

# Features of Strategic Economic Security Monitoring in the Context of Innovation and Investment Policy of Agro-Industrial Organizations



Makarova Nadezhda, Shubovich Alexander, Chusov Ivan, Khalyapina Ekaterina, Kuzmina Lyudmila

**Abstract:** *In modern economic conditions of economic activity, which are characterized by instability and multidimensional economic relationships, the strategic economic security of organizations of the agro-industrial complex (AIC) plays a key role. The purpose of this work is to develop theoretical and methodological approaches to the use of strategic economic security monitoring in the context of innovation and investment policy of agricultural organizations. It is revealed that the innovation and investment component of strategic economic security under the influence of innovation and investment policy creates more favorable conditions for investment in innovations of agricultural organizations. In the article, the concept of monitoring the strategic economic security of the agro-industrial complex in its innovation and investment component is defined from the position of the target orientation and system approach. Special attention is paid to the subsystems of the functional model of the monitoring system of innovation and investment component of the strategic economic security of agricultural organizations.*

**Keywords :** *Monitoring, strategic economic security, innovation- investment policy, information support.*

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## I. INTRODUCTION

The main vector of development of agribusiness organizations in modern conditions is the creation of an acceptable amount of investment by attracting external and internal investors, ensuring their real profitability through the introduction and implementation of innovative projects that allow to modernize agricultural production, upgrade equipment, carry out reconstruction and construction of new production facilities, increase the production capacity of the agricultural business structure. The subjects of this structure play an important role in the use of innovations of selection-genetic, technological, organizational-managerial and social type.

Agricultural science has sufficient experience in the field of improving technological processes in agricultural organizations and allows you to systematize them in the following innovative areas:

- creation and use of highly productive source material, including new varieties and hybrids of plants, young elite cattle, embryo technology, automatic feeding systems, etc.;
- improvement of existing and creation of new technologies in transport and logistics sphere: points of preparation of production after harvest, warehouse storage and transportation, pre-sale preparation and marketing;
- engineering and technical technologies that increase the energy efficiency of agricultural production and based on the principle of energy saving, as well as efficient resource-saving technologies and power plants of the latest generation;
- restoration and improvement of soil fertility through the use of natural nutrients, crop rotation with innovative complexes, integration of livestock and crop production;
- deep processing of agricultural raw materials, waste-free production based on biotechnology;
- environmentally safe treatment of soils and water bodies through the implementation of biotechnological processes;
- formation of agro-clusters;
- staffing of the innovation process, etc.

## Features of Strategic Economic Security Monitoring in the Context of Innovation and Investment Policy of Agro-Industrial Organizations

One of the most important security trends in the development of innovative activities of agricultural organizations should be considered the creation of a favorable investment climate that allows developing advanced innovative technologies.

The key elements of the development strategy of any agribusiness organization should include investment and innovation policies that are interrelated and interdependent. For determining the most appropriate capital investment (investment) in innovation and identifying the most efficient ways to use it for quite a long period with stable returns necessary to develop a unified innovation and investment policy, diverting an important role in the management of agriculture, which is responsible for the implementation of innovative-investment policy and monitors its implementation, periodically assessing the results of its implementation.

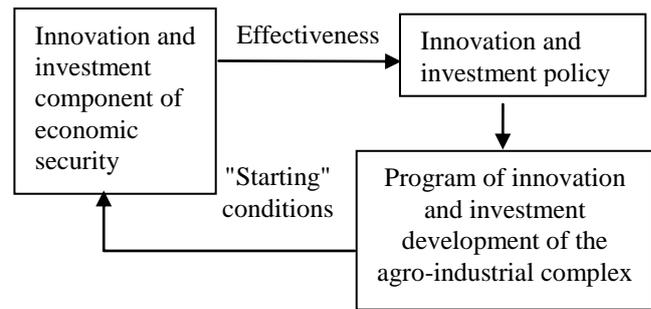
### II. RESULT AND DISCUSSION

For the information of the economic security of agricultural organizations apply a system of continuous monitoring that creates and regulates the flow of information on the identification and prevention of threats to neutralize (minimize) the consequences of an already-existing adverse events and establishes the levels of competence of specialists are also experts and have knowledge about the complex processes and leadership. The significant role of monitoring is recognized, among other things, in the Strategy of economic security of Russia for the period up to 2030.

