“Strategic management optimization of the regional agricultural sector by means of modern forecast modeling instruments”

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STRATEGIC MANAGEMENT OPTIMIZATION OF THE REGIONAL AGRICULTURAL SECTOR BY MEANS OF MODERN FORECAST MODELING INSTRUMENTS

Abstract

Under the conditions of Ukraine's integration into the world economic space, the agricultural sector is one of the priority and strategically important sectors of the national economy. The research objective is to substantiate the theoretical, methodological and methodical principles of strategic management of economic development of the regional agricultural sector and to solve actual problems in order to optimize strategic management based on cognitive scenarios of supply and demand balancing in the agrarian market, probabilistic modeling, which allows the regions to identify the "growth points", to optimize the sectoral structures of the economy, to improve the quality and efficiency of the developed and implemented scenarios and the strategies of the agroindustrial production development in the region.

As a result of the research, a scenario-probabilistic model of economic development of the regional agrarian sector was proposed, which allows to identify the priority directions for the long-term perspective, to adjust the direction of development if necessary, to explore different scenarios of the development of events on the priorities change at the macro level in the conditions of uncertainty and risks.

Thus, the practical value of the research enables to predict the strategic development of the agricultural sector of the region and its individual areas by using a systematic approach and compositions of methodological approaches to analysis and forecasting, considering it as a complex and structured system.

Keywords strategy, forecasting, planning, methods, modeling

JEL Classification C50, Q10, O18

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INTRODUCTION

The modern stage of transition to another model of the national economy at the regional level should be characterized by the formation of long-term development priorities aimed at overcoming the present challenges, and the identification of promising directions, maybe as of yet new, but priority for the future. Therefore, the system of strategic management of the regional level at the stage of decentralization implementation should be focused primarily on pumping up the local budgets, improving the efficiency and competitiveness of the economy of the region by identifying development priorities and forming optimal sectoral structure. Thus, for strategic management of social and economic development of the region and certain branches of its economy, it is offered to apply methodological approaches based on the use of modern tools of predictive modeling and planning.

The changing situation and the presence of significant mutual influence of trends in various spheres complicate the prediction of the development of events for the long-term perspective. In particular, the

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problem of ensuring the sustainable development of agrarian production involves the elaboration of a number of issues related to climate change, food security, demographic situation in the countryside, etc.

The purpose of the article is to study, analyze and develop financial and economic methods for selecting the priority directions of the agricultural sector of the region as the basis for strategic planning and forecasting, as well as improving the results with the quantitative characteristics of alternative scenarios.

Research needs a powerful information support that would allow to form the most comprehensive picture of the situation, that is, the centralized use of databases and knowledge, as well as the transition from a normative system of strategy development to the application of adaptive approaches that would allow to explore the complexity of the investigated issues, sensitivity to the social and economic system to the ongoing changes. Thus, the methods of strategic management based on the use of foresight are gaining more popularity. Unlike the traditional system of strategic planning, foresight focuses on the formation of the economic system of resistance to external threats, their prediction, early detection and rapid recovery after the crisis.

1. LITERATURE REVIEW

Literature review confirms the fact that the experience of applying foresight in agro-industrial production has been developed in the countries of the European Union, BRICS, Latin America, etc., and the research was carried out by such famous scientists as McAllester (1991), Burstein and Holsapple (2008), Grünig (2011). Such a technique, focused on stimulating the data collection, ensuring information exchange between organizations, early intervention of the negative situation at all levels of management allows you to solve the tasks of strategic management in conditions of uncertainty, structural transformations and socio-political changes, including implementing a foresight technique.

