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AgriRisk and Supply Continuity Methodology in Scenario Planning of Agricultural Holdings

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ABSTRACT

The article is devoted to the study of the AgriRisk and Supply Continuity methodology in the context of scenario planning of the activities of agricultural holdings. The purpose of the study is to determine the features of the application of an integrated approach to modeling the financial results of agricultural enterprises, taking into account the complex impact of risks and interrelated factors. In the course of the scientific study, general scientific methods of cognition were used, in particular, analysis, synthesis, generalization, comparison and a systematic approach. The results of the study show that a generalization of modern approaches to modeling the forecasted financial indicators of enterprises has been made, among which deterministic, stochastic, stress-test, behavioral and integrated approaches are distinguished. Their key characteristics and limitations are studied, in particular, orientation on individual factors, focus on extreme events or dependence on management decisions. It is shown that in conditions of growing uncertainty, combined author's methods that are able to take into account the multifactorial impact of risks on the results of enterprises are of particular relevance. The justification for the use of the AgriRisk and Supply Continuity Methodology as a tool for comprehensive forecasting of the financial results of agricultural enterprises is made. Its focus on assessing profitability is studied, taking into account the interrelationship of numerous factors, which allows for determining the direct impact of risks on economic efficiency. It is shown that the structure of the method includes three interconnected blocks: financial and accounting, agro-economic and logistics and export, each of which performs a separate function in the formation of the final result. Their interaction is studied and it is established that the integration of these blocks provides a holistic view of the impact of risks, increases the accuracy of forecasting and contributes to the adoption of informed management decisions. The practical significance of the study lies in the possibility of using the proposed method to increase the stability and efficiency of agricultural enterprises in conditions of uncertainty.

KEYWORDS

risks, agribusiness, modeling, EBITDA, logistics.

Introduction

The agricultural sector operates in conditions of increased uncertainty, which is due to a combination of natural, economic and institutional factors. As L. Theuvsen notes, agriculture is one of the riskiest sectors of the economy, since the results of its activities depend on a significant number of uncontrolled variables, in particular weather conditions, price fluctuations and the political situation (Theuvsen, 2013). In such conditions, traditional approaches to planning lose their effectiveness, since they are unable to adequately take into account the multi-vector nature of risks and their interrelationships. This creates a need for new tools that can provide more flexible and adaptive management.

Modern challenges further complicate the situation. Global geopolitical conflicts lead to disruption of logistics chains, increased transport costs and instability of export channels. As shown by C. Duden's research, extreme events, in particular those related to climate and market shocks, significantly affect management decision-making in agriculture (Duden et al., 2023). In such conditions, any disruption in supplies is transformed into direct financial losses, which is manifested through reduced margins, increased storage and transportation costs, and loss of contract positions in international markets. Costs become unstable, and profits are increasingly sensitive to external shocks.

In response to these challenges, agricultural enterprises are forced to look for approaches that allow at least partially predicting future financial results. Based on the study of O. Vergara, it was found that the use of risk models and scenario analysis increases the ability of enterprises to form reasonable expectations regarding market conditions (Vergara et al., 2014). This is especially important in interaction with counterparties, when it is necessary to determine an acceptable contract price and assess potential costs. In such conditions, scenario models become not just an analytical tool, but a necessary prerequisite for doing business, ensuring the possibility of harmonizing the interests of producers and buyers in an environment of high uncertainty.

Literature Review

The issue of modeling the forecasted financial indicators of agricultural enterprises based on various scenarios is not sufficiently covered in detail in the scientific literature. Despite this, some components of this topic are considered by scientists. In particular, approaches to uncertainty analysis and the formation of alternative scenarios were studied by the following authors: F. Akhavizadegan (2022), J. Cotter (2011). These authors focused on quantitative risk accounting, in particular through the use of stochastic models and the assessment of extreme financial losses, which allows a better understanding of the impact of uncertainty on the performance of enterprises. As for the behavioral and experimental aspects of decision-making under risk, this issue was studied by several authors. Among them, it is appropriate to highlight C. Duden (2013), who analyzed the impact of extreme weather conditions on the choice of management strategies; S. Hanger-Kopp (2022), who studied the mental models of decision-making among farmers; J. Shah (2024), who identified factors influencing the choice of risk management tools, in particular under conditions of uncertainty.

A. Figurek (2023), S. Kimura (2010), L. Theuvsen (2013) made a significant contribution to the study of systemic risk management. Their works considered the issue of forming comprehensive approaches to risk management, including the integration of economic, production and institutional factors, which allows increasing the resilience of agricultural enterprises to external influences.