To study the monitoring of strategic economic security in the context of innovation and investment policy of agricultural organizations, it is necessary to determine the understanding of such terms as "strategic economic security" and "monitoring".

Strategic economic security creates conditions for a full-fledged state of protection of the declared economic interests of the economic entity, in which the tools (methods, methods and technologies) to prevent and neutralize direct and potential exogenous and endogenous threats ensure its sustainable functioning and the achievement of remote goals in time. At the same time, each of the goals presumes the presence of a rational new state of the object, project or process, its optimal business plan-image.

The strategic economic security of the innovation and investment component of agribusiness organizations is a selective object of influence of innovation and investment policy. This aspect of economic security is characterized by a sign of dualism in relation to innovation and investment policy (Fig. 1): through the program of innovation and investment development of the organization, this policy is the starting point and sets the "starting" conditions and at the same time it contributes to the effectiveness of achieving goals, as there is a direct link with strategic management. Moreover, the category "performance" characterizes the level of achievement of the provided targets.



**Fig. 1. Innovation and investment component of economic security in relation to innovation and investment policy of the agro-industrial complex**

The main objectives of innovation and investment policy of agricultural organizations is to create optimal conditions for the activation of innovation and investment potential. This policy defines a reference point and expediency of processes of implementation of activity in the innovative and investment sphere, promotes activation of innovative and investment processes.

After the adoption of the innovation-investment policy process in the system of strategic economic security in innovative and investment component, agribusiness organizations, when the system is limited in time, but are not limited in space, to monitor progress and periodically evaluate results of its implementation. For information support of strategic economic security, a monitoring subsystem is used, within the framework of which information flows (formation, non-distribution, movement, interpretation of information) are created and regulated, spreading in communicative environments that are not limited in time and space, and the levels of awareness of specialists and managers are established. The relevance and timeliness of information is of particular importance.

The term "monitoring" has a dual origin: from the English "monitoring" - to instruct, advise, monitor, check, or from the Latin "monitor" - reminding, warning. The definition of "monitoring" does not have an exact unambiguous interpretation, since it is studied and applied in the course of various fields of scientific and applied activity. The complexity of the formulation of the definition of "monitoring" is primarily due to its belonging to both the field of science and the field of practice. In the big economic dictionary monitoring is interpreted as observation in the process of management of any phenomenon or process, with its subsequent assessment and forecasting [1].

The authors' position on the essence of the definition of "monitoring" in the system of economic security in the innovation and investment component of agricultural organizations should proceed from its target orientation. Therefore, the monitoring of strategic economic security in the innovation and investment component of agribusiness organizations is a constantly functioning subsystem for tracking critical points of identification of strategic threats, their dynamics,

and the final identification of patterns of development and state on the basis of observation of research objects, analysis of this state, diagnosis and forecasting. The main objective of the strategic monitoring of economic security of the innovative-investment component will be the supply of managers in the innovation and investment activities timely and comprehensive information about processes, whose development leads to the formation of internal and external threats that generate different types of crisis events (situations), for analysis and adjustment (revision) strategy and innovation-investment policy of the agricultural organization.

Currently, monitoring the innovation and investment component of strategic economic security at the micro level is quite popular, since the analysis of the situation at the Federal and regional levels does not fully reflect the picture of the state of the economy of both the state and the region. "Scientific and educational organizations, industrial enterprises, other organizations directly carrying out scientific, scientific-technical and innovative activities and using the results of such activities, Federal public authorities, public authorities of the subjects of the Russian Federation and the tools at their disposal shall ensure the integrity and unity of scientific and technological development of Russia" [2].