In Ukraine, a foresight reflecting a modern vision of the perspectives of agrarian sector development was worked out in 2016 by a team of scientists under the direction of Zghurovskyi (2016) for medium-term (until 2020) and long-term (until 2030) perspective. As noted by Zghurovskyi (2007), Pankratova (2014), in the modern world, qualitatively new events, alien to the past, are constantly taking place. They include a variety of fracture-like and stepped changes that are associated with the breaks in monotony of processes and have the nature of substantially nonlinear phenomena. Therefore, for the study of such processes and phenomena, the new issue is becoming of great importance, namely to represent a future that cannot be interpreted as an ordinary continuation of the past in view of the fact that this future can acquire fundamentally different forms and structures in comparison with those that were known in the past.

In the works of many scholars, such as Gozhiy (2011), Trofymchuk (2014), Dovhyi (2014), Talavyria (2012), Bidiuk (2017), it is substantiated that the reflection of all the main aspects in the problem of choosing effective solutions in the tasks of management with the help of socio-economic systems development can be achieved through a multimodal approach, when the choice of solutions is carried out with the development of a complex of different models, including mathematical ones. The set of different requirements for the decisions leads to the multi-criteria statement of the decision-making task of managing the development of socio-economic systems, since, for the majority of requirements, their presentation as a system of restrictions cannot be considered effective because of the incompleteness of the incoming data for such representation. This allows us to identify and solve the problems of managing the development of complex socio-economic systems as a task of multimodal and multi-criteria choice of effective solutions on a plurality of mathematical models.

In the decision-making tasks based on analytical procedures of Gozhiy (2011), Dovhyi (2014), logical rules and rational expert evaluation of Maryuta (2005), Redina (2005), Dolgorukov (2005) in many cases do not give the desired result in terms of the quality of prediction estimates,

and therefore there is a problem of systematic use of alternative methods of forecasting to improve the quality of estimates. In order to cope with this problem when solving decision-making tasks for the development of socio-economic systems of the agrarian sector based on the methodology of system analysis, which provides hierarchical analysis of modeling and forecasting processes, taking into account the uncertainties of the structural parametric and statistical nature, adapting the structure and model parameters to changes in processes and the use of alternative methods for evaluating model parameters in order to find the best estimates of predictions using a set of numerical criteria for their predictions, it is advisable to use the methodology suggested by Pankratova (2014), Dovhyi (2014), Terentiev (2017), Prosiankina-Zharova (2017), Efendiiev (2017).

2. DATA AND METHODS

The following methods determine the theoretical and methodological foundations of the research: the abstract and logical method – in substantiating the essence of the strategic management concepts; historical and logical method – in the study of the development and improvement of the components of the agricultural sphere functioning mechanism; monographic method – for a detailed concretization of scientific principles of strategic management, planning and forecasting. During the research, the SAS Enterprice Miner software for time series analysis and data mining was used in order to determine additional reserves for enhancing the economic development of the agricultural sector.

As for the practical implementation of the forecasting of the dynamics of the processes as the mean square deviation of one-step forecast for the educational (historical) sampling, the mean absolute deviation of the forecast in percent; Theil coefficient; Durbin-Watson statistics; multiple determination coefficient; Akaike information criterion; Schwarz-Bayesian statistics; sum of squared deviations of the model; Fisher statistics, were used.

Using the estimates of combined forecasts is justified in order to select the best model developed in the automatic mode (McAllester & Rosenblitt, 1991). This approach is characterized by a decrease in computational resources and the algorithmic complexity of the procedures for their use in decision-making processes with a certain level of forecasts quality. When using the combined forecasts, the following methods of forecast estimates combination are used: forecast averaging, sound forecast averaging, and optimization methods.

The application of information technology for the analysis and processing of information for the processes development and choice of promising methods (Kozhukhivska R., Parubok N., & Petrenko N., 2017) for local agricultural production is an integral part of the study, covering the widest range of socio-economic processes influencing its development. An equally important component of strategic management is the analysis and information processing. It is important to carefully analyze and evaluate quantitative and qualitative information, in order to determine the number and nature of external influences.

