

The mechanism of innovative development of the agricultural sector of the economy: an empirical approach

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Abstract. The innovative model of the agricultural sector of Russia is presented as a set of subjects and institutions whose activities are aimed at implementing innovative processes in the agricultural sector of the economy. Due to the ability to use a wide range of legal, administrative, economic, and other means of influencing the innovation sphere, it is the state that has a central role in the mechanism of innovative development. It is proved that the formation of the mechanism of innovative development of the agricultural sector of the economy should be carried out on the basis of the institutional model of innovative development of the agricultural sector. The mechanism of innovative development of the agricultural sector of the economy, developed in response to the requirements of the institutional model of the introduction of innovative technologies, is proposed. The innovative model is a recognized guideline for the strategic contours of the development of the agricultural sector, makes it possible to construct such a type of interaction of productive forces and the implementation of industrial relations, which carries the foundations of progressivity. The process of formation and optimization of the mechanism of innovative development of the agricultural sector of the economy is proposed to be divided into the following six stages, which allows us to identify potential opportunities for activating the innovative model of the agricultural sector. A methodological approach to the diagnosis of the functioning of the mechanism of innovative development of the economy has been developed, based on the technology of solving complex problems by analyzing hierarchies.

1 Introduction

The practical experience of highly developed countries of the world shows that it is impossible to achieve a high level of economic development without introducing innovations in all its spheres, without new forms of labor and production organization, without motivation for innovation, without innovative personnel. This is what ensures the strengthening of

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competitiveness in world markets, which create the potential for economic growth and socio-economic progress of society. The approval of an innovative model for the development of the agricultural sector of the Russian economy is extremely important for the functioning of the entire economic system of the state. This sector has the potential of a powerful locomotive of the national economy, the role of which is strengthened in the conditions of increasing social and economic value of food, and accordingly has great growth prospects.

World practice proves that one of the determining factors for the successful development of any national or sectoral economy is the degree of its innovativeness. Russia is no exception, and therefore must ensure positive changes in the economy and society, implement an innovative model and form an advanced type of economic development, unlike the raw material type. The effectiveness and prospects of applying an innovative development model largely depend on the results of innovative activity and the conditions created in the state for its implementation at all stages — from the development of an idea to the introduction of an innovative product. Modern conditions require an increase in the activity of innovative processes and the introduction of innovative technologies. To this end, special attention should be focused on creating prerequisites for innovative support, which should, first of all, provide for the formation of mutual mechanisms of the state and business, the development of information support systems and improving the efficiency of self-regulating organizations in the agricultural sector. Consequently, the formation of effective and efficient mechanisms for the implementation of innovative development of the agricultural sector will increase the level of competitiveness and strengthen positions in the international market of agricultural goods. There is a need to develop methodological tools for the formation of mechanisms for the innovative development of the agricultural sector of the economy, allowing for increased competitiveness, the introduction and effective use of modern technologies and strengthening the image of the Russian Federation in the system of world economic relations.

The mechanism of innovative development of the agricultural sector is a system of interrelated forms and methods of organizing and stimulating research and development work, business development in the scientific and technical sphere and state support at all stages of the process on the basis of mutual partnership of its participants in order to increase the socio-economic and innovative development of agricultural production [1].

The mechanism of innovative development of the agricultural sector makes it possible to distinguish in it a set of institutional, methodological and regulatory components, each of which determines its own forms and methods of organizing and stimulating innovative activity in agricultural production, as well as the directions of the main tasks to be solved, among which is the stimulation of innovative activity of business entities along the entire chain of formation of agro-innovations; development of the potential of business entities subjects; increasing the investment attractiveness of the industry; development of infrastructure and markets for agricultural products [2,3].

2 Methods and materials

The formation of the mechanism of innovative development of the agricultural sector of the economy should be carried out in stages and provide for a sequence of actions:

Stage I – monitoring of the innovative development of the agro-industrial complex of Russia at this stage using special research methods of qualitative and quantitative indicators, to carry out a comprehensive analysis of the results of innovative activities of enterprises and organizations. This will make it possible to identify and identify existing problems, development trends and further prospects for innovative development of the agricultural sector of the economy.

