

MANAGEMENT OF THE ACTIVITY OF AGRARIAN ENTERPRISES FOR ACCOUNTING RISK MANAGEMENT AND MULTICRITERIA DECISION MAKING

Abstract. *The main approaches to the management of the activity of agrarian enterprises are considered: an approach based on risk management and multicriteria management methods. Management of risks in the agrarian sector is presented as an integral part of the overall strategy for managing the activities of the agricultural enterprise. An overview of the known multi-criteria decision-making methods shows their applicability to the agrarian enterprise management task. Given the difficulties that arise when necessary to make adjustments and changes in the implementation of the strategy, it is appropriate to use several methods for selecting alternatives that focus on decision making under uncertainty. The requirements that should be followed when designing appropriate methods are formed. Particular attention should be paid to the theory of MAUT, which combines the benefits of management risk and multicriteria-based decision making and has good examples of implementation in the agrarian sector.*

Keywords: *agriculture, decision making, ecology*

Introduction

The problem of reliable supply of food and agricultural raw materials by the country remains unresolved. The functioning of other industries that process and use its products depends on the sustainable development of agricultural production. Ensuring food security, economic and social stability is a nationally important issue for each state.

Another important factor is the need to provide food to the ever growing population of the world. According to [1], the number of people lacking food is 820 million. Further growth of the planet's population will only increase the burden on agriculture. According to the recommendations by 2050, food production should be increased by 70%.

Effective management is possible only if the balance of functions, powers and responsibilities is maintained. Each of the subjects of management activity should be responsible for the possible consequences of risky decisions only to the extent that he participates in their development and has real opportunities to influence the degree of risk in the process of implementation. The possibility of regulating the risk of agricultural production can only be determined by the analysis of adaptive technologies and the assessment of the probability of expected weather, economic and other conditions of management.

The purpose of the article

The research objective is:

1. To conduct an overview of the main approaches to the management of the activities of agrarian enterprises.

2. To formulate requirements for application of methods of decision-making by agrarian firms in conditions of uncertainty.

Presenting main material

In order to improve the situation in agriculture, there is a need for new methods of management based on system analysis. Consider the main approaches to managing agribusiness activities: an approach based on risk management and multicriteria management methods.

Risk Management

Among the research scientists of the theory of risk should be distinguished by J. Keynes, A. Marshall, O. Morgenstern, F. Knight, J. Neumann. In the writings of [2-4] mentioned authors the categorical content of risk is defined, the theoretical approaches to the classification of risks are disclosed on the basis of classification, the methodical approaches to risk assessment and its impact on business entities are substantiated. These results can be used for management in the agrarian sector.

Risk is a probabilistic estimate of uncertainty and unpredictability of performance. The increased level of uncertainty in the activities of agrarian enterprises requires special management decisions on risk analysis and the development of measures to reduce them.

Agriculture, like any other branch of the economy, has its own peculiarities that predetermine certain peculiarities in the manifestation of risks. In his works [5] identifies the following types of risks: economic, organizational, technological and social. The paper [6] describes the classification of risks by origin. They include:

1. Risks that are not related to the will of the person on the environment (frost, freezing, ice, hail, lightning, earthquake, avalanches, landslide, land or water and land, fire, storm, hurricane, storm, rain, flood, drought, epiphytotic development of plant diseases, epiphytotic reproduction of harmful plants, secondary diseases of plants).

2. Risks related to the will of the person on the environment. These include: agrotechnical, agrochemical, industrial, environmental, marketing, radiation, institutional, social management and image.

3. Financial and economic risks. This category of risks includes: price, credit, investment and liquidity risk.

Consequently, the risk in the agrarian environment is interpreted as the probability of occurrence of certain positive or negative changes in the process of production, processing and marketing of agricultural products. The occurrence of risk is associated with certain costs of material and / or nature. Agrarians, in the course of their activities, constantly encounter situations that generate a certain uncertainty. These uncertainties can be interpreted as different forms and types of risks.

Risk management in the agrarian sector should be considered as a multi-stage process, which aims to reduce or compensate for damage to business entities in the event of an adverse event. At the same time, it should be noted that the risk management system does not eliminate these risks, but it allows a high degree of probability to predict and minimize possible losses in the event of adverse events.