All this involves the development of information technologies adapted to solve the tasks of supporting decision-making by the strategic management of the economy of the region and its components. This technology is based on the principles of multimodal and multi-criteria approaches, as well as on the integration of various types of information that may contain data omissions and is based on systematic use of data analysis, modeling, forecasting and decision-making. At each stage of decision-making, information technology is aimed at solving specific problems, namely information technology analysis of its evaluation of information, information technology modeling for forecasting, information technology forecasting, and information technology of decision-making support.

3. RESULTS AND DISCUSSION

After a period when the national economy functioned in the conditions of socio-political and financial instability, a rapid reorientation of foreign economic relations, the active implementation of reforms accompanied by radical changes in almost all the spheres of economy and society need to be revised and supplemented by the existing method of macroeconomic forecasting and planning.

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The task of choosing the priority directions of the agricultural sector development is complex and weakly formalized, since, while developing forecasts for strategic management of the development of the region and certain branches and areas of its economy, the researcher faces the need to solve a wide range of interrelated tasks of system analysis, such as study of the structure of a complex system and its external environment, identifying trends and making decisions about the prospects for its further development. As a rule, most of these tasks are weakly structured and characterized by the uncertainties in the interaction between elements of the system. All this significantly reduces the probability of a reliable mathematical model development and complicates the decision-making process. Using the methodology of system analysis, modern information technologies, including tools for automating the model development of complex systems and processes, combined with methods of economic analysis, the researcher is able to use not only quantitative indices, but also qualitative information, refine the model in course of the study, analyzing the behavior of a complex system, thereby increasing the decision-making justification.

Information model of the socio-economic system, based on the provisions of the general theory of systems, as noted in the scientific works of Serhieieva and Bakurova et al. (2009) has the following form:

$$S_0 = S_1 \cdot S_2 \cdot \ldots \cdot S_i \cdot \ldots S_m, \quad (1)$$

where S_i is i-th hierarchical level, m – number of hierarchical levels.

$$S_i = \langle M_i, P_i, R_i, X_i, Y_i, f_i, \phi_i \rangle, \quad (2)$$

where M_i, P_i, R_i – the set of real objects, entities and subsystems of the i-th hierarchical level, X_i, Y_i – the set of internal and external parameters of the system of the i-th hierarchical level and the external environment, ϕ_i, f – functionals that determine the relationship between the corresponding parameters on m levels in the form:

$$\phi_i : X_i \to Y_i; f_i : Y_i \to Y_{i-1}. \quad (3)$$

Such a representation of the information model of the problem of the complex system study involves its description with the help of information generated in different ways and obtained from different sources.

Therefore, the development of socio-economic systems has been studied by a number of diverse approaches, methods and tools designed both to study their development as a whole and their individual subsystems and elements. Most of these approaches are aimed at applying traditional econometric and mathematical models and focus on static models of systems, using predominantly quantitative assessments and relationships between their elements. Of course, the development of individual socio-economic processes can be sufficiently qualitatively predicted in the short-term perspective using relatively simple models, in particular models of multiple regression, autoregressive models, etc. However, better results in the medium and long-term perspective under dynamic structural transformations can be obtained using methods based on various ideas, namely compositions of methods of morphological, cognitive and scenario analysis, probabilistic modeling, time series research, neural networks, etc. (Smolin, 2003).

Having examined the trends of the agricultural sector of Ukrainian economy and certain regions, it can be noted that it is a nonlinear dynamic process of transition of this system from the unstable to a stable state under the influence of internal and external factors, mechanisms of self-organization, synergistic effect of territorial agro-industrial associations of different types, which causes positive changes and contributes to the desired effect in the economy, the social sphere, and the ecology of the region (Smolin, 2003):

$$\frac{dX}{dt} = F(S(t),\ R(t),\ C(t),\ D(t),\ I(t),\ Z(t),\ E(t)), \quad (4)$$

where $I(t)$ is the investment, $R(t)$ is the resource potential of the economy, $D(t)$ is the information flow, $C(t)$ is the control action, $S(t)$ – state of the economy, $E(t)$ are the environmental factors, $Z(t)$ are the external factors, X is the expected result, t – time.