Stage II – diagnostics of the functioning of the mechanism of innovative development of the agro-industrial complex. For its implementation, it is advisable to use the method of

hierarchy analysis using relevant information of various kinds (accurate data and data are obtained intuitively – experience and expert opinions).

Stage III – analysis of opportunities and resource support for the functioning of the mechanism of innovative development of the agricultural sector of the economy, which provides:

- search for opportunities (means, methods, levers), thanks to which the mechanism of achieving the goal of its functioning will be optimized. To do this, it is necessary to attract practitioners of different levels of innovation management;

- assessment of the identified opportunities by applying the hierarchy analysis method to establish the level of significance of recommendations and proposals developed by experts.

Stage IV – development of the program as a detailed plan of measures to be taken in the near future, the sequence of their implementation, the resources to be attracted, and responsible persons for their implementation are determined. The content of the program is updated each time in accordance with the results of the assessment of the possibilities identified by experts for improving the mechanism.

Stage V – evaluation of the proposed mechanism of innovative development of the agrarian economy. It is carried out using the tools of the hierarchy analysis method and assumes a step-by-step approach in establishing the priority directions of the proposed mechanism to determine the expected result of its functioning.

The proposed methodology determines the logic of the process of functioning of the mechanism of innovative development of the agricultural sector of the economy and contributes to improving the efficiency of innovation activity in Russia in conditions of increasing the scale of the impact of globalization changes [4,5,6].

Let's take a closer look at the hierarchy analysis method in the context of its application. Among the diagnostic methods (statistical analysis, factor analysis, methods of operations research, methods of economic and mathematical modeling, method of mathematical programming, expert methods). American scientist T. Saati created a method for analyzing hierarchies [7]. Its application makes it possible to solve the problems of choosing from several alternatives due to their multi-criteria rating. The problem is described using the terms of a hierarchical structure, and its solution is carried out by step-by-step prioritization, taking into account the experience of experts on a particular problem [8-11].

The methodology of calculations based on the hierarchy analysis method, which is proposed to be used to diagnose the functioning of the mechanism of innovative development of the agricultural sector of the economy, described in detail by T. Saati [7] and involves the following several stages:

The first stage is the presentation of a problem that requires a solution in the form of a hierarchy.

Schematically, the hierarchy of diagnostics of the functioning of the mechanism of innovative development of the agricultural sector of the economy is shown in Figure 1, the interaction of all components of which can lead to one of the following scenarios (alternatives) of its functioning:

1. Absolute inconsistency of the actual state of the innovative development of the economy according to the specified parameters – scenario B₁;

2. Partial correspondence of the actual state of the innovative development of the economy according to the specified parameters – scenario B₂;

3. Full compliance of the actual state of the innovative development of the economy with the specified parameters – scenario B₃.

