain by 35%, on irrigated land decrease constituted no more than 12%. Modern situation worsens by the fact that 30% of land from total number of irrigated objects are in unsatisfied condition (Balandin, 2014).

Measurement complex aimed at the industry's efficiency increase was developed and is implemented with the Federal target programme "Development of irrigation of agricultural land in Russia for 2014 – 2020" for solving similar risks and for sustainability of plant growing.

The Programme determined the tasks on exploitation of more than 800 thousand hectares of irrigated land, protection of agricultural land against water erosion during anti-flashflood measures, involvement into use 300 thousand hectares of abandoned agricultural land (Federal target programme, 2013).

The issues of implementation of efficient innovative development directions of agro-industry are linked with the transition to advanced technologies including household and agricultural waste recycling. Modern biotechnologies belong to the advanced technologies; their application can provide a great impetus for modernization of agrarian economy, transition to new technological modus; can significantly decrease ecological problems of rural areas and restore natural balance.

In international community, biotechnologies refer to technologies applying biological systems, live organisms or their derivatives to produce or modify products and processes (Bobylyov, 2014). The role of biotechnological methods in production processes of household waste recycling is continually increasing. Nowadays in EU countries, more than 60% of animal and vegetable waste in agriculture and forestry have been used or neutralized. However, the share of the Russian Federation comprises less than 0.1% in the structure of global biotechnologies market. At the same time, scientific society justified and achieved inclusion of measurement on biotechnological processes introduction, including in agro-industrial complex, into federal programme documents (Table 1).

Table 1. Indicators of biotechnologies development in the Russian Federation's agro-industrial complex

Measurement on introduction of biotechnologies in the Russian Federation's agro-industrial complex	2012	2015	2018
Number of innovative projects with application of biotechnologies	12	60	120
Number of implemented innovative projects in the field of alternative energetics including production of bio-fuel from agricultural waste	2	10	20
Share of agricultural waste treated with biotechnologies	6%	40%	65%
Share of ferments produced in Russia	1%	10%	15%
Share of food protein produced in Russia	10%	30%	50%
Share of agro-industrial complex and wood processing waste utilization in total volume of agro-food and wood waste	3%	30%	80%

**Source: Measurement plan («Road map») "Biotechnology and gene engineering development » dated 18, 2013, No. 1247-*

Indicators in the table show that at the relative increase in innovative projects number based on use of biotechnologies by 2018 tenfold in agro-industry, their absolute value remains low – 120 projects.

Let us consider biotechnologies application in agrarian economy more detailed at the region level. Nowadays in the agro-industry of Permskii krai, huge amounts of waste from animal production have a significant technogenic influence on the environment. Drainage of their moist component through filtering ground and sides of waste repositories causes pollution of underground waters with organic substances and nitrates. For instance, discharge of liquid manure happened in one of the farming enterprises in Chernushinskii district of Permskii krai in 2012. The polluted area exceeded 160 hectares. The environment damage and expenditures on its elimination were obviously not proportional to the administrative fine. And it is not an isolated incident. Bark storage resulted from forest-industry activities also cause substantial damage to the environment of the region and particularly to the agricultural areas, as well as to water. Terricones of bark storage and chemical and biological decomposition of concentrated in them wood rests lead to the pollution of arable land and waters with phenol compounds and heavy metals. To eliminate such sources of technogenic environment pollution different measures are proposed based, as the rule, on the use of chemicals, and this does not exclude the possibility of secondary pollution and can result in negative consequences for agro-industrial activities.

A group of Perm researchers offered an alternative technology, which allows preventing biological influence of heavy metals that can occur in bark storage through converting them into inactive form by means of biological transformation into organic fertilizer – bio-humus. The transformation processes are accompanied with microbiological distortion of phenols. The technology consists in microbiological treatment of bark storage substrate and its transformation into bio-humus; its application for technical crops enables biological re-cultivation of agricultural land and yield increase. The novelty of the practical proposal lies in the application of micro-organisms complex that enable to create a continuous chain of biological processing of forestry, agriculture and household waste and its involvement into the rural areas ecosystems rehabilitation. The use of biological preparation enables avoiding chemical pollution of environment and substantially improves ecological condition, does not require construction of permanent buildings and training of highly qualified specialists.

Unfortunately, examples of innovative projects are solitary. Practical implementation of such projects is based on enthusiasm of some experts and faces difficulties of bureaucracy and lack of financial support from regional government. At the same time, assignments for science and research, finance of the Russian State Science Foundation (Rus.: [Фонд поддержки научных исследований](#)) and Russian Foundation for Fundamental Research (Rus.: [Фонд фундаментальных исследований](#)) are distributed among highly specialized projects. There is no direct connection between fundamental and applied science, no complex

approach to solutions for mentioned above tasks; and major recommendations are too general, impersonalized.

CONCLUSION

The topicality of development problems in the agro-industry is caused by the complex of climatic and economic factors and reasons. Overcoming them determines the search for new approaches, requires theoretical and methodological justification of entire, logical and conceptual solution of system problems in agro-industry. Implementation of innovative development directions in agro-industrial complex enables us to justify conceptual alternatives with a great degree of confidence and forecast results of their application in aspects of sustainable rural development, to improve the mechanism of decrease in negative anthropogenic influence on environment and ecosystems rehabilitation.

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