

**Liliia Honchar**

*PhD in Economics, Associate Professor,  
Associate Professor of International Business and Logistics Department  
National Technical University of Ukraine  
"Igor Sikorsky Kyiv Polytechnic Institute", Ukraine  
[glo16071991@gmail.com](mailto:glo16071991@gmail.com)*

**Liliia Bukan**

*student of Management Department  
National Technical University of Ukraine  
"Igor Sikorsky Kyiv Polytechnic Institute", Ukraine  
[bukan777888@gmail.com](mailto:bukan777888@gmail.com)*

## **RISK MANAGEMENT IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT: CONCEPTS, METHODS, TOOLS**

### **УПРАВЛІННЯ РИЗИКАМИ У КОНТЕКСТІ СТАЛОГО РОЗВИТКУ: КОНЦЕПЦІЇ, МЕТОДИ, ІНСТРУМЕНТИ**

**Abstract.** The paper examines the basic concepts of risk management in the context of sustainable development, focusing on modern methods and practical tools for identifying, analyzing, and minimizing risks. Particular emphasis is placed on integrating risk management into the strategy of sustainable development of enterprises and society.

**Анотація.** У роботі розглядаються основні концепції управління ризиками у контексті сталого розвитку, акцентується увага на сучасних методах і практичних інструментах для ідентифікації, аналізу та мінімізації ризиків. Особливий акцент робиться на інтеграції ризик-менеджменту у стратегії сталого розвитку підприємств і суспільства.

**Key words.** sustainable development, risk management concepts, risk management methods, risk management tools, risk integration, strategic planning.

**Ключові слова:** сталий розвиток, концепції управління ризиками, методи ризик-менеджменту, інструменти управління ризиками, інтеграція ризиків, стратегічне планування.

In the modern world, enterprises face the challenges of environmental disasters, social changes, economic instability and technological transformations. Ensuring sustainable development is becoming a priority for business, government and society. Risk management in this context helps to predict threats and effectively adapt to changes, maintaining a balance between economic, environmental and social aspects. The implementation of optimal approaches increases the resilience of enterprises, reduces losses and increases competitiveness in the conditions of globalization and growing uncertainty.

Accordingly, within the framework of such a study, it is necessary to analyze existing concepts of risk management, as well as methods and technologies for identifying, assessing and managing various types of risks. This will make it possible to develop and substantiate recommendations for integrating risk management into the strategic planning of enterprises, which will ensure their long-term sustainability and responsibility to society and the environment, taking into account social, ecological and economic aspects of management.

Risk management is an important tool for ensuring the effective operation of enterprises and organizations in complex and changing conditions. This is especially relevant in the context of sustainable development, where it is important not only to avoid threats, but also to take into account the environmental, social and economic aspects of activities. According to the UN and the World Economic Forum, the top 10 risks in 2025 include armed conflicts at the state level (23%), extreme

weather events (14%), geoeconomic confrontation (8%), false information and disinformation (7%), social polarization (6%), economic recession (5%), critical changes in ecosystems (4%), lack of economic opportunities or unemployment (3%), human rights violations (2%) and inequality (2%) [3]. These data show the severity of modern challenges and the need for comprehensive risk management to ensure stability and sustainable development.

Given the current challenges and the diversity of risks that affect the implementation of sustainable development goals, it becomes obvious that the right strategies are needed for their effective management. Risk management concepts form the theoretical and practical basis for building effective mechanisms and strategies that allow enterprises and organizations to adapt to external and internal threats, minimizing their negative impact. Modern concepts of risk management that affect sustainable business development are presented in Table 1.

**Table 1. Analysis of the features of modern risk management concepts**

Concept	Contents	The result that the business will have
Concept of integrated ESG risk management	The concept is aimed at comprehensive management of environmental, social and managerial risks. It provides for the systematic integration of these areas into corporate governance and internal control, which meets the requirements of sustainable development.	Allows for increasing the transparency and responsibility of the company regarding its impact on the environment and society. Also reduces environmental and social risks through the implementation of assessment and monitoring systems.
Concept of risk-oriented management	It provides for a systematic process of identifying, assessing and prioritizing risks with the subsequent development of strategies for their minimization or acceptance. An important element is the risk register and scenario modeling, which enhances predictability and control.	Reduction of unexpected losses due to timely identification of critical risks. Additionally, resources will be optimized to minimize the most dangerous factors. Improvement in decision-making due to a structured and transparent risk management process.
Systemic approach to risk management	Risks are considered as part of a large system of interdependent factors of sustainable development. Interdisciplinary knowledge is involved for a comprehensive analysis of the impact of environmental, social and economic risks.	The concept creates a holistic picture of risks and contributes to a long-term balanced development strategy, increasing the company's ability to adapt to complex external changes.