On the basis of the proposed method of strategic management, the peculiarities of processes, oc-

curring in agro-industrial production, for the study and forecasting of the events, it is offered to use the scenario planning. In our opinion, SWOT analysis is also an integral part of the analytical process (formulae 1-4). At the stage of SWOT analysis matrix formation, on the basis of which future scenarios for further development will be formed, it is important to identify the disadvantages of existing sectoral structure of the agro-industrial complex, which are typical for groups of districts. As for the region in the economy, where the leading industry is agriculture, typical is the formation of cluster structures of different types, it is important to take into account the opportunities and prospects for the formation of such structures for the future, noting this in the SWOT analysis matrix. Strengths and weaknesses of the system are summarized using the SWOT analysis (Table 1).

Taking into account the situational and informational uncertainties, the experience of rapid systemic changes in the socio-political and economic spheres of our country, the increasing influence of global factors, the stages of scenario analysis, in which cognitive and probabilistic simulation were used, deserve special attention in the development of scenarios. The necessity of using the toolkit for making managerial decisions regarding the justification of scenarios for the regional level development of the national economy, its individual sectors and branches is due to the need to form an objective view of experts about the current state of the national economy, identifying potential problems that may arise under different circumstances.

The main problem that has to be solved when making development forecasts is that when constructing forecasts using methods widely used in the economy, as well as using mathematical and econometric models, it is often impossible to form long enough time series of comparable statistical indices of socio-economic development of Ukraine. Therefore, more and more researchers

Table 1. Results of SWOT analysis of the regional socio-economic system development

Source: Author's development.

Positive factors	Negative factors
Natural and climatic conditions, natural resources and ecological situation:	
• favorable ecological situation; • availability of mineral resources; • favorable meteorological conditions; • availability of water reservoirs for fish breeding; • most of the land in the region is the black soil	• emissions of low-purified wastewater into the environment; • acceleration of water erosion processes; • reduction of the forest cover area; • significant level of plowing; • insufficient use of available natural resources and climatic conditions
Demographic characteristics and the state of the labor market:	
• stable structure of labor potential, a significant number of working age population; • significant proportion of skilled labor resources; • growth of self-employed population; • reduction of hidden unemployment; • increase in demand for labor professions; • reduction of manual labor in agriculture	• reduction of population, in particular decline in birth rate; • population ageing; • considerable load on one vacant workplace; • low level of employment; • low wages; • the level of professional qualifications of a worker practically affects the possibility of employment
Economic development and sectoral structure:	
• stable dynamics of economic development and sectoral structure; • creation of cooperatives and other integrated formations; • stable growth of export potential; • leading positions of agriculture; • powerful chemical industry; • growth of investment attractiveness; • development of seed and pedigree livestock breeding; • development of processing and food industry	• production curtailment without taking into account the regional needs; • changes in the sectoral structure are unmanaged and hamper the development of the regional economy • slowly restoring intersectoral connections in agro-industrial production; • unmanaged investment activity leads to chaotic changes in the sectoral structure of the agro-industrial complex; • predominance of the raw material component in the export of agricultural products
Market infrastructure:	
• commodity exchange in the region	• low volumes of transactions
Social standard of living:	
• growth of average wages; • consumption of food according to rational consumption standards; • growth of household incomes and savings; • average pension rise	• advanced wage growth as a result of consumer prices increase; • low purchasing power of the population; • existence of significant differentiation between cities and districts of the region; • increase in the share of food spending of the population

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(Grünig, 2011; Burstein & Holsapple, 2008) prefer to use cognitive, causal and mathematical models, as well as econometric models, which greatly increase the information requirements of the decision support process. Cognitive modeling as a component of strategic management in developing scenarios for the development of the economic sectors of the region or national economy, taking into account the use of forecast technology, is used to systematize expert knowledge, identifying potential threats and opportunities for system development, objectives and possible contradictions in the definition of goals, criteria, object and subject of the research, description of complex system characteristics and factors of influence of the external environment.

