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IDENTIFICATION AND EVALUATION OF RISKS IN BUSINESS OPERATIONS DURING DIGITAL TRANSFORMATION

ІДЕНТИФІКАЦІЯ ТА ОЦІНЮВАННЯ РИЗИКІВ ДІЯЛЬНОСТІ СУБ'ЄКТІВ ГОСПОДАРЮВАННЯ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

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This article reflects on recent approaches for identifying and evaluating enterprise risks related to digital transformation and growing external uncertainties, particularly wartime risks. Using analytical tools such as synthesis, generalization, and systematization, the study consolidates both theoretical and methodological bases of risk analysis. Traditional techniques for risk assessment remain one of the most important tools for developing risk analytics, but their effectiveness is greatly enhanced when combined with digital technologies. This research asserts that risk identification and evaluation can be improved using Big Data, artificial intelligence, and information-analytical platforms to perform more accurate, timely, and efficient evaluations. A structured classification of traditional and digital risk analysis tools is applied to provide a holistic perspective of modern tools in this methodology. Practical considerations for developing risk assessment structures in enterprises result from the findings.

Keywords: risk identification, risk assessment, digitalization, digital transformation, Big Data, artificial intelligence, risk analytics, risk monitoring, risk management, control.

Стаття присвячена дослідженню ідентифікації та оцінювання ризиків діяльності суб'єктів господарювання в умовах цифрової трансформації економіки та зростання невизначеності зовнішнього середовища, що посилюється воєнними викликами, оскільки ці процеси є ключовим фактором забезпечення стабільності, стійкості та безперервності їх функціонування. Метою статті є дослідження сучасних підходів до ідентифікації та оцінювання ризиків діяльності суб'єктів господарювання та систематизація інструментів їх аналізу в умовах цифрової трансформації. У процесі дослідження використано загальнонаукові та спеціальні методи наукового пізнання, зокрема методи аналізу та синтезу, порівняльного аналізу, узагальнення, систематизації та логічного узгодження, що дозволило комплексно дослідити теоретичні та методичні засади оцінювання ризиків та виявити ключові тенденції їх розвитку. У роботі також застосовано структурний підхід, що забезпечив систематизацію традиційних та цифрових інструментів оцінювання ризиків. У результаті дослідження встановлено, що сучасне ризикове середовище суб'єктів господарювання характеризується зростанням складності, динамічності та багатовимірності під впливом цифровізації та воєнних факторів, що призводить до появи нових типів ризиків та трансформації вже існуючих. Обґрунтовано, що традиційні методи ідентифікації та оцінювання ризиків, зокрема експертні, статистичні та аналітичні підходи, залишаються базовими елементами ризикової аналітики, однак їх ефективність значно підвищується у поєднанні з сучасними цифровими технологіями. Доведено, що використання технологій Big Data, штучного інтелекту та автоматизованих інформаційно-аналітичних систем забезпечує підвищення точності, швидкості та обґрунтованості оцінювання ризиків, а також сприяє виявленню прихованих закономірностей у ризиковому середовищі підприємств. Встановлено, що інтеграція традиційних і цифрових підходів дозволяє сформувати комплексну систему ідентифікації та оцінювання ризиків, орієнтовану на підвищення адаптивності підприємств до змін зовнішнього середовища.

Практична цінність отриманих результатів полягає у можливості їх застосування для вдосконалення інформаційно-аналітичного забезпечення процесів оцінювання ризиків, підвищення якості аналітичних висновків та обґрунтованості управлінських рішень на підприємствах різних галузей економіки.

Ключові слова: ідентифікація ризиків, оцінювання ризиків, цифровізація, цифрова трансформація, Big Data, штучний інтелект, ризикова аналітика, моніторинг ризиків, управління ризиками, контроль.

Statement of the problem. Today, businesses operate amidst a landscape marked by ever-greater uncertainty and transformations resulting from wartime events, including economic instability, competitive pressure, and rapid digitalization of management practices. The digitalization of economic activity and the development of information technologies promote economic improvement, and also the creation of new risks and problems by which these risks need to be addressed on time.

Risks may occur in almost all aspects of business, from the preparation of a business strategy to the handling of capital and investment projects. Inadequate risk identification and evaluation methods may have dire financial implications, resulting in loss of competitiveness and/or declining economies and financial soundness. In this regard, it is critical to incorporate up-to-date methodologies that allow for a wide range of emerging risks to be identified and assessed at a lower latency and, even, to enable businesses to measure the effects of their actions on the organization's performance outcomes. The methodologies use classic analytical tools as well as new digital processing systems for the rapid process of analysis and improved forecast accuracy.