Monitoring is distributed in the management hierarchy. Operational monitoring is the control of the current activity of the subsystems of objects, a set of measures that allow to determine specific deviations from the established short-term development goals. The purpose of such monitoring is to ensure uninterrupted, rhythmic and mutually coordinated activities of all structural units related to it. The strategic objectives of the management of agribusiness organizations involve strategic monitoring, which allows to obtain data on the situation existing in the economic entity, determine the relevance of problems (in our case in the innovation and investment sphere), monitor changes occurring in the implementation of strategic plans for their development, to provide management bodies and other stakeholders with timely, reliable, sufficient and interpreted information for the purpose of making appropriate decisions based on its analytical processing.

Information technologies have a significant impact on the work of agricultural organizations. The use of modern information technologies by agribusiness organizations will increase the efficiency of management and accessibility for stakeholders of different levels to the arrays of accumulated information, which greatly optimizes the processes of processing indicators, including those States, events, processes that form the innovation and investment component of strategic economic security. As a result, the monitoring of the innovation and investment component of strategic economic security on the basis of it support at the micro level has been transformed into an active form of cognitive activity, an important management tool in it, a way of monitoring and analyzing the situation, as well as a risk reduction factor in the implementation of the control impact of the innovation and investment component of strategic economic security.

In accordance with the system paradigm, the authors consider the monitoring subsystem in the system of strategic

economic security in the innovation and investment component of agribusiness organizations as an independent process system (process) with unknown spatial and known temporal boundaries, combining subsystems of the same type. The functional model of the monitoring system of innovative-investment component of the strategic economic security of agro industrial complex organizations consists of the following subsystems: monitoring, business analysis, forecasting, controlling and regulating processes of innovative-investment component of the strategic economic security of AIC.

Any significant change in the external environment affects certain interests of the company and affects the results. The input receives information about the external and internal environment, which is used and converted to obtain the result (output) in the form of control, as well as business analysis and forecasting.

Subsystem monitoring results of the innovative-investment component of the strategic economic security of AIC is a focused and regular monitoring of the monitoring object, the fixation of the transition indicators belonging to this dimension from one "zone of risk" to another, the perception of the real events in the innovative-investment sphere, taking into account new challenges and threats, assessment of prospective trends in the development of innovative-investment component of the strategic economic security. In the process of observation, the necessary base of initial information is formed, which is further investigated in the framework of the necessary business analysis to assess the effectiveness of investment and innovative object subsystems for forecasting development.

"Business analysis is the practice of ensuring change in an enterprise by identifying needs and recommending solutions that provide value to stakeholders" [3].

Business analysis refers not only to changes implemented in a design way, but also to the evolutionary transformation of the organization. Business analysis provides an opportunity for agribusiness organizations to identify needs and motivate changes, as well as to develop and present appropriate solutions that will improve the efficiency of business processes and will contribute to the positive (useful) implementation of business changes. The subsystem of business intelligence in the monitoring system is an integrated information system that facilitates multivariate analysis of the accumulated information from the overall picture to its detailed view (dynamic reporting and multidimensional analysis of aggregated historical and current data, trend analysis, modeling and forecasting of the results of innovative-investment process), has a flexible means by the graphical representation of the analyzed information. The effective implementation of the subsystem (system) of business analysis of the process of monitoring the innovation and investment component of the strategic economic security of agricultural organizations can be represented by a model due to the integration of data of almost any information systems (Fig. 2).

## Features of Strategic Economic Security Monitoring in the Context of Innovation and Investment Policy of Agro-Industrial Organizations

A diverse set of data sources (for example, SQL servers IBM, Informix, Microsoft, Oracle, NCR, Sybase, as well as any other OLE DB or ODBC-compatible sources) gives a more complete picture and helps to better assess the context of actions in the integration and presentation of indicators for information and analytical support of innovation and investment component of strategic economic security of agricultural organizations.