The information base of these models is constantly and rapidly expanding, for the construction of such models, not only statistical indices and ratings, but also poorly structured Big Data can be used, the data from which can be obtained using appropriate analytical tools. At the stage of cognitive model development, as an information provision tool for the decision maker, not only the tools for entering and processing structured information, in particular, statistical data, but also unstructured information, including those placed on Internet resources, can be applied. The peculiarity of cognitive modeling is that the person making the decision is regarded as an integral part of the investigated system.

Taking into account the fact that the socio-economic system develops under the conditions of uncertainty, the model proposed by Pankratova, Nedashkovskaya, and Gorelova (2014) is supplemented with the model of population quality of life:

$$M = \begin{Bmatrix} M_0(Y,I,P),\ M_E(X),\ M_{OE},\ M_D(Q), \\ M_{MO},\ M_{ME},\ M_U,\ A,\ M_H,\ M_{RS},\ M_N \end{Bmatrix}, \quad (5)$$

where $M_0(Y,I,P)$ is the identification system model, Y is an endogenous variable, I is a vector of controlled variables, P is a vector of resources, $M_E(X)$ is an environmental model, X is an exogenous variable, M_{OE} is the interaction model of object and environment, $M_D(Q)$ – model of system behavior, Q – disturbing influence, M_{MO} – model of system state change, M_{ME} – model of environmental change, M_U – model of control system, A – rule of selecting object change processes, M_H – model of researcher's influence on the system and research results, M_{RS} – model of system risks, M_N – population quality of life model.

Thus, for the scenarios of the socio-economic system development, it is advisable to use a methodology that involves a combination of different means of modeling. The use of cognitive modeling (both mapping and matrix construction) and probabilistic modeling in the process of developing scenarios for the socio-economic system development involves the following steps:

STEP 1. Setting of scenario development targets.

STEP 2. Determination of the main factors influencing the system development.

STEP 3. Selection of the most significant factors.

STEP 4. Determination of strengths and weaknesses of the system based on the most important variables.

STEP 5. Formation of the set of input concepts for cognitive map construction.

STEP 6. Constructional cognitive map based on the 5 concepts selected in step 5.

STEP 7. Analysis of the cognitive map.

STEP 8. Assessment of systemic risk.

STEP 9. Formulation of possible event development scenarios.

STEP 10. Assessment of the constructed scenarios quality, justification of the choice of the best and most probable ones.

This methodology was used by us in order to make scenarios for the socio-economic system development – the agro-industrial complex of the region. The following factors are used in the research: natural, climatic and environmental conditions, resource potential, socio-economic development, market infrastructure, etc. Further selection of

factors is accomplished with the help of two-level multi-criteria analysis, because there is a significant number of different factors influencing the system development.

The first-level alternatives $A=\{a_1,\ a_2,\ \ldots,\ a_n\}$ are production in separate areas of the region. A set of first-level alternatives is evaluated on the set of criteria $C=C_1UD$. Alternatives of the second level $B=\{b_{i1},\ b_{i2},\ \ldots,\ b_{ik}\}$ are the types of products to be sold, sales volumes and production volumes of the agro-industrial enterprises. The subset of the criteria $C_1=\{c_1,\ c_2,\ \ldots,\ c_p\}$ is used to evaluate only the first-level alternatives, and the set of criteria D – for both the first and second-levels. Each element of the set A ("district") corresponds to the set of the second-level alternatives (the sales volumes of each type of agricultural product in a particular direction). It is necessary to rank alternatives of the set A, taking into account the multi-criteria estimations of the alternatives of the set B. The complexity of this task is that on the first level, for the choice of alternatives, predominantly qualitative characteristics are used, and on the second level, the quantitative ones. Therefore, the next step is to build a cognitive map. The advantage of fuzzy cognitive maps is their visibility and ease of presentation of cause-and-effect relationships between concepts. The target parameter of the cognitive map is the growth of agricultural production. The following indices were used to analyze the cognitive map (Shvydenko, 2013):