This is due to the fact that the potential of the risk assessment system allows to isolate all sources of risk, establish their nature, carry out quantitative and qualitative assessments, manage risks on a single methodological basis and make managerial decisions at different levels.

Risk management should be considered as an integral part of the overall management system for implementing the strategic, tactical and operational objectives (objectives) of the agricultural enterprise development. At the same time, the effectiveness of management should be determined by the optimum correlation between the magnitude of profitability from agricultural activities and the level of risks that threaten the normal functioning of the entity. The process of risk management in the agrarian sector consists of the following 7 stages (Fig. 1).

The purpose of identifying risks is to identify and compile a complete list of risks that may affect the activities of the agrarian enterprise. This list should be as complete as possible, since unidentified risks present a significant risk in achieving the goals set, the loss of control over the management processes and the coordination of the enterprise, as well as the non-use of existing development opportunities. A prerequisite for a complete and comprehensive risk identification is the quality of information that is determined by such parameters as: reliability, objectivity, timeliness, relevance, completeness of coverage.

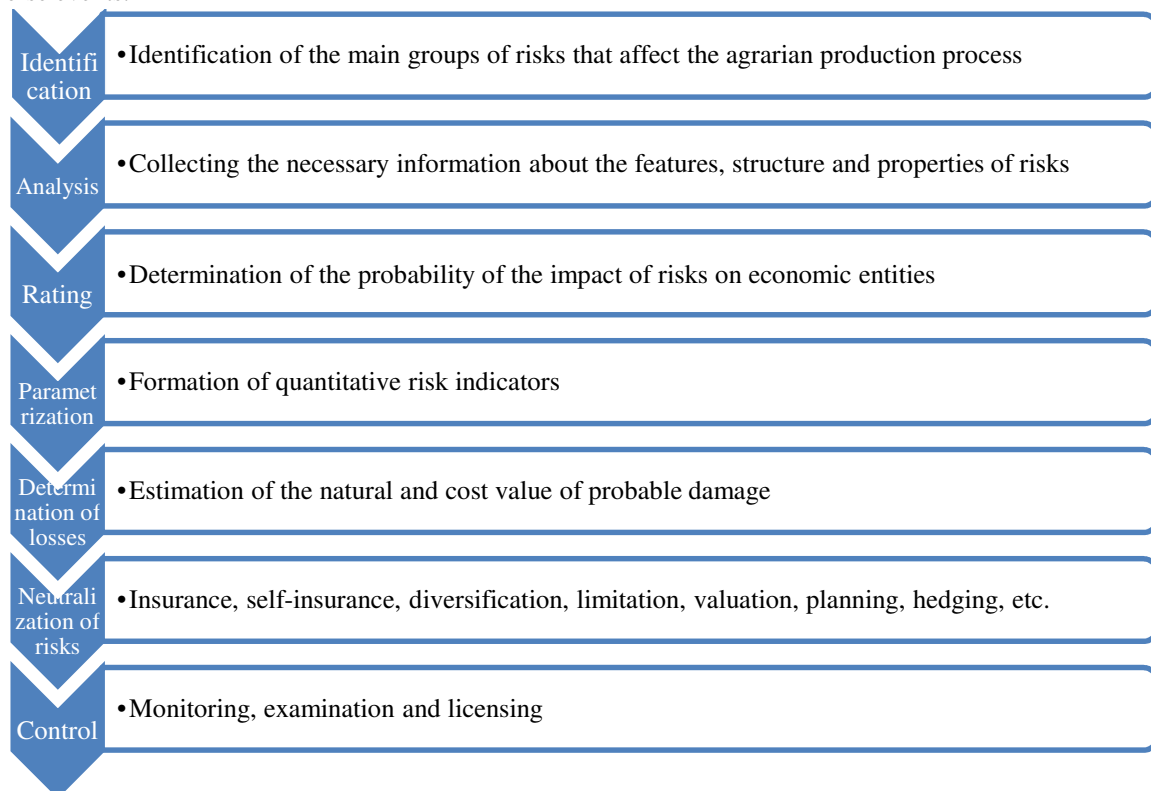


Figure 1 – Risk Management Scheme

The main sources of information used in identifying risks are:

1. forecast of changes in meteorological and hydrometeorological phenomena and processes, which pour into the state of production of agricultural products;
2. level of financial, economic, technological and labor resources availability;
3. level of application of technologies used by farmers;
4. assessment of the state and trends of changes in the state of domestic and foreign markets of agricultural products;
5. changes in the institutional conditions for the implementation of agrarian policy;
6. the level of management and organizational decisions regarding the production, processing and marketing of agricultural products.