An effective risk assessment system helps companies identify risks quickly and monitor the effectiveness of these risks on their overall operating processes. This provides a foundation for informed tactical decisions aimed at minimizing negative consequences. For companies operating under martial law in Ukraine, especially, the need for appropriate identification and assessment of risk is acute because of the altered operational environment brought on by full-scale war, which makes the entire business environment highly volatile with increased economic volatility, unstable supply chains, resource depletion, exchange rate fluctuations, loss of market opportunities, as well as higher financial risks. With these circumstances full of uncorrelated uncertainty with ongoing uncertainty, adaptive risk management must be adopted as adaptive practices to risk management are required.

The research challenge lies in improving approaches to identifying and assessing business risks, taking into account changes in the economic environment caused by digital transformation and wartime conditions. These factors significantly alter the context in which enterprises operate and require the development of more adaptive and resilient risk-management practices. As a result, it is worthwhile studying theoretical frameworks alongside practical risk management factors to fortify resilience for enterprises.

Analysis of recent research and publications. The most recent research on business-related risks investigated among Ukrainian scholars emphasizes advancing modern methods for identifying and evaluating these risk factors in light of the ongoing progress of the digital economy. Digitization radically changes the risk landscape by exposing risks while also enabling fast discovery and investigation via innovative technologies, including information systems or Big Data analytics.

In particular, Kaminskyi A.B. examines the development of risk management as an integrated system in which the stages of risk identification, analysis, and measurement play a key role, as well as the need for managerial systems to adapt to a changing risk environment [1]. The author emphasizes that modern risk management must be proactive, oriented toward the early detection of risks and their minimization.

In the research of Kozlovskyi S.V. and Chebotok V.V., it is noted that the formation of an effective risk assessment system is based on the stages of risk identification and evaluation, which are increasingly integrated with digital technologies, data analytics, and automated decision-support systems [2].

Tokmakova I.V., Chornobrovka I.V., and Zub M.V. emphasize that modern approaches to risk identification and assessment require the continuity of this process, including ongoing monitoring, which is particularly important in an unstable and digitalized business environment [3]. The use of digital tools enhances the adaptability of enterprises and ensures timely responses to changes in the external environment.

Titov V.V. highlights the necessity of combining classical (qualitative and quantitative) risk assessment methods with modern digital

data-analysis technologies. Such an approach improves the accuracy of risk evaluation, reduces uncertainty, and enhances the quality of managerial decision-making [4].

Khadzhinova O.V. and Kurtyanyk M.S. examine the phased formation of a risk-oriented management system, in which risk identification and assessment are defined as fundamental stages that determine the level of threats to the financial and economic activities of enterprises [5].

Bilous S.P. and Synytsia I.Yu. argue that risk management is a continuous process of identifying, assessing, and monitoring risks, and they emphasize the importance of digital innovations, including machine-learning and analytical tools [6].

Makhmudov Kh.Z., Mykhailova O.S., and Pysarenko S.V. investigate methodological approaches to assessing entrepreneurial risks, stressing the need to apply comprehensive quantitative and qualitative methods to determine the level of risk exposure faced by business entities [7].

Highlighting previously unresolved parts of the overall problem. A summary of academic research indicates that most contemporary scholars consider risk identification and assessment to be key stages in forming a system for analyzing the risk exposure of business entities. The literature emphasizes the need for a comprehensive approach to identifying and evaluating risks, which includes their sequential identification, analysis, quantitative and qualitative assessment, as well as subsequent monitoring of changes in the risk environment. The soundness of methodological approaches to risk assessment and the timeliness of risk identification largely determine the effectiveness of managerial decision-making within enterprises. At the same time, modern scientific studies increasingly focus on the impact of digital transformation on the changing nature of enterprise risk environments. The use of information technologies, Big Data analytics (Big Data), artificial intelligence systems (AI), and automated information-analytical platforms creates new opportunities for improving the accuracy of risk identification and the reliability of their assessment. However, digitalization of economic activity also leads to the emergence of new types of risks and complicates the process of their timely detection and evaluation.

Despite the significant number of scientific works, certain issues related to the application of modern approaches to identifying and assessing business risks under conditions of digital transformation and wartime challenges remain insufficiently explored. This necessitates improving methodological approaches to identifying and assessing risks faced by business entities through the use of modern information-analytical tools.

Formation of the objectives of the article. The purpose of the article is to examine modern approaches to identifying and assessing the risks of business entities under conditions of digital transformation, and to systematize and generalize traditional and digital tools for their analysis in order to form a comprehensive understanding of the methodological framework for risk assessment.