1) consonance (c_i):

$$c_{ij}=\frac{\left|v_{ij}+\bar{v}_{ij}\right|}{\left|v_{ij}\right|+\left|\bar{v}_{ij}\right|}, \tag{6}$$

where v_{ij}, $\bar{v}_{ij}$ is a pair of connections in a transitively closed cognitive matrix (Bidiuk, 2017):

2) dissonance d_i:

$$d_{ij}=1-C_{ij}, \tag{7}$$

3) system impact on the concept $\bar{P}_i$ (Bidiuk, 2017):

$$\bar{P}_l=\frac{1}{n}\sum_{j=1}^{n}P_{ij}, \tag{8}$$

4) and the concept on the system $\vec{P}_J$ (Bidiuk, 2017):

$$\vec{P}_J=\frac{1}{n}\sum_{i=1}^{n}d_{ij}. \tag{9}$$

The indices of the influence consonance for most of the concepts are quite high and range from 0.7 to 0.96. The maximum dissonance is quite low – its value is 0.25. That is, between the selected concepts and the system, there is a significant interaction and they can be used in making scenarios for the system development.

When comparing the alternatives, taking into account the presence of risks, the hierarchy analysis method is used. The transfer coefficient was used to convert the utility estimates into a comparative value estimate (Shvydenko, 2013):

$$K=\frac{c_{\max}-1}{u_{\max}-u_{\min}}, \tag{10}$$

where $u_{\max}$ and $u_{\min}$, respectively, are the maximum and minimum alternative utility according to a certain criterion, $c_{\max}$ is maximum assessment of the relative importance of the criteria.

The maximum estimate of the alternative importance is determined according to the estimate scale by the decision maker (Grünig, 2011; Kussul, 2012). In the decision-making process, the preference is given to the alternative with the maximum value of the mathematical expectation and the minimum standard deviation of the weights. These values are calculated for each scenario separately.

Having the quantitative characteristics of the scenario alternatives, at the next level of analysis, the decision maker can visualize the shape of scenario alternative to a certain time point of the time interval, comparing the time cross sections of the alternatives to one or more scenarios at a specific time point. Each factor, worked out according to the proposed methodology, is described by a certain integral index, which consists of linguistic variables in the form of verbal descriptions of possible variants of events development, grouped and organized according to the importance for this factor. This allows to formalize indistinct notions regarding the development of the social and economic process within the framework of a certain scenario based on the trends identified by experts.

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As a result of the study, it was found that factors influencing the development of the socio-economic system of the region should be considered not only in terms of the overall characteristics of a particular factor, but also in the context of a specific system and its target. For example, the unemployment index (making 59% as in the opinion of a significant population group according to research on Internet resources is a negative factor for the regional development), in reality, as the calculations have shown, is not a negative factor, as the general labor market situation makes its own adjustments. Rather, the negative factor is the age structure of unemployment, declining economic activity of the population and the share of hidden unemployment, which leads to a decrease in the capacity of the consumer market. Development of investment activity in agro-industrial production is an impact factor for the economy development and raising the socio-economic level of the population, on the other hand, the growth of the economy and the improvement of the social standard of living contribute to the inflow of investment resources, as the main investor in the countryside is the inhabitants of the region. This, as the study showed, is a feature of the socio-economic system of the region, where the agro-industrial production is a leading branch of economics. The choice of the target setting took into account the bi-directionality of the factors influencing the development of the socio-economic system of the region. It was also determined that the target setting is the development of agricultural production in the region. The most important factors influencing the development of agro-industrial production in the region are grouped in Table 2.

Based on the results of SWOT analysis of the social and economic system development of the region and the obtained results of the analysis (formulae 1 to 10), the following possible scenarios for the development of agro-industrial production in the region are formed (Table 3).