Multidimensional Olap cubes are used for analytical processing of large amounts of data based on different sources. The use of a multidimensional array of data allows you to effectively extract "slices" of data, to detail the data that are necessary for specific users when monitoring the innovation and investment component of strategic economic security.

Corporate data warehouse (from the English. Data Warehouse) acts as a single platform for the implementation of a specially organized corporate data model, in which information is collected, processed and stored from various functional subsystems-sources (accounting systems, transactional systems). The corporate data warehouse provides quick access through information showcases to operational and historical information, analyzes the data of key performance indicators in various dimensions, forecasting in sections, consistent with regulatory and reference information.

system of the process of monitoring the innovation and investment component of the strategic economic security of agricultural organizations depict the iterative nature and reflect the mutual relationship between the multidimensional database and the means of viewing and analyzing data.

The data viewer and analysis tools consist of the following groups of components:

1) to generate arbitrary ad hoc queries and reports that provide quick access to information from the data warehouse, data marts;

2) designed to analyze the qualitative and quantitative characteristics of the multidimensional database and build intelligent systems to support the decision-making process and provide operational analytical processing of large amounts of data, analysis of historical data, forecasting, "what-if" scenarios and financial modeling.

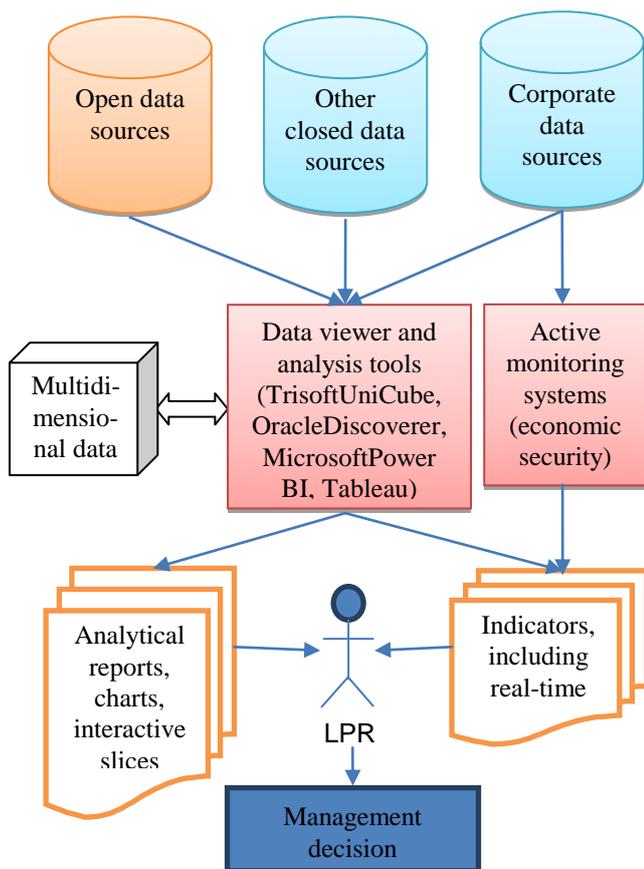
The system of active monitoring allows revealing at early stages potential threats of emergence and further distribution of risks of innovative and investment component of strategic economic security of the organizations of agro industrial complex, the main triggers and channels of "infection" of promotion of investment projects. To do this, it is necessary to use a wide range of individual analytical indicators, which the organization sets individually depending on the investments used in innovation, innovation and investment projects, financial condition, and which characterize almost all aspects of innovation and investment development of the agro-industrial complex.

To organize the reporting process, you should use specialized software based on an analytical server that works directly with the data warehouse and multidimensional database. As a result, in the business analysis system, the data accumulated by the agro industrial complex organization turns into valuable output information for decision-makers.

It should be noted that the agricultural sector is highly dependent on the external environment, which significantly increases the risks associated with financial investments in innovation. At the same time, the strategic analysis provides identification of key factors of external and internal environment of agribusiness organizations. One of the main most frequently used tools of business analysis is, in particular, SWOT analysis, focused on identifying strategic factors of the external (opportunities and threats) and internal (strengths and weaknesses) environment.