Summary of the main research material. The risks faced by business entities are an objective component of enterprise functioning in a market environment and reflect the probability of events that may cause deviations of actual performance results from planned ones. Under traditional economic conditions, primary attention was paid to financial, operational, investment, and market risks, which formed the basic contour of the enterprise risk environment [8; 9]. At the same time, modern economic conditions have significantly transformed the structure of risks under the influence of two key factors – digital transformation of the economy and wartime challenges. The full-scale war in Ukraine has led to a substantial increase in business-environment uncertainty, disruptions in supply chains, loss of sales markets, limited access to resources, intensified exchange-rate fluctuations, and higher levels of financial and operational risks. Additionally, risks related to the physical security of assets, personnel, and business-process continuity have increased.

In parallel, the digital transformation of the economy has changed the nature of risk formation and manifestation. The widespread implementation of information technologies, automated management systems, cloud services, Big Data analytics, and artificial intelligence systems not only enhances the effectiveness of managerial decision-making but also creates new sources of risks. These include cyber risks, risks of data leakage or loss, risks of digital infrastructure failures, as well as risks associated with enterprises' dependence on information systems [10]. A distinctive feature of modern risks is their high dynamism, interdependence, and complexity of forecasting. Wartime and digital factors intensify the instability of the external environment,

complicating the timely identification and assessment of risks. This necessitates the use of modern information-analytical tools capable of ensuring real-time monitoring of risk situations and improving the accuracy of their evaluation. A classification and comparative description of risks faced by business entities under conditions of digital transformation and wartime challenges is presented in Table 1.

Accordingly, the modern risk environment of enterprises is characterized by the simultaneous intensification of traditional risks under the influence of wartime factors and the emergence of new digital risks resulting from the digital transformation of the economy. Whereas risks previously had predominantly financial and economic characteristics, under current conditions they have become more complex and now also encompass the informational and technological dimensions of enterprise operations.

Risk identification and risk assessment are essential components of analyzing the risk environment of an enterprise, as their application enables the timely detection of potential threats and the determination of the extent of their possible impact on business performance. These processes form the basis for developing a systematic understanding of the uncertainty factors that may affect the stability of business operations, the efficiency of resource utilization, and the achievement of strategic and operational objectives.

Risk identification focuses on detecting potential risk events, determining their sources, causes, and areas of influence on enterprise activity. During this process, factors that may generate risks are systematized, including economic, financial, production, technological, informational, and other types of risks. An important task at this stage is also to identify the interrelationships among individual risk factors and to determine potential channels through which these risks may manifest [12]. The result of the identification process is the formation of a list of risks that may affect enterprise activity, as well as the identification of business areas in which these risks are most likely to occur.

Risk assessment involves determining the qualitative and quantitative characteristics of the identified risks, including the probability of their occurrence, the scale of potential losses, the duration of their impact, and the degree of their influence on enterprise performance [4]. At this stage, the significance of each risk is analyzed, and its criticality for enterprise functioning is determined. Risk assessment makes it possible to establish the priority of individual risks, identify those requiring immediate attention, and form the basis for subsequent managerial decisions aimed at minimizing or neutralizing their negative effects. In addition, the results of risk assessment can be used to forecast the potential consequences of risk events and to develop appropriate response measures.

Table 1

Transformation of Risks of Business Entities Under the Influence of Digitalization and Wartime Challenges

Risk Group	Risks Under Traditional Conditions	Risks Under Conditions of Digitalization and War
Financial	inflationary, credit, currency risks	intensified exchange-rate fluctuations, limited access to financing, financial instability
Operational	production failures, logistics risks	destruction of supply chains, suspension of activities due to military actions
Market	changes in demand, competition	loss of sales markets, sharp changes in demand structure
Investment	risk of non-return on investments	sharp increase in investment uncertainty
Informational	limited automation	dependence on digital systems, data-related risks
Cyber Risks	almost absent	cyberattacks, data leakage, disruption of IT systems
Technological	slow implementation of technologies	failures of digital infrastructure, risks of AI / Big Data systems

Source: formed by the authors based on [9; 10; 11]

Given the increasing complexity of the external environment and the emergence of new types of risks associated with digitalization and military actions, the application of modern methodological approaches to risk identification and assessment has become particularly relevant. These approaches form the analytical foundation for determining the level of enterprise risk exposure and for further risk classification. At the same time, the digital transformation of the economy necessitates expanding methodological tools through the use of modern information-analytical technologies.

A systematization of the primary methodological approaches to risk identification and assessment under current conditions is presented in Table 2.

