Risk-orientated management in the sustainable economic system of united agricultural enterprises

by ***Natalia Trusova****, ***Natalia Zakharova****, ***Andrii Lysenko****, ***Inna Kohut******

Abstract

The relevance of the research is due to the need to modernization of the risk management process of agricultural enterprises and their associations. In this regard, this article is aimed to develop areas for implementation of risk-oriented management of united agricultural enterprises in order carrying out a comprehensive diagnosis of economic risks in the economic system of entities and timely identification of threats to sustainable economic development under uncertainty of macro-, and microenvironment. The study based on methods of analysis and synthesis. As well as modeling method and statistical methods applies in article. The article presents the results of the development situational matrix of risk-oriented management of the economic system according to the probability of decision-making options in economic activity was proposed. In the course of the research, were considered the risk-oriented management in the economic system of united agricultural enterprises for sustainable development. In adittion, model of qualitative and quantitative analysis of economic risks in the economic system of the united enterprises of agricultural production is presented. The practical significance is based on finding the forecast risk factors of change of effective indicators of economic activity in the economic system of the united enterprises of agricultural production and developing the priority administrative initiatives on minimization of economic risks.

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1. Introduction

The sustainable development of the agricultural sector of the national economy is determined by the institutional and economic ability of enterprises and their associations to acquire maintain and expand their share of agricultural markets, mainly through the levers of market influence.

Risks ensure the extinction of outdated forms and methods of management, but, at the same time, destroy the viability of the economic system of economic entities, which is not ready to counteract the destabilizing factors of macro- and microenvironment of their functioning (Hrynko et al., 2021; Ginters et al., 2013; Kuzmin and Kulyniak, 2011; Shalbolova et al., 2014; Tlessova et al., 2016). The risk is especially significant for associations of agricultural enterprises, as the impact of cyclical macroeconomic fluctuations leads to a crisis of microeconomic genesis of medium and small agricultural businesses. Accordingly, the combined influence of macro and micro-environmental factors exacerbates the destructive nature of agricultural production, which requires risk-oriented management in the economic system of associations of enterprises (Jankelova et al., 2017; Janowicz-Lomott and Lyskawa, 2014; Gumentyk et al., 2020; Johnson et al., 2017; Proskurnina et al., 2021; Kiseleva, 2007; Schweizer, 2021; Khodadadyan A. et al., 2021).

Modernization of the risk management process of agricultural enterprises and their associations is a top priority of top management, which takes into account the effective counteraction to the risks of domestic and international competition, as well as the risks of the global integration system, which has an uncertain threat environment (Knight, 1921; Kovalenko, 2013; Koshkinbaeva et al., 2019; Kuzmin et al., 2015; Levchenko, 2010; Lipińska, 2016; Lorant A. and Farkas, 2015; Komarek et al., 2020; Bao et al., 2021; Shvets et al., 2013; Pohoretskyi et al., 2020). Unfortunately, this trend cannot be accurately predicted and reliably assessed even with a significant array of indicators and tools for diagnosing sustainable economic development.

The specific of agricultural production carries an additional source of uncertainty – weather conditions (Ross, 2021; Rubtsova et al., 2021; Saienko, 2006; Komarek et al., 2020). This makes the agricultural sector of the economy a riskier area than other sectors of the economy. At the same time, additional risks of indirect action, which level the sustainability of agricultural production, both at the state level and at the local level do not protect the economic interests of united enterprises and require revision of the functions and principles of risk management (Sivash, 2019; Ryskaliyev et al., 2019; Tastulekova et al., 2018). Therefore, the application of this practice, if there is a proper theoretical and methodological basis, adapted to the realities of economic activity, can have a double benefit for both integrated enterprises and their stakeholders – both in terms of risk management in their economic system and in their resource system potential, forming a sufficient amount of resource provision, the level of profitability and economic growth (Kostiukevych et al., 2020; Tytarchuk et al., 2020; Vodovozov et al., 2021).

Considerable attention has been paid to the study of the theoretical foundations of risk management, where the category of "risk" is studied mostly at the macroeconomic level F. Knight (1921), I. Lipińska (2016), O. Renn (2021). Research by V. Nitsenko et al. (2016) is devoted to the study of principles and mechanisms of risk management in the agro-food sphere (Sedikova and Savenko, 2012; Sedikova and Savenko, 2014; The government has…, 2021; Trusova et al., 2021, Utkin and Frolov, 2003; Vereshchaha et al, 2019; Vitlinskyi et al, 1996, Vitlinskyi and Verchenko, 2000). The priority of our study is to develop areas for implementation of risk-oriented management of united agricultural enterprises in order carrying out a comprehensive diagnosis of economic risks in the economic system of entities and timely identification of threats to sustainable economic development under uncertainty of macro-, and microenvironment.

2. Materials and Methods

Any management activity in one way or another has a risky nature, due to both the multifactorial dynamics of the object of management and its external environment, and the role of the human factor in the process of influence. The method of risk-oriented management in the economic system of united enterprises, focused on choosing the optimal ratio of business activity, profitability. This method based on risk analysis is a significant part of the content of the process of making and implementing business

decisions. The model of risk-oriented management of economic activity in the economic system of united enterprises involves the implementation of the following stages (Fig. 1).

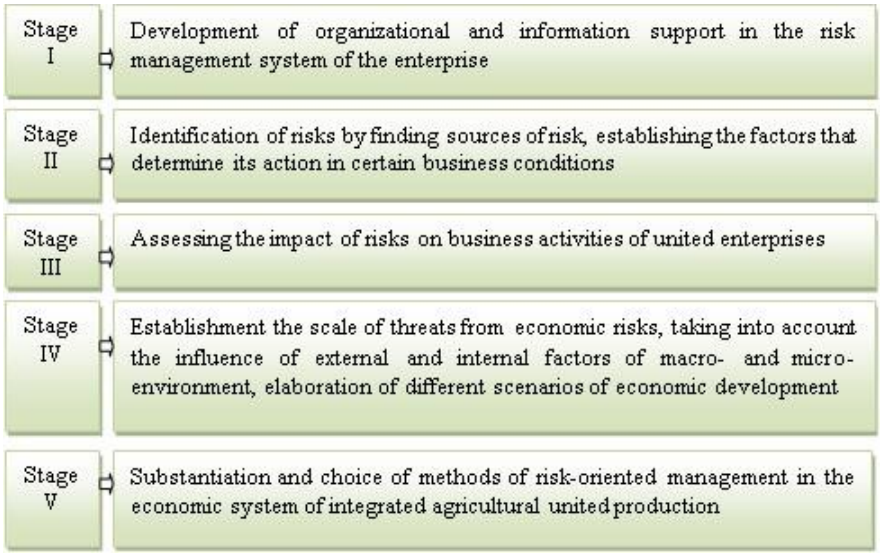


Figure 1. Stages of the model of risk-oriented management in the economic system of united agricultural enterprises

Note that the method of analysis of the impact of environmental risk factors in the economic system of united agricultural enterprises distinguishes two groups.