The quality estimation of the developed scenarios, the justification for choosing the best and most probable one was done using probabilistic modeling. Unlike other methods, when developing a foresight study of the prospects for the agro-industrial production development in the long-term perspective, probabil-

Table 2. Grouping of factors influencing the development of agro-industrial production in the region

Source: Author's development.

Group of factors	Nature of influence	Degree of influence
Political factors		
• A frequent change in the legislative framework governing the economic activity in agro-industrial production	Negative	High
• The existence of bureaucratic barriers, the lack of coordination between the authorities at different levels and local government	Negative	Moderate
• Socio-political instability	Negative	Moderate
• State support	Positive	moderate
Economic factors		
• Increase in the openness of the national economy and competition in the world markets of food and agricultural raw materials	Egative	Moderate
• Instability of the financial and credit system, limited working capital for business	Negative	High
• Support of priority projects in the agro-industrial complex, granting of tax and other advantages to the investors, development of public-private partnership	Positive	Moderate
• Considerable investment attractiveness of separate branches (enterprises) of agro-industrial production	Positive	High
• European integration and trade liberalization	Positive	Moderate
• Growth of state support for agro-industrial production	Positive	High
Social factors		
• Cheap and skilled labor resources	Positive	Moderate
• Decline of income of the population	Negative	Moderate
• Developed agricultural education and science	Positive	High
Technological factors		
• Significant production potential of the agro-industrial complex	Positive	High
• Introduction of innovative technologies in the food industry and agriculture	Positive	High
• Reduction of domestic agricultural machinery and equipment for agro-industrial production	Negative	High

Table 3. Possible scenarios for the development of agro-industrial production

Source: Author's development.

Scenario	Scenario content
S1: Efficient use of resources	This scenario implies the availability of the optimal sectoral structure of the region's economy, a significant inflow of investment resources into agro-industrial production for all sources, including foreign direct investment. At the same time, pumping up of local budgets and the expanded powers of the local self-government bodies of the region will contribute to the effective development of the economy of individual territories. The volumes of investments aimed at agricultural production are sufficient for reproduction, management of the economy is effective, powers are distributed in a proportional manner, and regional level of public administration has the authority to ensure the autonomy of strategic management decisions. The scenario can be considered sustainable, because the enterprises' own funds during a long period of time form the basis of their reproduction
S2: Dependence on the center	According to this scenario agro-industrial production will be the leading sector of the region's economy, the necessary investment volumes will be delivered to the economy, providing expanded reproduction, pumping up of local budgets will increase at the expense of effective operation of enterprises, a favorable investment climate that will attract foreign investors, but there is a risk of excessive centralization of management, as the local budgets are limited due to social protection costs (low wages in agriculture and demographic load will not allow to significantly increase the revenues from the personal income tax to local budgets), centralized economic management, which can continue the current trend
S3: Diversification of resources	This scenario assumes that investment support will remain at practically the existing level, which is not sufficient for expanded reproduction, but autonomy of local government will be realized. The implementation of this scenario implies that under the absence of investment resources for the development of agro-industrial production, business entities in the agrarian sector will have the support of the executive and local self-government and will intensify their activities to attract investment resources and create conditions for rational use of domestic investment resources
S4: Centralization of resources	This scenario implies a purely centralized management, when the issue of directing investment resources in the national economy will be resolved at the national level, budget financing will decrease, the overall investment attractiveness of the agricultural production of the region will decrease, the state does not care about support of the regional level initiative, and local government will not have sufficient resources for the use of appropriate economic instruments

istic modeling using the Bayesian network was used to assess systemic risk. Based on the set-up topology of the Bayesian network, the most significant variables affecting the target are determined. After that, a multiple regression equation with forced inclusion of the detected variables in the model is built. The estimation of model parameters is performed on the basis of the recursive least squares method.