A synthesis of modern methodological approaches to risk identification and assessment indicates that traditional methods remain the fundamental tools for forming the risk analytics of business entities. They ensure the primary detection of risks and make it possible to assess their overall level based on the available information base. At the same time, the development of digital transformation significantly expands the methodological toolkit of risk management by increasing the speed of data processing, improving the accuracy of forecasting risk events, and enhancing the efficiency of analytical conclusions regarding the level of enterprise risk exposure.

Big Data technologies play an important role in modern risk assessment systems, as they enable the processing of large volumes of structured and unstructured data obtained from internal enterprise information systems, open information sources, financial databases, and other digital resources. The analysis of such data sets makes it possible to identify hidden patterns, establish relationships among various risk factors, and generate more accurate forecasts regarding the probability of risk events.

Artificial intelligence technologies also have significant potential in the field of risk assessment, as they provide automated data analysis, the construction of predictive models, and the detection of anomalies in enterprise operations [14]. The use of such algorithms enables the timely identification of signs of increased risk in specific business processes, the forecasting of potential negative consequences of risk events, and the formation of analytical conclusions regarding their likelihood. In addition, modern enterprises actively use automated management information systems, including ERP systems, business intelligence (BI) systems, and specialized software solutions for risk monitoring. These systems ensure continuous analysis and control of key performance indicators, automated generation of analytical reports, and prompt detection of deviations that may indicate an increased level of risk.

Table 2

Modern Methods for Identifying and Assessing Risks of Business Entities

Group of Methods	Methods	Characteristics	Features of Application Under Conditions of Digitalization
Traditional qualitative methods	expert methods, SWOT analysis, scenario analysis	based on expert judgments and logical analysis	ensure the primary identification of risks
Traditional quantitative methods	statistical analysis, probability methods, variance analysis	rely on numerical data	require a sufficient volume of historical data
Analytical methods	comparative analysis, factor analysis	enable identification of the causes of risks	used for detailed examination of risk factors
Digital methods (Big Data)	big data analytics, data mining	processing of large volumes of information	increase the speed of risk detection
Intelligent methods	artificial intelligence	forecasting and automatic detection of risks	ensure the predictive nature of assessment
Automated systems	ERP systems, risk management systems	integrated monitoring systems	ensure continuous risk control

Source: formed by the authors based on [9; 10; 13]

Table 3

Integration of Traditional and Digital Approaches to Identification and Assessment of Enterprise Risks

Group of Methods	Tools	Application Capabilities	Advantages
Traditional methods of risk identification	expert assessments, documentation analysis, interviews, questionnaires	identification of potential risks and their sources	simplicity of application, possibility of use under limited information
Traditional methods of risk assessment	statistical analysis, comparative analysis, ratio analysis	determination of the probability of risk occurrence and possible losses	formation of a basic risk assessment
Digital methods of risk analysis	Big Data analytics	processing of large data sets to identify risk patterns	high speed of data processing
Intelligent assessment methods	artificial intelligence	forecasting risk events and scenario modeling	increased forecasting accuracy
Information-analytical systems	ERP systems, BI systems, analytical platforms	monitoring of performance indicators and automatic detection of risky deviations	promptness of analytical information

Source: formed by the authors

A summary of traditional and digital approaches to identifying and assessing enterprise risks is presented in Table 3.

Therefore, combining traditional with digital risk assessment methods allows for a comprehensive enterprise risk analytics system to be integrated. Use of modern digital technologies improves the accuracy of risk evaluation, accelerates the identification of risks, and generates reliable analytical results about the risk exposure in the business.

Conclusions. The conducted analysis of contemporary approaches to identifying and evaluating risks in business operations demonstrates that, under conditions of increasing external uncertainty caused by wartime challenges and the ongoing digital transformation of the economy, the importance of effective risk analysis has increased significantly. Timely detection of potential threats and assessment of their impact on enterprise performance are essential for ensuring operational stability and forming an objective understanding of the overall level of business risk exposure. The study confirms that traditional methodological approaches to risk identification and evaluation – including expert assessments, analytical procedures, and statistical analysis – remain fundamental tools of enterprise risk analytics. However, the modern business environment, characterized by rapidly expanding information flows and high economic volatility, necessitates the enhancement of methodological tools through the use of advanced digital technologies. It has been substantiated that the application of Big Data technologies, artificial intelligence, and information-analytical systems enables deeper analysis of risk factors, improves the accuracy of forecasting risk events, and facilitates the prompt identification of potential threats.

As a result of the research, traditional and digital approaches to enterprise risk identification and evaluation were systematized, allowing for the formation of a comprehensive understanding of the modern methodological toolkit of risk analytics. Future research should focus on developing practical models for applying digital technologies to automated risk assessment and creating integrated enterprise risk analytics systems.

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