Group I. Qualitative methods of economic risk analysis, which modify the algorithm of influence of risk factors on the formation of marginal and safe margin of profitability of economic relations under objectively existing uncertainties and conflicts, immanent management processes, decision-making, assessment, burdened with possible threats and untapped production opportunities in the event of potential threats to management in the agricultural market segment (Matviichuk, 2005; Lutsenko et al., 2019; Shalbolova et al., 2012). To counteract their negative impact on the resource potential and economic opportunities of united agricultural enterprises the stages of their identification by the following groups are provided (Fig. 2). The results of the qualitative analysis of economic risks in the economic system of the united economic entities are the initial information and analytical support for the quantitative analysis of risks.

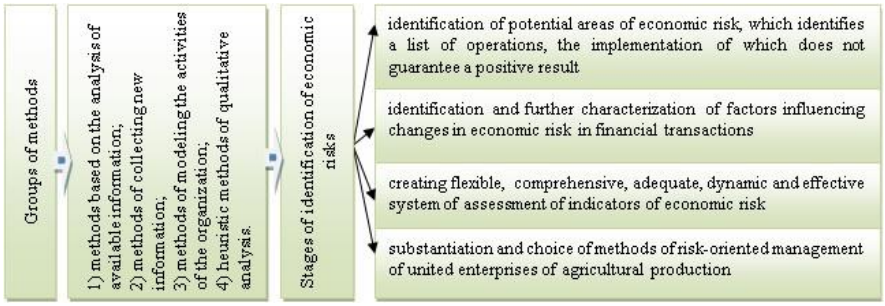


Figure 2. Model of qualitative analysis of economic risks in the economic system of united agricultural enterprises

Group II. Quantitative methods of economic risk analysis under conditions of uncertainty of factors influencing the formation of marginal and safe margins of profitability of economic relations (Levchenko, 2010; Manzhula et al., 2019; Aizstrauta and Ginters, 2013), allow to determine the size of individual risk factors in the resource potential of united agricultural enterprises to overcome uncertainty and conflict in the situation of inevitable choice of the expected result and deviations from the goals, taking into account the influence of controlled and uncontrolled factors. In addition, this group of methods allow to develop a project to minimize them under conditions of uncertainty of the macro-, and microenvironment to stabilize economic development (Table 1).

Table 1. Model of quantitative analysis of economic risk factors in the economic system of united agricultural enterprises

Methods	Characteristics
Statistical	Quantitative assessment of economic risk factors in the economic system of united agricultural enterprises using the methods of mathematical statistics.
Method of analogies	The use of parametric data in projects to minimize economic risks, which were performed in the face of threats to the macro-, and microenvironment of the functioning of the united enterprises of agricultural production.
Sensitivity analysis	Identification of the sensitivity of the estimated indicators of the project of minimization of economic risks in the economic system of the united enterprises of agricultural production when changing the values of input resources. It provides an isolated change in the values of individual risk factors and the determination of a new final financial result from the project to minimize economic risks when changing each risk factor.
Scenario analysis	Substantiation of numerous variants of realization of the project of minimization of economic risks in the economic system of the united enterprises of agricultural production on the basis of information and communication technologies.
Normative method	It is based on the use of a system of coefficients that compare with the limits (parameters) of the estimated risk factors of economic activity of the united enterprises of agricultural production.
Method of expert	Economic risk assessment is performed on the basis of subjective opinions of

assessments	experts in the field of agricultural production.
The method of financial stability	Determining the effective management of financial resources and opportunities to increase the stability of the economic system of united agricultural enterprises in the future.
The method of building a decision tree	Variability of the simulation of the decision tree on the rational risk-oriented management of the economic system of united agricultural enterprises with possible consequences.
Calculation and analytical	Use of traditional indicators for assessing the effectiveness of the implementation of projects to minimize economic risks in the economic system of united agricultural enterprises; comparison of indicators of alternative projects to minimize economic risk factors and the degree of their impact on the economic system of united agricultural enterprises.
Monte Carlo method	Generating a large number of random variables in the implementation of the project to minimize economic risks in the economic system of united agricultural enterprises; formation and distribution of possible results of profitability of economic activity, determination of an estimation scale according to the chosen level of probability of occurrence of a case of threat to economic system of the united enterprises of agricultural production.
Rating method	Implementation of the choice of coefficients with a minimum amount of parametric data generated in accordance with the specific purpose of the analysis and management of economic risks; ranking of the obtained result on a scale.

When choosing methods of risk-oriented management of economic activity, it is necessary to use an adaptive approach to the diagnosis of economic risks in the economic system of united agricultural enterprises (Fig. 3).

Figure 3. Tools of risk-oriented management in the economic system of united agricultural enterprises

Among the main types of insurance of agricultural risks are: insurance of risk of death and (or) damage to crops; insurance against the risk of future crop loss; insurance of the risk of death and (or) damage of perennial plantations and (or) non-receipt or non-receipt

of harvest of perennial fruit crops; insurance against the risk of costs united with the death or forced slaughter of livestock; insurance against the risk of costs united with damage or loss of agricultural machinery (Rubtsova et al., 2021; Patyka et al., 2021).

Risk-oriented management of economic activity in the economic system of agricultural enterprises has a dynamic process and meets certain criteria and requirements of the agricultural market for dynamic and flexible decision-making to neutralize risks (Table 2).

Table 2. Criteria for neutralization of economic risks in the economic system of united agricultural enterprises

Criteria	Priority of method selection
Efficiency	Obtaining a high effect in the process of neutralization of risks with minimal expenditure of resources in conducting financial and economic operations in order to form a safe value of the economic system of united agricultural enterprises
Effectiveness	Assessing the impact of threats and dangers on the sustainability of economic development of united agricultural enterprises.
Consistency	Ensure a "risk-return" ratio that meets the limits set by the parameters of the united enterprises of agricultural production
Conformity	The method of neutralization of risks of economic system corresponding to volume of the formed resource potential of the united enterprises of agricultural production is chosen
Accessibility	The method of neutralizing the risks of the economic system is chosen, which is based on the use of available information and the mechanism of action of which is available for the implementation of risk management in the united enterprises of agricultural production
Complexity	The method of neutralizing the risks of the economic system is chosen, which allows to obtain a comprehensive result that contains risk identifiers in order to identify uncertainties and threats to the sustainable economic development of united agricultural enterprises.
Adaptability	The choice of the priority method of neutralizing the risks of the economic system, which allows to take into account the influence of the most important factors of the external environment of the united enterprises of agricultural production on the efficiency of their economic activity.

The method of risk-oriented management in conditions of uncertainty involves the formation of a situational matrix that allows making informed decisions about economic risk management in the economic system of enterprises (Sivash et al., 2019; Ginters et al., 2014) (Table 3).

Table 3. Situational matrix of risk-oriented management of the economic system of united agricultural enterprises by the probability of decision-making options

Options for	Options for the development of the situation

decision-making	C_1	C_2	…	C_n
P_1	E_{11}	E_{12}	…	E_{1n}
P_2	E_{21}	E_{22}	…	E_{2n}
…			…	
P_n	E_{n1}	E_{n2}	…	E_{nn}

Note: P_1, P_2, …, P_n – possible options for decision-making; C_1, C_2, …, C_n – possible options for the development of the situation; E_{11}, E_{12}, E_{1n}, E_{21}, E_{22}, E_{2n}, E_{n1}, E_{n2}, E_{nn} – the level of efficiency that corresponds to a certain solution in a certain development of the situation.