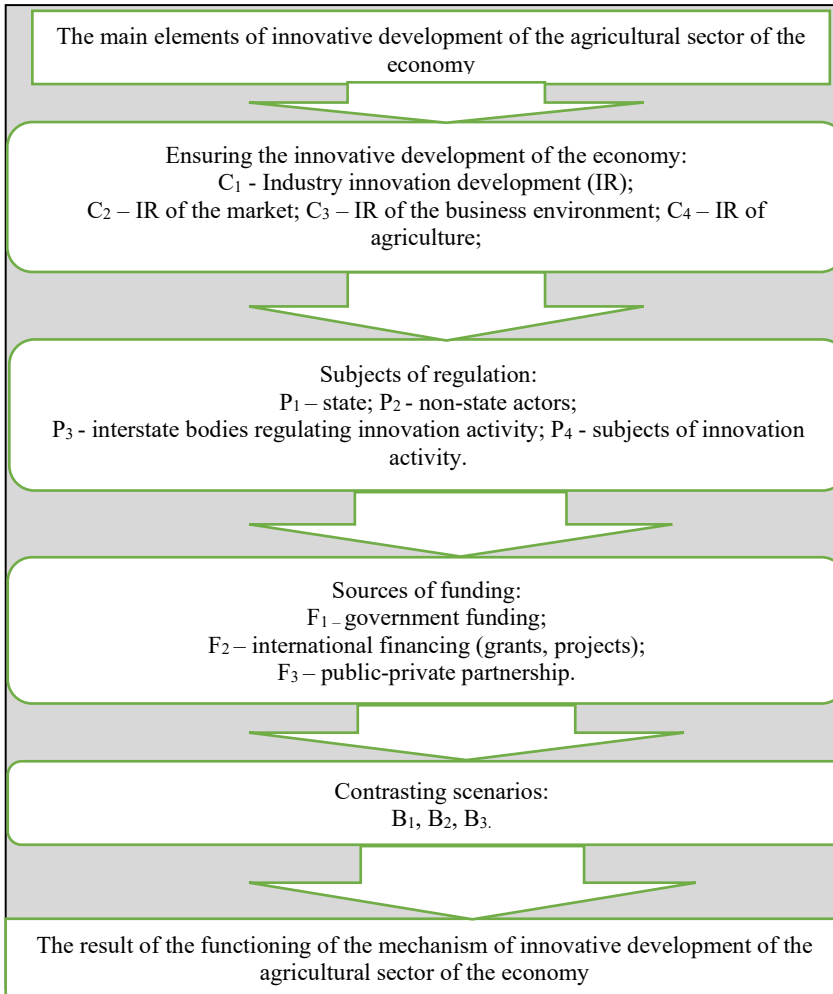


Fig. 1. Hierarchy of diagnostics of functioning of the current mechanism of innovative development of the agricultural sector of the economy.

It should be noted that possible contrasting scenarios are further integrated into a generalized scenario – the result of the functioning of the mechanism of innovative development of the agricultural sector of the economy.

At the second stage, the local priorities of all elements of the hierarchy are determined using the method of paired comparisons.

The third stage involves the analysis of all alternatives with respect to each element-criterion. At the fourth stage, the global priorities of alternatives are determined using a linear convolution of the priorities of the elements, in fact, on the hierarchy.

The algorithmic process of diagnostics of the functioning of the mechanism of innovative development of the agricultural sector of the economy should consist of the following steps: Step 1. Determining the impact of the spheres of ensuring innovative development of the agricultural sector of the economy on the focus of the hierarchy – the implementation of regulation of activities by the spheres of ensuring innovative development of the economy to match its actual state according to the specified parameters.

Step 2. Setting the priorities of regulatory entities in relation to the areas of ensuring innovative development of the agricultural sector of the economy provides for a pairwise

comparison of regulatory entities P_1, P_2, P_3, P_4 for each of the areas of ensuring innovative development of the agricultural sector of the economy $C_1, C_2, C_3, C_4, C_5, C_6$ based on expert judgments on the Saati scale.

Step 3. Determining the importance of regulatory entities in relation to the focus of the hierarchy.

Step 4. Determining the significance of contrasting scenarios among themselves (B_1, B_2, B_3) for each subject of regulation (P_1, P_2, P_3, P_4).

Step 5. Defining the structure of the generalized scenario.

Step 6. Determination of the result of the functioning of the innovative development of the agricultural economy as the implementation of a generalized scenario.

3 Results and discussion

Each individual and generalized scenario can be quantified according to criteria identified by experts. Statistical indicators of innovation activity can be considered as criteria:

- 1) the total cost of innovation activity (Kp_1);
- 2) the number of introduced new technological processes (Kp_2).