Source: compiled by the authors based on [1, p. 150-151, 4.7]

Thus, different risk management concepts reveal, in their own way, approaches to ensuring business resilience and adaptability in challenging conditions. They emphasize the need for a systemic vision, prioritization of risks, and comprehensive integration of environmental, social, and governance factors into organizations' strategies, which is the key to their long-term success and responsibility to society.

Traditional risk management methods, such as SWOT analysis, PEST analysis, scenario analysis, Value at Risk and stress testing, remain fundamental tools for identifying and assessing risks. They help to systematically identify potential threats and assess their impact on the organization. However, these methods often have limited ability to respond quickly to dynamic and complex risks, particularly in the context of globalization and digitalization. New technologies, such as artificial intelligence, machine learning, blockchain and big data analysis, significantly increase the accuracy and efficiency of risk identification and assessment. They allow for automated monitoring, risk forecasting based on the analysis of large volumes of data and adaptation of management strategies to rapidly changing conditions. Thanks to this, organizations can avoid surprises and quickly adjust their actions to reduce negative consequences [5].

Relevantly developed risk management tools help to implement the specified risk management methods in practice, helping enterprises and organizations effectively identify, assess and respond to risks [5]. In the context of sustainable development, the most common and at the same time modern risk management tools are the risk matrix, software platforms for monitoring and risk analytics (big data, artificial intelligence), early warning systems, ESG tools and standards, corporate training

programs and risk management training. An analysis of the features of the application of the outlined tools in the risk management system in the context of sustainable development of enterprises is presented in Table 2.

**Table 2. Risk management tools for achieving sustainable development**

Tool	Tool Features	Features of application in the context of sustainable development of enterprises
Risk Matrix	A basic tool for systematizing all risk information with an assessment of probability and potential impact, which helps prioritize management efforts. It can be successfully integrated into the general management processes.	Promotes a balanced assessment of economic, environmental and social risks, which is important for comprehensively ensuring sustainable development.
Software platforms for risk monitoring and analytics	Provide automated collection and processing of a large amount of information, allowing you to predict and detect changes in the risk environment in real time, increasing the efficiency of response. They support complex management models and scenario analysis.	Helps to take into account long-term environmental and social trends to minimize adverse impacts and support environmental responsibility..
Early warning systems	A tool that allows you to quickly signal about threats, ensuring the adoption of timely macro- and micro-decisions to minimize losses and conserve resources.	Provides rapid response to risks, which contributes to sustainability and environmental protection.
ESG tools and standards	Standardized mechanisms for assessing and reporting environmental, social and management risks, which are integrated into corporate policy and management structures in accordance with international standards.	Key to implementing sustainable development practices, improves transparency and accountability of business to society and investors.
Corporate risk management training and education programs	A tool for forming a risk management culture, which improves staff qualifications and promotes a conscious attitude to risks in the organization.	Forms in employees an understanding of the importance of sustainable development and integrates environmental and social aspects into everyday activities.

Source: compiled by the authors based on [2,5,6,7]

Summarizing the analytical information presented in Table 2, it can be stated that the outlined tools contribute to the effective implementation of the principles of sustainable development at enterprises. They provide the ability to identify, assess and respond to economic, environmental and social risks. Through the integration of modern technologies, standardized practices and personnel training, the analyzed tools help to increase transparency, efficiency of decision-making and form a culture of responsible attitude to sustainability. This creates the basis for the stable functioning and competitiveness of enterprises in a dynamic risk environment.

Therefore, risk management in the context of sustainable development is a key tool for ensuring the sustainability of enterprises and society as a whole. Various concepts and modern risk management methods allow for the effective identification, assessment and minimization of diverse risks, taking into account environmental, social and economic aspects. The introduction of new technologies increases the efficiency and accuracy of management processes, which allows organizations to adapt to global challenges and maintain a balance between development and environmental responsibility.

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