The given situational matrix is reduced to definition of an efficiency indicator.

Most operations are characterized by a normal probability distribution (Gaussian distribution). The "universality" of a normal law is explained by the fact that any random variable that is the sum of a large number of individual numerical values, each of which obeys different distribution laws and has a negligible effect on the amount is distributed almost according to the normal law. However, in the practice of risk assessment Laplace distribution, Student distribution and triangular distribution can be used. In the case where the solution is an alternative, i.e. only two consequences of its implementation are possible the risk indicators are calculated according to the following dependence (Willett, 1951; Aizstrauts et al., 2015):

$$R = X_i \times P_i, \quad (1)$$

where, X_i – the amount of losses in case of a negative consequence of the decision; P_i – the probability of a negative consequence.

If the solutions have several (many) consequences of implementation, we use the indicators of the mathematical expectation of the discretionary quantity $M(x)$ and variance σ. The mathematical expectation of a discretionary quantity $M(x)$ is the sum of the products of possible variants of this quantity on their probability (Blank, 2006):

$$M(x) = \sum_{i=1}^{n} X_i \times P_i. \quad (2)$$

Moreover, the main condition for the use of a discretionary quantity $M(x)$ s the probability of a negative consequence P_i, which is calculated by formula (3) (Blank, 2006):

$$\sum_{i=1}^{n} P_i = 1 \quad (3)$$

The mathematical expectation for a continuous quantity $M(\overline{x})$ is calculated by formula (4) (Blank, 2006):

$$M(\overline{x}) = \int_{-\infty}^{+\infty} f(x)dx. \quad (4)$$

The variance characterizes the degree of variability of real data of some random variable around a mathematical expectation. The index is defined as the mathematical expectation of the squares of the deviations of individual values of a random variable from its mathematical expectation formula (5) (Blank, 2006):

$$\sigma^2 = M(x - M(x))^2 \quad (5)$$

For the dispersion value, formula (5) has the form formula (6) (Blank, 2006):

$$\sigma^2 = \sum_{i=1}^{n}(x_i - M(x))^2 \times P_i \quad (6)$$

For a continuous quantity, it is converted into a quantity $\overline{\sigma}^2$ by formula (7) (Blank, 2006):

$$\overline{\sigma^2} = \int_{-\infty}^{+\infty} M(x - M(x))^2 f(x)dx, \quad (7)$$

The standard deviation is calculated by formulas (8)-(9) (Blank, 2006):

$$\sigma = \sqrt{M(x - \overline{M(x)})^2}, \quad (8)$$

$$\sigma = \sqrt{\sum_{i=1}^{n}(x_i - \overline{M(x)})^2 \cdot p_i}. \quad (9)$$

For a deeper interval assessment of the risky project of minimization of economic risks, curves of density distribution of probability of accidental losses are constructed; defining risk zones (Fig. 2). The intersection of the function $f(x_1)$ and the magnitude of the loss in the event of a negative consequence (x_1) (intersection 1) – characterizes the most probable losses on the project of minimizing economic risks and the expected or average return of this project. The intersection of the function $f(x_{add})$ and the magnitude of the loss in the event of a negative consequence (x_{add}) (intersection 2) – corresponds to the allowable point of economic risk at which losses will have a value equal to the total amount of profit from the project (the point is the upper limit of the zone of permissible level of economic risks).

The probability of an acceptable level of economic risks ($f(x_{add})$ is determined by dependence (10), (Utkin et al., 2003):

$$f(x_{add}) = \int_0^{x_{add}} f(x)dx \quad (10)$$

The zone of acceptable level of economic risks is the area within which the activity of united agricultural enterprises its economic feasibility, i.e., accidental losses do not exceed the expected risk from the project to minimize their value.

The intersection of the function $f(x_{kr})$ and the amount of damage in the event of a negative consequence (x_{kr}), (intersection 3) – characterizes the degree of maximum allowable critical level of economic risks (i.e., risks of financial losses equal to the estimated income from the project to minimize economic risks).

The area of the critical limit of economic risks is understood as the area of accidental losses, the size of which exceeds the value of the expected business loss and reaches the value of estimated income.

The intersection of the function $f(x_{dis})$ and the magnitude of the loss in the event of a negative consequence (x_{dis}), (intersection 4) – characterizes the degree of marginal catastrophic level of economic risks (i.e., risks of financial losses equal to the total property of united agricultural production).

The probability of a catastrophic level of economic risks $f(x_{dis})$ is determined using the integral formula (11) (Utkin et al., 2003):

$$f(x_{dis}) = \int_{x_{kr}}^{x_{dis}} f(x)dx \quad (11)$$

Most often, when making management decisions, agricultural producers are interested not so much in the probability of a certain level of financial losses, but in the probability that these losses will not exceed a certain level. For this purpose, the distribution function of the probabilities of exceeding a certain level of random losses ($W(x)$) is determined by formula (12), (Utkin et al., 2003):

$$W(x) = 1 - f(x) \quad (12)$$

This function corresponds to the scale of density distribution of the probability of exceeding the level of accidental losses in certain areas of economic risk in the economic system of united agricultural enterprises (Table 4).

Table 4. Zones of economic risks in the economic system of united agricultural enterprises

Risk areas	Criteria
Risk-free zone	No losses are expected
Permissible risk area	Possible losses in the amount of a certain amount of profit
Critical risk zone	Losses can reach the amount of income per transaction

Catastrophic risk zone	The losses amount to most of the equity of the integrated entity invested in the transaction

The hypothesis is accepted that the probability of financial losses greater than 0 is equal to 1. As the level of losses increases, the probability of economic sustainability of associations of agricultural enterprises decreases dynamically. With a limited increase in the level of financial losses, the probability of growth of economic development of enterprises goes to 0.

3. Results and Discussion

The process of risk-oriented management of economic activity covers all stages of distribution, exchange and use of resources and is a complex form of economic cycle. The material, value and monetary forms of the produced product of the agricultural sphere are closely interconnected and pass from one to another (Dunayev et al., 2019). At the same time, the growth rate of production, improvement of its structure, as well as the overall speed of reproduction turnover are the conditions of management strategy under the influence of a set of regulatory risk factors (Ginters and Aizstrauta, 2018; Martynova, 2014; Tastulekov et al., 2019). The latter does not lose its relevance, because in the current European integration conditions of sustainable economic development of the agricultural sector of Ukraine's economy, the main task is risk-oriented management of agricultural production and its adaptation to dynamic market changes (Rusnak et al., 2020). Only under this condition, we can count on a stable process of economic activity of united agricultural enterprises and their associations, based on quantitative and qualitative analysis of the resource component of the economic system as a whole.

Economic risk is due to the indeterminacy of the result of the management decision (i.e., the smaller the variance of the result of the management decision is, the more predictable it is, the lower the risk is), (Kiseleva, 2007; Shartava et al., 2019).