Risk analysis is conducted in order to obtain the necessary information about the features, structure and properties of risks that can potentially threaten socio-economic and environmental interests of the agrarian enterprise. In the framework of the analysis, the identification of risks is carried out, the causes of their occurrence are investigated and the scenarios of the development of adverse situations are predicted. The analysis consists in constructing the function of probability distribution, the occurrence of losses depending on its size. The analysis enables to identify and group the risks by the level of potential danger and assess the possible consequences of their occurrence.

According to the probability of occurrence, risks are divided into 3 groups:

1. Probable events
2. Permissible risks
3. Emergency situations.

The purpose of risk assessment is to increase the level of socio-economic and environmental safety of the economic activity of the business entity. It is necessary to assess the level of risk in two basic parameters: quantitative and qualitative. The methods of quantitative analysis of the most common risks are: statistical methods of evaluation, cost-benefit analysis, method of expert evaluations, method of analogies, group of analytical methods [7]. The main results of qualitative analysis of risks: the identification of specific risks and sources of their occurrence, analysis and cost equivalent of the hypothetical consequences of the implementation of existing risks, proposals for taking measures to minimize losses, and, finally, cost estimation. Additional results include the definition of the values of the possible change in all risk factors (variables).

Parameterization of risk is to determine the risk characteristics as a random variable. Finding the mathematical expectation and dispersion of each type of risk allows us to determine the range of possible

fluctuations of the expected return on economic activity in conditions of uncertainty and conflict.

When managing risks in the agrarian sector, it is important to adhere to the concept of acceptable risk, that is, that which would not endanger the process of production, processing and marketing of agricultural products. The concept of acceptable risk involves identifying and justifying the levels of acceptable risks at all stages of the agricultural product's life cycle (from selection of sowing material to the marketing of products).

To estimate the relationship between risk and efficiency of economic activity, the coefficient of variation is used.

The agrarian risk management strategy may be based on the choice of the risk level within the limits of the risk values from the minimum to the acceptable, determined for a specific type of economic activity. Comparison of the current risk value with acceptable, the definition of measures to reduce risk, the impact on the parameters of sources of hazards, assessment of the effectiveness of the measures taken – the necessary components of risk management. In case of risk reduction it is necessary to take into account the cost of measures intended to reduce the likelihood of occurrence and reduce the impact of the consequences of emergencies. The application of the risk indicator will allow comparing the effect of hazardous factors of different nature and different species, and, taking into account the contribution of each individual factor, the integral degree of danger of any type of agricultural activity. By its nature, risk management in the agrarian sector is systemic and aimed at reducing the integral risk due to the combined effect of hazardous natural, man-made and anthropogenic factors.

Management of risks in the agrarian sector should be considered as an integral part of the overall strategy for managing the activities of an agricultural enterprise. A prerequisite for such a management is finding the optimal correlation between the level of agricultural incomes and the aggregate level of risks that threaten effective agricultural activity. Only in the presence of such a consensus will be provided the necessary conditions for the effective development of agrarian production.

Multicriteria methods of decision making

Among the research scientists of the theory of risk should be identified J. Keynes To manage agrarian enterprises can be used methods of multicriteria decision-making. These methods are intensively developed, modified and improved. Let's consider the basic methods of multicriteria choice from a variety of alternatives and their application possibilities for application in the agrarian sphere.