In the process of many years of use, the method of SWOT analysis [4] has undergone significant changes, and now has become a tool for the intellectual work of a business analyst.

In the business analysis subsystem of the process of monitoring the innovation and investment component of the strategic economic security of agribusiness organizations, SWOT analysis can exist in the form of a plug-in, which is designed to assess the factors of the external and internal environment, conducted on the basis of the analyst's judgments and representations, using fuzzy algorithms. Work in the plugin for user convenience is organized in seven stages: "Opportunities", "Threats", "Strengths",



**Fig. 2. Model of the business analysis system for monitoring the innovation and investment component of the strategic economic security of agribusiness organizations**

Bilateral arrows in the model of the business analysis

"Weaknesses", "matrix Construction", "matrix Calculation", "Dynamics of SWOT parameters". Inside the plugin "SWOT-analysis" contains an additional block "Editor of linguistic variables", consisting of the assistant for the description of linguistic variables (Linguistic Variable Wizard), variable properties editor (Variable Properties), variable editor (Variable Editor) and term properties editor (Term Properties). This block is used to create a database of fuzzy linguistic variables characterizing individual analyzed factors, graphical tasks, allows you to describe linguistic variables, change the membership functions of individual terms of linguistic variables, based on subjective measures. The obtained estimates of the importance of external and internal environment factors and their combinations allow to choose the right combinations, which is additional information when making decisions on the choice of strategic projects of innovation and investment development of agricultural organizations.

The most important process subsystem of monitoring the innovation and investment component of strategic economic security in the context of innovation and investment policy of agricultural organizations is forecasting.

Forecasting of modern threats is carried out in order to change the vector and adjust the direction of innovation and investment development of economic entities. By using threshold and target values of a particular indicator of the innovative-investment component of the strategic economic security state of the organization of AIC is considered from the point of view of compliance trends in its development strategic areas, both inside and in a competitive innovation and investment environment.

In this paper, for the evaluation of monitoring, an automated system-cognitive (SC) analysis based on the intellectual system "Eidos" is proposed for use. The mathematical basis of this analysis is information theory, which is based on set theory, by replacing the concept of a set with a more General concept of a system and by tracing all the concepts of this replacement [5].

SC-analysis is implemented in the universal cognitive analytical system "Eidos", which is the national universal system of artificial intelligence and is widely used and developed at the present time. The system "Eidos" and the method of its application were developed by Professor Lutsenko E. V. in 1979 for medical diagnosis. The experimental approbation of the system in the course of a numerical experiment was carried out in 1981. Currently, the system "Eidos" is used to solve problems of forecasting, decision support in many subject areas.

To build models of pattern recognition systems and decision-making, focused on the use of the synthesis of adaptive control systems of complex objects, the "Eidos" system determines the total amount of information about each information source, which allows obtaining an integral criterion for identifying or predicting the state of the object.

For synthesis of system-cognitive model of estimation of degree of attractiveness of investment of economy it is offered to use a technique which includes the following stages:

1) Formalization of the subject area, that is, the development of classified and descriptive scales and gradations. Descriptive scales and their gradations are

designed to enter the main factors affecting the behavior of the control object-class;

2) Preparation of empirical data in a file in Excel format containing indicators characterizing investors on the basis of the rules (Table- 1);

**Table- I: The rule Base of the investment**

N	The degree of attractiveness of the investor	Modernization of agricultural production	Update equipments	Reconstruction and construction	Increase in capacity
Investor 1	m	m	l	l	m
Investor 2	h	m	m	h	m
Investor 3	h	h	h	m	h
...					
Investor 20	l	l	l	l	m

3) Automated data entry into the system "Eidos" from a file in Excel format using the standard software interface of the system;

4) Synthesis and verification of intelligent models;

5) Determining the most reliable model and assigning it to the current one;

6) Solving the problem of identification and forecasting.