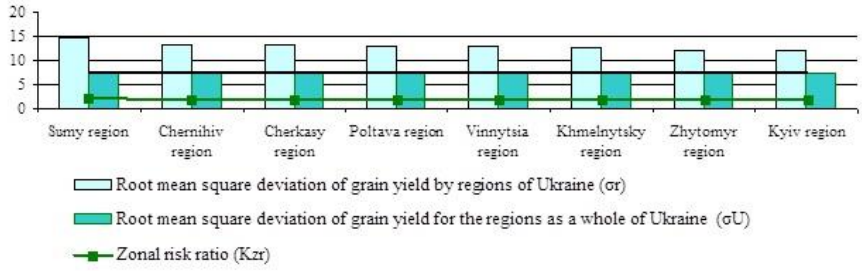
Therefore, according to the assessment of economic risk regarding fluctuations in grain yield, the calculation of variance and standard deviation is carried out according to formulas (7)-(8) (Blank, 2006). In this case, x_i – the specific value of grain yield in quintals per hectare of sown area, $\overline{M(x)}$ the average expected grain yield, p_i – the frequency of obtaining individual yield options, n – number of observations. According to the calculation of the standard deviation of grain yields in Ukraine as a whole for the

period 2005-2020 is equal to 6.708. Similarly, the standard deviation of grain yields by regions of Ukraine is calculated. For this purpose, an indicator of zonal risk of grain yield fluctuations (K_{zr}), is proposed, which is defined as the ratio of the standard deviation of grain yields by region and in Ukraine as a whole formula (13), (Kiseleva, 2007):

$$K_{zr} = \sigma_r / \sigma_U, \tag{13}$$

where, σ_r – standard deviation of grain yield by regions of Ukraine; σ_U– standard deviation of grain yield in Ukraine as a whole.

Thus, according to the regional level of fluctuations in grain yields in Ukraine, the territories are divided into three risk zones: high-risk zone ($K_{zr} \geq 1.65$), medium-risk zone ($0.9 \leq K_{zr} \leq 1.65$) and low-risk zone ($K_{zr} \leq 0.9$). The results of the calculation K_{zr} for the period 2005-2020 are shown in Fig. 4. Each zone includes regions of Ukraine in which the value K_{zr} is within the above interval level. Thus, in the high-risk zone the greatest value K_{zr} is in Sumy region (2.010), the least value is in the Transcarpathian region (0.614).



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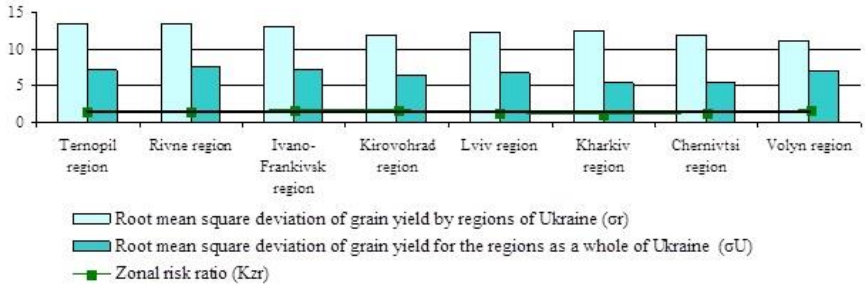

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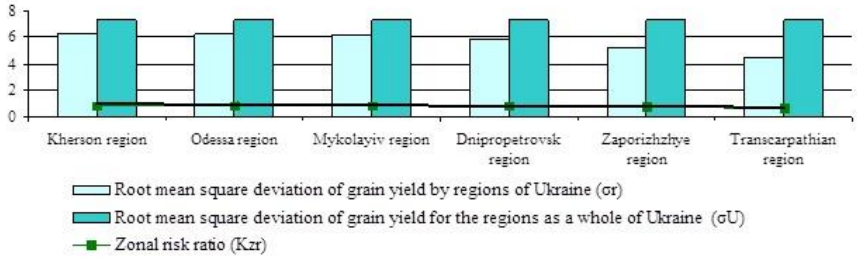

c

Figure 4. Regions of Ukraine in the zone of risk of agricultural production for 2005-2020

Note: a) high risk; b) medium risk; c) low risk.

Therefore, as an indicator of internal risk of economic activity, the calculation of the standard deviation of net profit of united agricultural enterprises in the agro-climatic zones of the Steppe, Forest-Steppe and Polissya is carried out. Deviation for the period 2005-2020 averages 58.96 million EUR, 33.87 million EUR and 15.58 million EUR respectively. In this case, the coefficient of variation, which determines the level of risk of reduced profitability for the united enterprises of agricultural production in the studied agro-climatic zones is 0.345, 0.502 та (-1.867) respectively.

Analysis of the dynamics of indicators of return on equity and return on sales of integrated enterprises of agricultural production and their standard deviation for 2005-2020 in terms of agro-climatic zones of Ukraine showed that in the Steppe zone they are 12.95% and 2.85%, in the Forest-Steppe zone – 3.37% and 3.65%, in Polissya zone – (-59.4%) and 8.5% respectively.

In the system of comprehensive assessment of economic risks in the economic system of integrated agricultural enterprises, taking into account the peculiarities of zonal distribution by climatic conditions, an important place is occupied by the assessment of the risk of loss of solvency (Harust et al., 2019). Thus, according to the integrated rating assessment of the risk of loss of solvency for the integrated enterprises of the agro-climatic zone of the Steppe for the period 2005-2020, this indicator is equal to 95.3, Forest-Steppe – 112.1, Polissya – 92.8.

The generalized characteristic of indicators of complex assessment of economic risks of the integrated enterprises of agricultural production in agro-climatic zones of Ukraine is presented in Table 5.

Thus, the negative impact on the economic sustainability of united of agricultural enterprises of Ukraine, the general increase in the level of economic risks of their activities are caused by factors of political, social and economic instability (Dunayev et al., 2020). These factors are reflected in Ukraine's low credit rating and, consequently, in increased country risk in general. At the same time, natural and climatic factors are poorly predictable, the relative measurement of which can be obtained based on calculating the standard deviation.