Fuzzy set theory and fuzzy analysis are an effective tool for making multi-criteria solutions [8]. This theory is based on the concept of fuzzy set and membership function. Incomplete and inaccurate data is a hallmark of many practical tasks. That is why the use of fuzzy logic enables to effectively solve applied management problems, including in the agrarian sector. The advantage of this approach is the succinctness of describing the task with a set of fuzzy rules. The disadvantage is the need to use simulation before the methods can be used to select the best solutions.

The traditional approach to solving difficult decision-making problems is the method of hierarchy analysis [9,10]. This approach is based on pairwise comparisons of alternatives. Its advantage is the scaling and ease of implementation. The main disadvantage is the need for expert assessments.

The Multi-Attribute Utility Theory (MAUT) [11] is used to assess risk and degree of uncertainty, as well as to make multi-criteria solutions. In many studies, MAUT uses natural resource management, in particular [12], based on it, considers the method of determining the risks of using land resources. [13] used a combination of spatial analysis methods and multi-criteria analysis and decision-making methods based on MAUT to assess the risk of soil contamination in Europe. [14] describes a model based on the MAUT, which uses institutional, cultural, technical and other criteria designed to promote the stability and development of individual regions. Based on this model, the SANEX decision support system has been established, which has been successfully implemented in Indonesia. The use of MAUT for multicriteria assessment of climate change trends is described in [15].

For the agricultural problems in India, the Data Envelopment Analysis (DEA) [16] has been successfully used. The authors were able to identify the weaknesses in the agriculture of a particular region by ranking farms.

At the heart of DEA is the measurement of the relative efficiency of alternatives by solving the linear programming problem. Alternatives get ratings belonging to the segment [0,1]. These estimates can be considered as weights of the respective alternatives. In particular, it is possible to combine with simple additive weighting, SAW [17]. This method is often used in business, the financial sector for quick calculations when establishing a rational alternative.

Conclusions and perspectives of further research

According to the results of the analysis of known methods of making multi-criteria solutions and multicriteria analysis, it can be concluded that their use in isolation can complicate the interpretation of results. It should be taken into account that the choice of the wrong strategy for the functioning of an agrarian enterprise can lead not only to significant financial losses, but also for irreversible effects on the ecological state. It is also worth noting the difficulties that arise when necessary to make adjustments and changes in the implementation of the strategy. Therefore, it is proposed to use several methods to select alternatives that focus on decision making under uncertainty. Appropriate methods should take into account the blurriness of the data, that is, to work with fuzzy values. Also, for the interpretation of results, it is necessary to develop quantitative or qualitative scales without the constant involvement of experts or the decision maker.

Particular attention should be paid to the theory of MAUT, which is used to assess risks and uncertainty, as well as to make multi-criteria solutions. This technology combines the benefits of management risk and multicriteria-based decision making and has good examples of implementation in the agrarian sector.

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Чунмей Жі

Аспірант кафедри інформаційних систем та технологій, orcid.org/0000-0002-9030-407X
Київський національний університет імені Тараса Шевченка, Київ

УПРАВЛІННЯ ДІЯЛЬНІСТЮ В АГРАРНОМУ СЕКТОРІ З УРАХУВАННЯМ РИЗИКІВ ТА БАГАТОКРИТЕРІАЛЬНОГО ПРИЙНЯТТЯ РІШЕНЬ

Анотація. Розглянуто основні підходи до управління діяльністю аграрних підприємств: підхід, що базується на управлінні ризиком та багатокритеріальних методах управління. Менеджмент ризиків в аграрній сфері представлено як невід’ємну складову частину загальної стратегії управління діяльністю сільськогосподарського підприємства. Огляд відомих багатокритеріальних методів прийняття рішень показує їх можливість застосування для задачі управління аграрним підприємством. Враховуючи труднощі, які виникають за необхідності внесення коректив та змін у процесі впровадження стратегії, доцільно використовувати для відбору альтернатив кілька методів, які зосереджені на прийнятті рішень в умовах невизначеності. Сформовано вимоги, яких слід дотримуватися при розробці відповідних методів. Особливу увагу слід приділити теорії МАУТ, яка поєднує переваги ризик-менеджменту та багатокритеріального прийняття рішень, а також має позитивні приклади впровадження в аграрній сфері.

Ключові слова: сільське господарство; прийняття рішень; екологія

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