A characteristic feature of the system "Eidos" is the ability to use a wide range of gradations. They can be a different number on different scales.

In our case, descriptive scales determine the main parameters: modernization of agricultural production, equipment renewal, reconstruction and construction, increase in production capacity.

Gradations of descriptive scales are given in the form of terms: "High", "Medium", "Low" and form a matrix

$$A = [a_{ij}], \tag{1}$$

where  $i = \overline{1..n}; j = \overline{1..m}$ ;

n –the number of investors;

m – the number of factors affecting the state of the economic system as an object of study;

$a_{ij} \in \{n, s, h\}$  – refer to the terms of the descriptive scales.

As a classification scale, the "degree of investor attractiveness" is used, which can contain the gradations "High", "Above average", "Average", "Below average", "Low".

Gradations of the classification scale of the resulting sample form a vector

$$T = \begin{bmatrix} t_1 \\ t_2 \\ \dots \\ t_n \end{bmatrix}, \tag{2}$$

where  $t_i \in \{h, hs, s, ns, n\}$  - the accepted values of the terms of the classification scale.

# Features of Strategic Economic Security Monitoring in the Context of Innovation and Investment Policy of Agro-Industrial Organizations

The degree of attractiveness of the investor (DAI) depends on the modernization of agricultural production (MACP), equipment upgrade (EU), reconstruction and construction (RS), increase in production capacity (IPC). The degree of attractiveness of the investor can be set in the form of gradations "High", "Above average", "Average", "Below average", "Low". The main parameters are given in the form of fuzzy sets containing the terms "High", "Medium", "Low".

For perform the simulation, it is necessary to compile a database of rules of the "Eidos" system. For example, if (MACP is "Average") and (EU is "Low") and (RS is "Low") and (IPC is "Average") then (DAI is "Average").

To build a semantic information model of the degree of attractiveness of an investor, a sample is formed in the form of an Excel file, reflecting 20 variants of investors. The file is located on the C:\AID\_DATA\Inp\_data\ drive named "Inp\_data.xls". An example of a rule base is shown in table I.

Next, the intelligent system "Eidos" is launched, which implements a number of software interfaces that provide automatic formation of classification and descriptive scales and gradations, as well as a database of rules. In this case, the best is to enter data in Excel format. To enter data into the system "Eidos" is used universal software interface in Russian.

Seven particular knowledge criteria INF1, INF2,..., INF7 are used to synthesize the model in SC-analysis, and two integral similarity criteria are used to verify the models and solve the problem of identification and prediction: "Semantic resonance of knowledge" and "Sum of knowledge". Thus it is possible to receive the model having the highest reliability of identification and not identification of objects.

Then, with the help of special commands, integral criteria of similarity of investors with gradations of classes "degree of attractiveness of the investor" are determined.

Thus, the task of developing information technologies that support the monitoring system of investment attractiveness and innovation activity of agricultural organizations is actualized.

The monitoring system initiates a procedure for diagnosing the level of strategic economic security in the context of innovation and investment policy of agribusiness organizations according to indicators characterizing the key components of the innovation and investment component and taking into account the likely manifestation of risk factors, which in the future is aimed at improving the economic stability of the process of implementing a knowledge-intensive project.

## III. CONCLUSION

Formed research and analytical tools monitoring system of innovative-investment component of the strategic economic security of agro industrial complex organizations allows for a comprehensive analysis and evaluation of security indicators of this current status and to determine the level of strategic development as a whole and its individual subsystems, and to determine the main directions of adjustments of innovation and investment policy. Moreover, the active use of the data obtained by monitoring the innovation and investment component of the strategic economic security of agricultural

organizations will contribute to the rapid solution of many problems, in particular: timely decision-making on the prevention and (or) risk reduction; changing the model of a highly dangerous survival strategy in the innovation and investment sphere to a less dangerous strategic perspective of viability and sustainability in it.

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