Table 5. Characteristics of indicators of comprehensive assessment of economic risks in the economic system of united agricultural enterprises by agro-climatic zones of Ukraine

Indicator	The value (characteristic) of the indicator	Interpretation of the indicator value
Indicators of a comprehensive assessment of economic risks of the economic system in conditions of uncertainty of the macro-environment of united agricultural enterprises		
Economic risk of the country	High	Characterizes a negative outlook for long-term economic development
Indicator of zonal risk of grain yield fluctuations	0.860	Characterizes the affiliation of the regions
Indicators of a comprehensive assessment of economic risks of the economic system in conditions of uncertainty of the micro-environment of united agricultural enterprises		
Risk of loss of solvency of united enterprises of agricultural production	95.3 112.1 92.8	Very low Low Very low
The average ratio of receivables and payables in the united enterprises of agricultural production	0.688 0.95 2.546	An acceptable ratio An acceptable ratio Unsatisfactory ratio
Risk of reduced profitability in the united enterprises	0.345 0.502 -1.867	Low risk Average level of risk High level of risk
Risk of reducing the return on equity of united enterprises	0.3027 0.5341 -1.5641	Low risk Average level of risk High level of risk
Risk of reduction of profitability of sales of the integrated enterprises	0.3865 0.606 -1.7576	Low risk Average level of risk High level of risk

The assessment of economic risks associated with the impact of the microenvironment of the united enterprises of agricultural production is determined by the design discipline of contractors, suppliers and consumers of products. The status and dynamics of receivables and payables of economic entities are important indicators. The basic indicators that characterize the impact of a significant number of external and

internal risk factors are indicators of net profit and profitability. Their comprehensive assessment is a prerequisite for forming a mechanism for choosing a strategy of risk-oriented management of economic activity to improve the viability of united agricultural enterprises (Bissenov et al., 2014; Ginters et al., 2010).

Taking into account the economic cycles of the resource cycle in agricultural production, due to innovations in production technology through the acceleration of the financial cycle at the stages of reproduction of resources, requires from the integrated economic entities a formative base that ensures food security at the level of 9% of GDP and 6% of tax revenues. In 2020, the share of agricultural products and food in the total volume of Ukrainian exports is 45% or 67.2 billion EUR, imports – 19.7 billion EUR, foreign trade balance – 47.5 billion EUR. During 2005-2020, the volume of real GDP of Ukraine increased by 36.8%, including due to agricultural industries – in 5.2 times (Fig. 5).

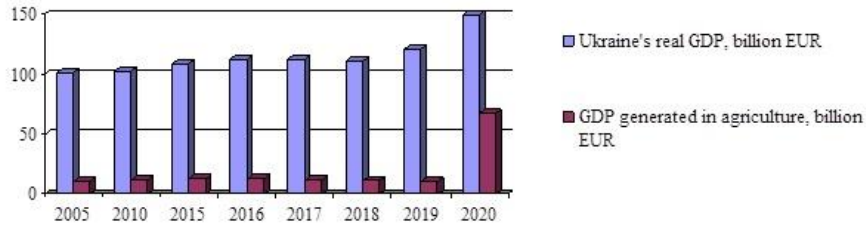

Figure 5. Dynamics of real GDP of Ukraine and its share in agricultural production for 2005-2020, billion EUR

It should be noted that the agricultural sector has faced a lack of financial resources. An important source of funding for farmers is effective state support. In 2021, the amount of state support for the sustainable development of agricultural production in Ukraine is equal to 136 billion EUR, including the total amount of financial support for the support of united enterprises of agricultural production is 121 billion EUR. In addition, new budget funding programs in the amount of 15 billion EUR are provided for state support of agricultural insurance (compensation for crop losses, support for the sustainable development of organic production, potato development and irrigation restoration) (Zakharova and Mazurova, 2020).

Among other measures of financial support of agricultural production by reducing the cost of loans in 2020 34 million EUR of public funds were used. The total amount of

loans attracted by the united enterprises of agricultural production amounted to more than 4.7 billion EUR, of which – 0.81 billion EUR were compensated at the expense of budget funds, including short-term loans – 0.38 billion EUR (46.7%), medium-term loans – 0.2 billion EUR (24.7%), long-term loans – 0.23 billion EUR (28.6 %). The use of credit resources by the type of activity of integrated economic entities in the field of animal husbandry amounted to 0.17 billion EUR (18%). Provision of credit resources to other industries is 0.64 billion EUR (82%). It should be noted that in Ukraine the state support of agricultural industries is only 2% of the country's GDP, while in France it is 24%, in Germany – 22%, in Poland – 40% (The government has restored…, 2021).

According to the established function of economic risks in the economic system of united agricultural enterprises of Ukraine and the proposed method (Trusova et al., 2021) the authors determined the forecast dependence of this function on economic indicators for the period 2021-2027. After the analysis and unification of economic risks in the macro- and micro-environment of the integrated economic entities of agricultural production, the calculated equations of indicators were determined. These indicators best describe the parametric data of economic development (the sum of squares of deviations of calculated data from statistical is the smallest than by the method of least squares) (Table 6).

Table 6. Unification of economic risks in the conditions of uncertainty of macro-, and microenvironment of the united enterprises of agricultural production of Ukraine (dependence of the function of economic risks on economic indicators)

Indicators	Type of formula
Level of profitability of economic activity, %	$y = e^{2.13+0.053x}$ – growing
Aggregate index of costs of agricultural production	$y = e^{4.83915-0.009407x}$ – falls
Indices of agricultural products	$y = e^{4.65105-0.0027x}$ – falls
Price indices of agricultural products sold by united enterprises	$y = e^{4.74698-0.00166x}$ – falls
Credit rate	$y = e^{3.0764-0.01565x}$ – falls
The level of insurance payments	$y = e^{2.9679+0.013193x}$ – growing
The ratio of cash. current financial investments and receivables to current liabilities, %	$y = e^{4.4525+0.0056368x}$ – growing
Exchange rate index of EUR	$y = e^{4.6843+0.002266x}$ – growing

Having analytical dependences on each of indicators for 2005-2020 we receive settlement parametric data for 2021-2027 (Table 7).

Table 7. Forecast risk factors for changes of the indicators of activation of the economic system of united agricultural enterprises

Indicators	2021	2022	2023	2024	2025	2026	2027
Level of activity, %	20.7179	21.8456	23.0347	24.2884	25.6104	27.0044	28.4742
Agricultural production	107.687	106.679	10.680	104.690	103.710	102.739	101.777
Indices of products	99.9980	99.7284	99.4594	99.1913	98.9238	98.6571	98.3911
Price indices	112.029	111.843	111.657	111.472	111.287	111.103	110.919
Credit rate	16.61	16.35	16.10	15.85	15.60	15.36	15.12
The level of insurance payments	24.34	24.66	24.99	25.32	25.66	26.00	26.35
The ratio of receivables to current liabilities	0.9447	0.9501	0.9555	0.9609	0.9663	0.9717	0.9772
Exchange rate index of EUR	112.49	112.74	113.00	113.25	113.51	113.77	114.03

Visually, the trend of changing the level of profitability of economic activity of united enterprises of agricultural production of Ukraine is presented in Fig. 6.