Separately, it is worth noting the studies devoted to information support and risk analysis tools. In particular, O. Vergara (2014) considered models aimed at improving market information systems, and B. Khakhula (2024) investigated innovative risk management tools in the production activities of agricultural enterprises.

At the same time, the scientific literature does not sufficiently address the issue of a comprehensive combination of financial, production and logistics factors within a single approach to forecasting financial results. The scientific novelty of the study lies in the development of an approach to modeling the predicted financial indicators of enterprises based on the integration of different risk groups and their impact on the final result. To achieve the set goal, the methods of generalization, comparative analysis, systematization and logical modeling were used.

Special attention is paid to the author's methodology of O. S. Zlochovska (2025), which offers a comprehensive approach to modeling the forecasted financial indicators of agricultural enterprises based on various scenarios. Within the framework of this approach, financial, production and logistics factors are integrated into a single analysis system, which allows assessing the impact of risks on the final economic result. The methodology is focused on quantifying the consequences of crisis events and provides the opportunity to form informed management decisions in an environment of increased uncertainty.

Problem Statement

The purpose of the article is to study the features of scenario planning in agricultural holdings and to substantiate the features of the author's methodology AgriRisk and Supply Continuity. To achieve the goal, the following tasks will be performed during the study: 1) to reveal the essence of scenario planning and its main types; 2) to determine the content and place of the author's methodology AgriRisk and Supply Continuity, in the scenario analysis system; 3) to characterize the structural blocks of scenario planning within this methodology.

Methods and Materials

The study used general scientific methods, in particular analysis, generalization, comparison and systematization to study approaches to modeling the forecasted financial indicators of agricultural enterprises. At the same time, as a special method, the author's approach was used, which is based on a combination of sensitivity analysis, scenario modeling and stress testing to assess the impact of critical variables on EBITDA.

Results and Discussion

Scenario planning in agricultural holdings should be considered as a strategic management tool aimed at modeling alternative options for the development of the external and internal environment in order to increase the enterprise's resilience to uncertainty. As shown by the study of F. Akhavizadegan, the use of a scenario approach in combination with stochastic optimization allows us to take into account the multiplicity of possible system states and to formulate solutions taking into account the risk-averse behavior of agricultural producers (Akhavizadegan et al., 2022). At the same time, the work of L. Theuvsen emphasizes that scenario planning is a key element of risk management, since it provides a structured vision of potential threats and options for responding to them (Theuvsen, 2013).

The generalization of scientific approaches allows us to state that scenario planning in the agricultural sector performs several interrelated functions. It is not limited to forecasting, but involves assessing the sensitivity of financial results to changes in key factors, in particular prices, yields and logistical conditions. As O. Vergara notes, the use of risk models in combination with scenario analysis improves the quality of information support for management decisions, especially in unstable markets (Vergara et al., 2014). At the same time, some studies demonstrate a simplified interpretation of scenarios as separate forecasts that do not take into account their interrelationship and the cumulative effect of risks. This limits the possibilities of practical use of such models in large agricultural holdings.

In the scientific literature, various approaches to the classification of scenario planning have been formed, reflecting its multidimensional nature (see Table 1).

It can be summarized based on Table 1 that scenario planning is gradually evolving from simple deterministic assessments to complex integrated models. This creates the prerequisites for the formation of more flexible risk management strategies, but at the same time increases the requirements for data quality and analytical support.

Table 1. Types of scenario planning in agricultural holdings

Type of scenario planning	Characteristics	Example of application
Deterministic scenario planning (Theuvsen, 2013)	is based on fixed assumptions regarding key parameters and allows assessment of the consequences of specific changes	calculation of the impact of fuel price increases on production costs
Stochastic scenario planning (Akhavizadegan et al., 2022)	takes into account the probabilistic nature of changes and uses distributions of random variables	modeling yield fluctuations depending on weather conditions
Stress-testing scenario planning (Cotter et al., 2011)	focuses on the analysis of extreme, low-probability but critical events	assessment of financial losses in the event of a sharp price drop or crop failure
Behavioral scenario planning (Hanger-Kopp, & Palka, 2022)	considers managerial decisions and psychological aspects of risk perception	analysis of farmers' responses to drought risk and selection of insurance strategies
Integrated (system-based) scenario planning (Vergara et al., 2014)	combines financial, production, and market factors within a single model	comprehensive modeling of the impact of logistical constraints and currency fluctuations