The calculation of the priorities of the designated criteria ($Kp_1, Kp_2, Kp_3, Kp_4, Kp_5, Kp_6, Kp_7, Kp_8, Kp_9, Kp_{10}, Kp_{11}, Kp_{12}, Kp_{13}, Kp_{14}$) for evaluating scenarios provides for their pairwise comparison based on expert judgments on the Saati scale. Based on the calculations of the weights of the criteria, the most significant criterion is determined. An integral assessment of the generalized scenario of the functioning of the mechanism of innovative development of the agricultural sector of the economy is carried out, it consists in calibrating the values of criteria relative to probable scenarios. Using the scale, it is estimated in which direction in the future (will increase, decrease or remain unchanged) the change of the i -th criterion will occur when the j -th result (scenario) is implemented, as well as the intensity of changes in the i -th criterion.

To determine the value of the integral assessment of the generalized scenario of the functioning of the mechanism of innovative development in the agricultural sector of the economy, a matrix for evaluating the results is constructed, presented in Table 1.

The generalizing significance of A_i for each Kp_i criterion is determined as follows:

$$A_i = \sum_{j=1}^n \rho_i * a_{ij} * w_j \tag{1}$$

ρ_i - the weighting factor of the i -th criterion;

a_{ij} – evaluation of the j -th result -scenario according to the i -th criterion;

w_j - the value of the elements of the priority vector of probable (logical) results-scenarios by the focus of the hierarchy.

Table 1. Ranking the state variables of the innovative development of the agricultural sector of the economy (according to criteria) relative to contrasting scenarios.

Criteria for assessing the consequences	Weight of the criterion	The script and its weight			The weight of the generalized scenario
		B ₁	B ₂	B ₃	
		w ₁	w ₂	w ₃	
Kp ₁	ρ_1	a ₁₁	a ₁₂	a ₁₃	A ₁
Kp ₂	ρ_2	a ₂₁	a ₂₂	a ₂₃	A ₂

Kp_3	ρ_3	a_{31}	a_{32}	a_{33}	A_3
Kp_4	ρ_4	a_{41}	a_{42}	a_{43}	A_4
Kp_5	ρ_5	a_{51}	a_{52}	a_{53}	A_5
Kp_6	ρ_6	a_{61}	a_{62}	a_{63}	A_6
Kp_7	ρ_7	a_{71}	a_{72}	a_{73}	A_7
Kp_8	ρ_8	a_{81}	a_{82}	a_{83}	A_8
Kp_9	ρ_9	a_{91}	a_{92}	a_{93}	A_9
Kp_{10}	ρ_{10}	a_{101}	a_{102}	a_{103}	A_{10}
Kp_{11}	ρ_{11}	a_{111}	a_{112}	a_{113}	A_{11}
Kp_{12}	ρ_{12}	a_{121}	a_{122}	a_{123}	A_{12}
Kp_{13}	ρ_{13}	a_{131}	a_{132}	a_{133}	A_{13}
Kp_{14}	ρ_{14}	a_{141}	a_{142}	a_{143}	A_{14}

The proposed procedure for finding the value of the integral assessment of the generalized scenario of the functioning of the mechanism of innovative development of the agricultural sector of the economy should be carried out in dynamics in order to track the trend of change to improvement or deterioration in the conditions of increasing globalization processes.

4 Conclusions

Thus, the diagnostics of the functioning of the mechanism of innovative development of the agricultural sector of the economy has been carried out, and the resulting integrated assessment of the generalized scenario will confirm the assumption about the results of innovative development of the economy and will allow us to conclude about the need to adjust the mechanism in accordance with the processes of globalization.

For the development of innovation infrastructure in Russia, it is necessary to pay due attention in various strategic and program documents developed at the state and municipal level. In addition, conditions should be created for the development of innovative infrastructure.

It is important to ensure the revision or adjustment of the state innovation policy in accordance with the current state of innovation infrastructure, global financial and economic impacts, trends in the development of global innovation networks; create different innovation structures; ensure coordination of the activities of executive authorities, public and scientific

institutions in the implementation of measures for the development of innovation infrastructure.

The practical use of the proposed mechanism of innovative development will increase the level of innovative development of the agricultural sector and will contribute to ensuring food security and economic well-being of society.

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