Assuming the level of profitability of economic activity as a function, and all other indicators as arguments, the authors used the standard Gaussian method (Vereshchaha et al, 2019) (system 7 of unknown from 7 equations) we obtain the function of economic risk for this model. The risk function R (profitability of economic activity of integrated enterprises of agricultural production) (2021-2027) has the form:

$$R = 17{,}11y_1 - 130{,}344y_2 + 97{,}085y_3 - 1{,}825y_4 - 4{,}978y_5 + 3{,}999y_6 + 0{,}975y_7 \quad (14)$$

The same calculations for the economic risk function were obtained for 2007-2013:

$$R = -0{,}187y_1 + 0{,}73y_2 + 0{,}317y_3 - 1{,}305y_4 + 0{,}806y_5 - 0{,}723y_6 - 0{,}055y_7 \quad (15)$$

for 2014-2020:

$$R = 1{,}624y_1 - 0{,}543y_2 - 1{,}398y_3 + 3{,}534y_4 + 0{,}128y_5 - 0{,}809y_6 + 0{,}424y_7, \quad (16)$$

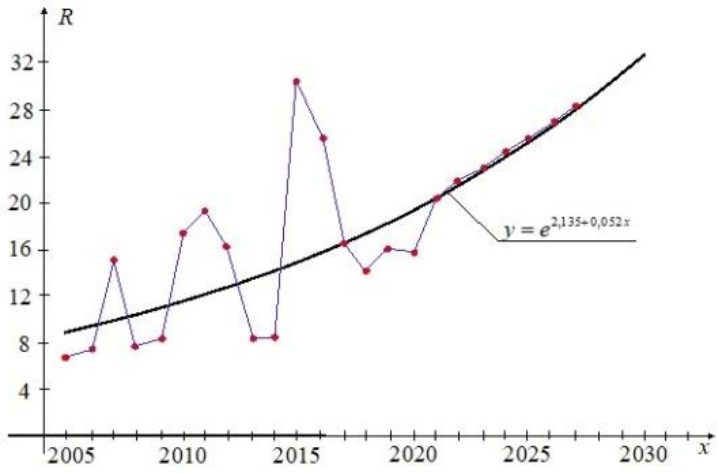

Figure 6. Forecast level of profitability of economic activity of united enterprises of agricultural production of Ukraine

In this case, it is important to assess the function of economic risk, carried out according to formula (17):

$$p = 1 - \frac{|R - R_{theoretical}|}{R}, \quad (17)$$

where, p – the probability of risk of loss of profitability of economic activity; R – the level of profitability of economic activity; R – the level of profitability of economic activity; $R_{theoretical}$ – the level of profitability of economic activity.

The calculations confirm that the probability of occurrence of the event scenario is more than 0.99 (Fig. 7).

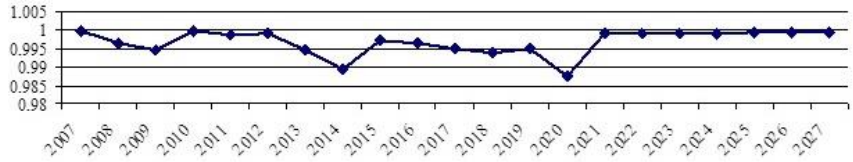

Figure 7. Probability of risk of loss of profitability of economic activity by the united enterprises of agricultural production of Ukraine for 2007-2027

Protection against economic risks of integrated agricultural enterprises arising at the macroeconomic level is proposed to be carried out according to the appropriate matrix of indicative management initiatives (Fig. 8), which should comply with clear regulations and provide:

1. Collection of information:

1.1. Formation of functional working groups;

1.2. Involvement of experts in working groups;

1.3. Analysis of the current sustainability of agricultural development.

2. Feedback from the expert environment:

2.1. Formation of the list of representatives of sectors and experts;

2.2. Validation of previous hypotheses;

2.3. Collection of initiatives, their justification and selection.

3. Discussion of initiatives with government officials:

3.1. Holding meetings with stakeholders;

3.2. Adjustment of initiatives with government officials;

3.3. Finalization of initiatives based on the received feedback.

Among the risk-oriented management initiatives, it is necessary to introduce the following areas:

1. Availability of domestic and international markets to stimulate economic activity of integrated agricultural enterprises through state financial support and expanding opportunities to enter foreign markets:

1.1. Implementation of measures for the organization and functioning of the Export Credit Agency;

1.2. Risk reduction of Ukraine within the OECD (Country Risk Experts Group);

1.3. Deepening trade liberalization in the framework of the Association Agreement between Ukraine and the EU, between Ukraine and Euratom. Creating conditions for further economic integration into the EU market;

1.4. Stimulating remote marketing of agricultural products by supporting online projects.

2. Infrastructure support. Creating a strong digital, educational, consulting and physical infrastructure to support the activities of agricultural enterprises:

2.1. Creating a remote platform for access to innovative and digital technologies;

2.2. Support for the development of innovation ecosystems and inclusive access to licensing rights;

2.3. Reduction of the scope of quarantine certificates;

2.4. Development of a mobile version of a single agro-industrial portal;

2.5. Creation of agricultural centers of logistics and services.

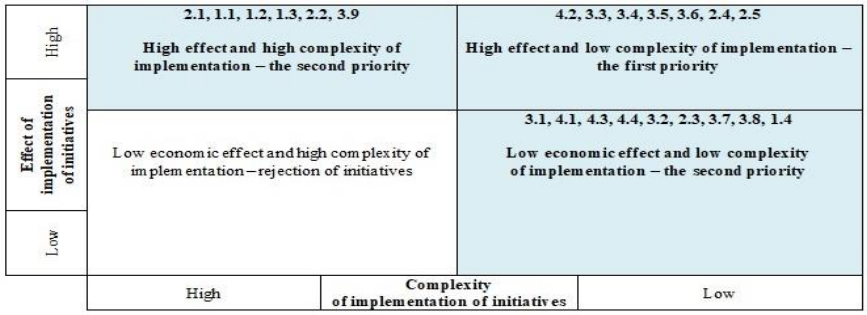

Figure 8. Matrix of priority management initiatives to minimize economic risks in the economic system of united agricultural enterprises

3. Normative regulation. Improving the regulatory framework, which is the basis for the activities of integrated enterprises of agricultural production, including reducing the tax burden:

3.1. Simplification of obtaining administrative services for integrated enterprises of agricultural production;

3.2. Application of non-financial measures of state support of investment activity;

3.3. Formation of the list of priority investment projects for the state for 2021-2023 with definition of the mechanism of their realization;

3.4. Cancellation of obsolete administrative documents;

3.5. Optimization of tax administration and statistical reporting; 3.6. Abolition of reporting on the payment of taxes that can be calculated according to the registers;

3.6. Development of a unified economically sound assessment of agricultural land;

3.7. Ensuring the possibility of attracting the production area of small integrated forms of agricultural production of seasonal employees;

3.8. Promoting the creation of conditions for the development of organic production.

4. Expanding funding opportunities. Simplification of access to finance by guaranteeing available loans and launching grant programs, expanding government support, creating a favorable investment environment to increase investment in the industry:

4.1. Development of factoring as an alternative to lending;

4.2. Expansion of lending goals of the program “Available loans 5-7-9”;

4.3. Expanding access to information on the possibility of providing loan guarantees to local budgets;

4.4. Provision of financial support, including in the form of grants, to the Export Promotion Office to potential exporters.

4. Conclusions

Thus, the effectiveness of economic activity of united agricultural enterprises depends on the action of multifactorial economic risks of various modifications. The conditionality of their impact leads to the possibility of establishing parametric limits of growth of the level of profitability of economic activity in the future. The prevailing economic preconditions for the functioning of agrarians allowed us to state that the aggregate index of agricultural production costs, the index of agricultural products, the price index of agricultural products and the credit rate have a declining trend. At the same time, a growing trend is observed in the level of insurance payments, the quick liquidity ratio and the index of change in the euro exchange rate. We propose to protect against risks arising at the national level according to the matrix of indicative assessment and complexity of implementation of initiatives in risk-oriented economic risk management of united agricultural enterprises, which records selected initiatives developed under clearly defined regulations.