Source: Compiled by the author based on sources (Akhavizadegan et al., 2022; Cotter et al., 2011; Hanger-Kopp & Palka, 2022; Theuvsen, 2013; Vergara et al., 2014)

Modern studies present a significant number of approaches to scenario planning in the agricultural sector, which differ in the level of formalization, depth of risk consideration and focus on final results. Based on the study by S. Kimura, it was established that traditional models are often limited to the analysis of individual risk factors without their integration into the financial results of the enterprise (Kimura et al., 2010). Within the framework of this study, special attention is paid to the author's methodology by O. S. Zlochovska, which forms a holistic vision of scenario planning through the prism of continuity of supplies and financial stability.

Olga Zlochovska's author's methodology AgriRisk and Supply Continuity Methodology (Zlochovska, 2025) is defined as an integrated scenario planning system that combines financial and accounting, agro-economic and logistics and export components within a single model of cross-risks. Its key feature is the transition from descriptive risk analysis to its quantitative measurement through the impact on the final financial result of the enterprise. This approach allows not only to identify threats, but also to determine their real "cost" for the business.

From the perspective of scenario planning classification, this methodology belongs to the integrated (system) and stress-test type. This is explained by the fact that it:

• combines various risk management subsystems into a single model that provides a comprehensive view of the impact of factors on the enterprise's activities;

• focuses on modeling extreme scenarios, in particular, logistical blockades, macroeconomic shocks and climatic disasters, which corresponds to the logic of stress testing (Cotter et al., 2011);

• takes into account the relationship between risk factors and their cumulative effect, which distinguishes it from isolated scenario models (Vergara et al., 2014).

A fundamentally important feature of the methodology is its focus on the final performance indicator, in particular, EBITDA. Within the framework of the approach, a sensitivity analysis is carried out, which allows you to determine how changes in individual parameters, in particular prices, costs or productivity, affect the business margin. This approach transforms scenario planning from a forecasting tool into a financial diagnostics mechanism that ensures the validity of management decisions.

A comparative analysis shows that the focus on the final economic indicator is not inherent in all methodologies. A summary of the main approaches is given in the table (see Table 2).

The author's methodology of O. S. Zlochovska (2025) differs from most existing approaches in its clear focus on financial results as the ultimate criterion of efficiency.

This methodology is based on several functional blocks, each of which is responsible for a separate dimension of scenario planning. This approach reflects the modern trend towards systemic risk analysis, when financial, production and logistics factors are considered in relation to each other. Based on the research of A. Figurek, it was established that effective risk management models in the agricultural sector should combine economic and operational components in a single system (Figurek, 2023). Within the framework of the author's methodology, this logic is implemented through three interconnected blocks.

Table 2. Scenario planning methodologies based on the focus on the final economic result

Methodology	Characteristics	Orientation toward financial results
Stochastic optimization (Akhavizadegan et al., 2022)	Model's managerial decisions, taking into account risk and uncertainty	Partially, through the utility and profit function
Extreme risk models (Cotter J. et al., 2011)	Analyze extreme financial losses in the agricultural sector	Yes, through the assessment of financial risks
Behavioral decision-making models (Hanger-Kopp, & Palka, 2022)	Focus on cognitive aspects of strategy selection	No, predominantly a qualitative approach
Market information models (Vergara et al., 2014)	Are aimed at improving information systems	Partially, indirectly
AgriRisk and Supply Continuity (Zlochovska, 2025)	An integrated model of cross-risks with a focus on business resilience	Yes, directly through the EBITDA indicator

Source: Compiled by the author based on sources (Akhavizadegan et al., 2022; Cotter et al., 2011; Hanger-Kopp & Palka, 2022; Vergara et al., 2014)

The financial and accounting block is characterized by a focus on quantitative assessment of the impact of risks on the financial results of the enterprise. Within this block, an analysis of the structure of costs, income and liquidity is carried out, and the impact of changes in key parameters on the EBITDA indicator is also simulated. For example, a 20% increase in fuel costs can be transformed into an increase in logistics costs and a decrease in operating margins; devaluation of the national currency affects the cost of imported resources, in particular fertilizers and plant protection products, which leads to a revision of the production budget; an increase in interest rates on loans creates an additional financial burden and changes the structure of the enterprise's cash flows; delays in payments under export contracts lead to cash gaps and the need to attract short-term financing (Zlochovska, 2025);