The scenario-based probabilistic model for the optimization of strategic management and economic development of the regional agrarian sector is proposed, which allows to identify the priority directions for the long-term perspective, adjusting the direction of development if necessary, taking into account different development scenarios on the change of priorities at the macro-level in the conditions of uncertainty and risks. The introduction of a combined approach based on the use of principles and methodology of scenario planning, foresight, probabilistic modeling was recognized as the perspective direction of improving the strategic management of the agri-food sector development in the region. It will allow to concentrate efforts on the regional development implementation based on the interests of territorial communities, maintaining the national priorities at the same time.

CONCLUSION

On the basis of the obtained results, it is possible to make a conclusion concerning the sectoral structure in the agricultural production of the region, which ensures its resistance to the influence of various groups of external factors. Almost all branches of agro-industrial production have a significant effect on the growth of the regional (and national) economy. This is with the exception of mixed agriculture, production of pesticides and other chemicals, as well as wholesale trade of agricultural raw materials and live animals.

It is also advisable to apply the scenario approach when developing the strategies for socio-economic development of districts and cities with the participation of the territorial communities, as well as when justifying the alternative ways of development of the system in the future, and so on.

The remoteness and universality of the long-term forecast and the limited ability to take into account the impact of the economic factor variety require detailed and precise results of the forecast. Short-term forecasting,

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supplementing the long-term one, provides an opportunity to take into account the impact of a greater number of factors on the resulting index, which greatly improves the quality of forecasting. According to the current practice of developing short-term forecasts in socio-economic development programs for the next year, the growth rate of the economy is usually planned to be at the level of 5-7% of their values in the previous year.

In modern conditions, it is difficult to predict changes, it is impossible to qualitatively describe the system behavior in such a way. However, the determination of the total investment volume necessary for the growth of the regional economy in most cases is not carried out. Therefore, considerable attention was paid to the modeling of gross regional product volume in the short-term perspective in the study of the prospects of investment activity in agro-industrial production.

It is determined that for short-term forecasting, especially in the conditions of rapid, abrupt change of the situation in the national economy, forecasting of investment support of the regional economy, it is optimal to make the forecast of the investment supply of regional economy on the basis of gross regional product forecast, since it is the resulting index that characterizes the industry structure and dynamics of the regional economy, generalizing the influence of all factors of growth.

The sectoral structure of the region's economy, in particular, the presence of an agrarian component, influences the fact that the results of investment tend to become tangible for the economy after a certain time from their investment. The results of the study of the relationship between the volume of the gross regional product and various sources of capital investment and the most significant sources have shown the presence of lags of the third order (state budget, local budget, own funds of enterprises, bank loans), that is, the results of investment activity will manifest as much as possible three years after their investment.

Practical recommendations for the future strategic management optimization of the regional agrarian sphere are worked out. Namely, it is advisable to use combined methods for forecasting the development strategy of individual industries and the economy of the region, including the use of a scenario approach that allows to form of flexible strategic decisions, to develop a strategy for the researched system development, forecasting the alternative development scenarios, even when it is impossible to forecast the development of social and economic processes only on the basis of retrospective observations. Besides, it is also reasonable to apply the scenario approach when developing the strategies for social and economic development of districts and cities involving the territorial communities, as well as when substantiating the alternative ways of future development etc.

As an optimization of strategic management of the regional agricultural sector economic development, the conceptual approaches to the formation of a development strategy of its branches and spheres were proposed on the basis of cognitive scenarios of agrarian market demand and supply balancing and, as well as probabilistic modeling that allows the regions to identify the "growth points", to optimize the sectoral structures of the economy, to improve the quality and effectiveness of the developed and implemented scenarios and strategies of the agro-industrial production development in the region. The formation of integrated structures of different types, promotion of cooperation and integration in the agroindustry production, contributing to obtaining a sustainable synergetic effect from the cluster organization of agro-industrial production under decentralization, are proposed to be implemented on the basis of the region's activities as the main point of the reforms and their management.

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