In the cyclical fluctuations of economic development of agricultural production in Ukraine, there is an urgent need to use different methods of risk management, including agricultural insurance, hedging, diversification, and formation of internal reserves, limitation and more. Their use should be accompanied by processes of improving the regulatory framework, expanding state support, intensifying the flow of financial resources to the agricultural sector of the economy, the development of the insurance market by providing services to united agricultural enterprises.

References

Aizstrauta D., Ginters E. (2013), “Introducing integrated acceptance and sustainability assessment of technologies: A model based on system dynamics simulation”, *Lecture Notes in Business Information Processing*, 145, 23-30.

Aizstrauts A., Ginters E., Baltruks M., Gusev M. (2015), “Architecture for distributed simulation environment”, *Procedia Computer Science*, 43(C), 18-25.

Bao C., Wan J., Wu D., Li J. (2021), “Aggregating risk matrices under a normative framework”, *Journal of Risk Research*, 24(8), 999-1015.

Bissenov K.A., Uderbayev S.S., Shalbolova U.Z. (2014), “Environmental and economic efficiency of using insulated wood concrete in building based on agricultural and industrial wastes”, *Actual Problems of Economics*, 151(1), 304-311.

Blank I.O., Sytnyk H.V. (2006), *Enterprise financial management*, National University of Trade and Economics, Kyiv.

Dunayev I., Kuts Y., Stativka N., Ziuz O., Kralia V. (2020), “An analysis of the mechanisms for establishing cooperation between public authorities, the private sector, and the public in domestic waste management in Ukraine”, *Public Policy and Administration*, 19(2), 314-328.

Dunayev I., Latynin M., Ulyanchenko Y., Kosenko A. (2019), “Renewing an economic policy for a rising Ukrainian region: Smoothing discrete shifts and mastering new competencies”, *Regional Science Inquiry*, 11(3), 133-150.

Ginters E., Aizstrauta D. (2018), “Technologies sustainability modeling”, *Advances in Intelligent Systems and Computing*, 746, 659-668.

Ginters E., Aizstrauts A., Chinea, R.M.A. (2014), “Sociotechnical aspects of policy simulation”, in *Handbook of Research on Advanced ICT Integration for Governance and Policy Modeling* (pp. 113-128), IGI Global, Hershey.

Ginters E., Barkane Z., Vincent H. (2010), “System dynamics use for technologies assessment”, in *Proceedings of the 22th European Modeling and Simulation Symposium, EMSS 2010* (pp. 357-361), FES, Morocco.

Ginters E., Cirulis A., Blums G. (2013), “Markerless outdoor AR-RFID solution for logistics”, *Procedia Computer Science*, 25, 80-89.

Gumentyk M.Y., Chernysky V.V., Gumentyk V.M., Kharytonov M.M. (2020), “Technology for two switchgrass morphotypes growing in the conditions of Ukraine's forest Steppe zone”, *INMATEH - Agricultural Engineering*, 61(2), 71-76.

Harust Y., Zagorska D., Vashchenko S., Moskalenko S. (2019), “Problems of construction of the financial system of the state: Organizational and legal aspects”, *Asia Life Sciences*, (2), 213-231.

Hrynko P., Grinko A., Shtal T., Radchenko H., Pokolodna M. (2021), “Formation of an Innovative Business Model of a Trade Organization in the Context of Economic Globalization”, *Scientific Horizons*, 24(6), 92-98.

Jankelova N., Masar D., Moricova S. (2017), “Risk factors in the agriculture sector”, *Agricultural Economics*, 63(6), 247-258.

Janowicz-Lomott M., Lyskawa K. (2014), “The New Instruments of Risk Management in Agriculture in the European Union”, *Procedia Economics and Finance*, 9, 321-330.

Johnson A.M., Boehlje M.D., Gunderson M.A. (2017), "Agricultural credit risk and the macroeconomy: Determinants of Farm Credit Mid-America PD migrations", *Agricultural Finance Review*, 77(1), 164-180.

Khodadadyan A., Mythen G., Bishop B., Assa H. (2021), "Grasping the nettle? Considering the contemporary challenges of risk assessment", *Journal of Risk Research*, 24(12), 1605-1618.

Kiseleva I.A. (2007), *Modeling of risk situations*, MESI, Moscow.

Knight F.H. (1921), *Risk, Uncertainty and Profit*, University of Boston Press, Boston.

Komarek A. M., De Pinto A., Smith V. H. (2020), "A review of types of risks in agriculture: What we know and what we need to know", *Agricultural Systems*, 178, 102738.

Koshkinbaeva A.S., Shaigaliyev M.G., Buribayev Y.A., Khamzina Z.A., Khamzina S.S. (2019), "International legal regulation of environmental safety: In focus – Kazakhstan", *Rivista di Studi sulla Sostenibilita*, 1, 121-142.

Kostiukevych R., Mishchuk H., Zhidebekkyzy A., Nakonieczny J., Akimov O. (2020), "The impact of european integration processes on the investment potential and institutional maturity of rural communities", *Economics and Sociology*, 13(3), 46-63.

Kovalenko O.V. (2013), *Entrepreneurship and its organizational and legal principles*, Taras Shevchenko Lviv National University Publishing House, Kyiv.

Kuzmin O.Y., Kulyniak I.Y. (2011), "Polyparametric modeling for selecting measures on risks minimization in leasing", *Actual Problems of Economics*, 126(12), 280-288.

Kuzmin O.Ye., Feshchur R.V., Skybinskyi O.S., Drymalovska Kh.V. (2015), "Peculiarities of diversification of enterprises as a bureaucrat for the safety of innovation and technological development", *Business Inform*, 7, 194-201.

Levchenko M.O. (2010), "Methods for assessing the risks of foreign economic activity of a machine-building enterprise", *Bulletin of the Khmelnytsky National University*, 6(3), 190-194.

Lipińska I. (2016), "Crop and livestock insurance as risk management instruments in Polish agriculture compared to the EU regulations", *EU Agrarian Law*, 5(2), 13-19.

Lorant A., Farkas M. (2015), "Risk management in the agricultural sector with special attention to insurance", *Polish Journal of Management Studies*, 11(2), 71-82.

Lutsenko I., Dmytriiev I., Avanesova N., Semenyshyna I., Rozhnenko Z., Danileyko O. (2019), "A method to form control over queuing systems taking into consideration the probabilistic character of demand", *Eastern-European Journal of Enterprise Technologies*, 1(3-97), 28-36.

Manzhula A., Harust Y., Myrhorod-Karpova V., Sobol Y. (2019), "Search for ways to optimize the activities of state bodies managing the funds of international technical assistance", *Asia Life Sciences*, (2), 189-212.