The agricultural economic block focuses on production aspects of activity, in particular, yield, crop structure and the impact of climatic factors. In this case, the risks of droughts, excessive rainfall or changes in agricultural technologies that directly affect production volumes are taken into account. For example, a decrease in the amount of rainfall during critical phases of the growing season can lead to a loss of yield by 30-40% and, accordingly, to under fulfillment of contractual obligations; a sharp cooling in spring can reduce crop germination and require additional costs for reseeding; changing the crop structure towards more marginal crops can increase profitability, but at the same time increases risks due to dependence on a narrow sales market; the spread of pests or crop diseases creates the need for additional costs for protection and affects the quality of products (Zlochovska, 2025);

The logistics and export block covers the risks associated with the transportation, storage and sale of products on foreign markets. Within this block, scenarios of disruption of logistics chains are analyzed, in particular, the blocking of ports or the shortage of transport resources. For example, the temporary closure of sea routes forces the company to redirect flows to rail transport, which significantly increases transportation costs; the shortage of wagons during peak export periods leads to delays in shipment and accumulation of products at elevators; long-term storage of grain without proper ventilation causes loss of quality and a decrease in the selling price; the introduction of trade restrictions in certain markets forces sales at a discount, which directly affects the financial result (Zlochovska, 2025).

The interaction of these blocks forms a holistic model of cross-risks, within which individual factors are not considered in isolation. This approach allows you to identify the cumulative effect of risks, when, for example, a simultaneous decrease in yield and an increase in logistics costs leads to a sharp deterioration in financial results. As shown by the study of J. Shah, the effectiveness of risk management largely depends on the ability to take into account the relationship between various factors of uncertainty (Shah, 2024).

In addition to purely mathematical calculations, the methodology provides a number of functional capabilities that ensure the practical implementation of analytical results in the enterprise management system. The generalization of such capabilities allows you to consider it not only as an analysis tool, but as a full-fledged mechanism for supporting management decisions.

- automated data collection involves the integration of various sources of information, in particular accounting systems, bank transactions and production sensors. This allows you to form an up-to-date information base without delays, for example, when daily updating data on fuel costs or inventory levels at elevators (Zlochovska, 2025);
- comparison of indicators with control limits is implemented through algorithmic verification of key financial and operational indicators. For example, the system can automatically detect exceeding the permissible level of costs or a decrease in liquidity below the set level (Zlochovska, 2025);
- activation of financial triggers provides a transition from observation to action. In practice, this can manifest itself in launching cost reduction scenarios or reviewing financing when critical EBITDA or cash flow thresholds are reached (Zlochovska, 2025);
- generation of analytical notifications allows you to promptly inform management about changes in the system state. For example, with a sharp increase in logistics costs or shipment delays, a signal is generated with a forecast of further development of the situation (Zlochovska, 2025);
- escalation of information to senior management involves the transmission of critical signals directly to the strategic management level. This ensures quick decision-making, for example, in cases of risk of contract termination or liquidity shortage (Zlochovska, 2025);
- visualization of system states is implemented through division into stability, attention and threat levels, which allows you to quickly interpret the situation. For example, a transition of the indicator into the “red zone” signals the need for immediate intervention (Zlochovska, 2025).

Conclusion

In modern scientific practice, several approaches have been formed to modeling the forecasted financial performance of companies based on various scenarios. Among them, it is advisable to distinguish deterministic, stochastic, stress-test, behavioral and integrated approaches. Each of them has its own limitations, since some are focused on individual factors, while others focus on extreme events or managerial behavior. In this regard, authorial approaches are becoming widespread that combine various elements and allow taking into account the complex impact of risks on the results of enterprise activities.

The AgriRisk and Supply Continuity Methodology is aimed at use in agricultural enterprises and is focused on the formation of a forecasted financial result taking into account numerous interrelated factors. Its feature is the focus on profitability, which allows assessing not only the presence of risks, but also their direct impact on economic efficiency. This approach creates the basis for more accurate coordination of the future cost of products and increases the validity of management decisions.

The structure of the methodology involves the functioning of three interconnected blocks, each of which performs a clearly defined role. The financial and accounting block provides an assessment of income, expenses and liquidity and transforms the change in factors into a financial result. The agro-economic block is responsible for production parameters, in particular yield and the impact of natural and climatic conditions. The logistics and export block covers the processes of transportation, storage and sale of products, which determine access to markets and the level of costs. The coordinated interaction of these elements allows you to form a holistic picture of the impact of risks on the activities of the enterprise and provides a basis for increasing its sustainability.

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