Martynova L.V. (2014), "Development of tools for forming an adaptive risk management strategy for the economic activity of a grain processing enterprise based on game theory", *V. Dahl Bulletin of the East Ukrainian National University*, 8(215), 119-126.

Matviichuk A.V. (2005), *Analysis and management of economic risk*, Center for Educational Literature, Kyiv.

Nitsenko V.S., Havrysh V.I. (2016), "Enhancing the stability of a vertically integrated agro-industrial companies in the conditions of uncertainty", *Actual Problems of Economics*, 10(184), 167-172.

Patyka N., Khodakivska O., Mohylnyi O., Pugachov M. (2021), "Ukraine's Agrarian Sector in the Conditions of COVID-19 Distribution and Restrictive Quarantine Measures: Methodological Principles of Empirical Evaluation", *Scientific Horizons*, 24(12), 55-69.

Pohoretskyi N.A., Cherniak A.N., Hribov M.L., Rusnak A.V., Artemov V.Y. (2020), "Organization of training in legal disciplines based on the implementation of international standards", *International Journal of Management*, 11(5), 770-777.

Proskurnina N.V., Shtal T.V., Slavuta O.I., Serogina D.O., Bohuslavskyi V.V. (2021), "Omnichannel Strategy of digital transformation of retail trade enterprise: From concept to implementation", *Estudios de Economia Aplicada*, 39(6). Available at: https://ojs.ual.es/ojs/index.php/eea/article/view/5238

Renn O. (2021), "New challenges for risk analysis: systemic risks", *Journal of Risk Research*, 24(1), 127-133.

Rod O'Donnell. (2021), "Keynes and Knight: risk-uncertainty distinctions, priority, coherence and change", *Cambridge Journal of Economics*, 45(5), 1127-1144.

Ross B. (2021), "Emmett the writing and reception of risk", *Uncertainty and Profit Cambridge Journal of Economics*, 45(5), 883-900.

Rubtsova N.M., Radchenko N. H., Trusova N.V. (2021), "Insurance protection of agricultural producers of Ukraine: a review of insurance companies and products", *Business Inform*, 4, 249-256.

Rusnak A.V., Pulianovych O.V., Kozak Y.H., Gribincea A., Lytvyn N.Y. (2020), "Innovative priorities of ukraine in the context of global economic trends", *Journal of Advanced Research in Law and Economics*, 11(4), 1376-1387.

Ryskaliyev D.U., Mirzaliyeva A., Tursynbayeva G., Muratova E.M., Buribayev Y.A., Khamzina Z.A. (2019), "Gender inequality among employees in Kazakhstan", Lawyer Quarterly, 9(4), 319-332.

Saienko M.H. (2006), *Enterprise strategy*, Economic Thought, Ternopil.

Schweizer P.-J. (2021), "Systemic risks – concepts and challenges for risk governance", *Journal of Risk Research*, 24(1), 78-93.

Sedikova I.O., Savenko I.I. (2012), "Problems of management of risks at the enterprises of the grain-food complex", *Economic Innovations*, 51, 345-351.

Shalbolova U., Narmanova R., Elpanova M. (2012), "Methodical peculiarities of tariff setting at oil transportation via main pipelines", *Actual Problems of Economics*, 138(12), 540-555.

Shalbolova U.Z., Yegemberdiyeva S.M., Uderbayev S.S., Elpanova M.A., Kazbekova L.A. (2014), "Specifics of oil pipeline systems' risks management", *Life Science Journal*, 11(11), 591-594.

Shartava S., Smolyarova M., Harust Y., Kryvosheiev K. (2019), "Theoretical and legal analysis of the category "financial security of the state"", *Asia Life Sciences*, (2), 135-151.

Shvets V.Y., Rozdobudko E.V., Solomina G.V. (2013), "Aggregated methodology of multicriterion economic and ecological examination of the ecologically oriented investment projects", *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*, 3, 139-144.

Sivash O., Ushakov D., Ermilova M. (2019), "Investment process resource provision in the agricultural sector", *IOP Conference Series: Earth and Environmental Science*, 272(3), 032118.

Tastulekov S.B., Shalbolova U.Zh., Satova R.K. (2019), "Public-private partnership formation in Kazakhstan", *Academy of Strategic Management Journal*, 18(5), 1-8.

Tastulekova A.B., Satova R.K., Shalbolova U.Zh. (2018), "Business valuation and equity management when entering the IPO market", *European Research Studies Journal*, 21(4), 875-886.

The government has restored support for agribusiness entities by partially compensating interest on loans (2021). Available at: https://www.kmu.gov.ua/news/derzhpidtrimka-2021-uryad-vidnoviv-pidtrimku-subyektiv-gospodaryuvannya-apk-shlyahom-chastkovoyi-kompensaciyi-vidsotkiv-za-koristuvannya-kreditami

Tlessova E.B., Shalbolova U.Z., Berzhanova A.M. (2016), "Financial stability diagnostics for construction enterprises", *Actual Problems of Economics*, 180(6), 357-367.

Trusova N.V., Rubtsova N.N., Rubtsov M.A., Chkan I.A., Radchenko N.G., Osypenko S.A. (2021), "The Optimal Parameters of Agricultural Insurance of the Products in the Ukraine", *Estudios de Economía Aplicada*, 39(6), 1-19.

Tytarchuk I., Nehoda Y., Shalyhina I., Bazhanova N., Horbachova O., Rybina L. (2020), "Innovations financing in the agricultural sector", *International Journal of Advanced Research in Engineering and Technology*, 11(4), 246-255.

Utkin E.A., Frolov D.A. (2003), *Enterprise risk management: training manual*, TEIS, Moscow.

Vereshchaha V.M., Pavlenko O.M., Adoniev Ye.O., Rubtsov M.O. (2019), "Geometric method of interpolation of a point polynomial in parametric form", *Modern Problems of Modeling*, 16, 28-139.

Vitlinskyi V.V., Nakonechnyi S.I., Sharapov O.D. (1996), *Economic risk and methods of its measurement*, IZIN, Kyiv.

Vitlinskyi V.V., Verchenko P.I. (2000), *Analysis, modeling and management of economic risk*, KNEU, Kyiv.

Vodovozov E.N., Dmytriiev I.A., Dmytriieva O.I., Spitsyna N.V., Mykolaiets A.P. (2021), "Peculiarities and directions of interaction of stakeholders at transport enterprises", *Estudios de Economia Aplicada*, 39(6). Available at: https://ojs.ual.es/ojs/index.php/eea/article/view/5144

Willett A.H. (1951), *The Economic Theory of Risk Insurance*, University of Pennsylvania Press, Philadelphia.

Yastremskyi O. I. (1992), *Modeling of economic risk*, Lybid, Kyiv.

Zakharova N.Yu. (2011), “Mechanism of financial risk management of agricultural”, *Bulletin of Sumy National Agrarian University, Series “Economics and Management”*, 6/2 (49), 164-167.

Zakharova N.Yu., Mazurova I.V. (2020), “State support for the development of agricultural enterprises in Ukraine”, *Collection of scientific works of the Tavriya State Agrotechnological University, Series Economic Sciences*, 2 (42), 27-34.