DOI: http://doi.org/10.31617/1.2025(164)06
UDC 005.334:69=111

BAI Serhii
https://orcid.org/0000-0003-0599-2582
Doctor of Sciences (Economics),
Professor, Head of the Department
of Management State University
of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine
s.bay@knute.edu.ua

BUKHANENKO Igor
https://orcid.org/0009-0002-2019-4087
Postgraduate Student
at the Department of Management
State University of Trade and Economics
19, Kyoto St., Kyiv, 02156, Ukraine
I.bukhanenko@knute.edu.ua

PROJECT RISK MANAGEMENT IN CONSTRUCTION

The relevance of the research is due to the importance of construction for the domestic economy and the tendency of this industry to grow even during the russian-Ukrainian war. The current research was based on the hypothesis of a positive cumulative effect from the use of innovative technologies in the process of managing and accessing project risks of construction industry enterprises. A number of general scientific methods were used (monitoring, abstraction, analysis and synthesis), and one special one, a statistical method of risk assessment. In the course of writing the article, scientific literature was also used, namely – publications of domestic and foreign researchers and the results of observations of independent scientists. To achieve the aim of this research, we identified the specifics of the functioning of construction industry enterprises, analyzed the risk management process in projects of construction industry enterprises and provided an assessment of project risks and identified possible ways to reduce them. It allowed us to determine the trend of increasing the cumulative average annual growth rate of the Ukrainian market of building materials in monetary terms by 2.56 times more than the world one. The most common problems of the construction industry enterprises and the main steps in choosing the concept of their products or services were also identified. The conclusions of the research showed the complexity and complexity of the processes of

БАЙ Сергій
https://orcid.org/0000-0003-0599-2582
д. е. н., професор,
завідувач кафедри менеджменту
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна
s.bay@knute.edu.ua

БУХАНЕНКО Ігор
https://orcid.org/0009-0002-2019-4087
аспірант кафедри менеджменту
Державного торговельно-економічного
університету
вул. Кіото, 19, м. Київ, 02156, Україна
I.bukhanenko@knute.edu.ua

УПРАВЛІННЯ ПРОЄКТНИМИ РИЗИКАМИ У БУДІВНИЦТВІ

Актуальність дослідження зумовлена важливістю будівництва для вітчизняної економіки та тенденцією цієї галузі до зростання навіть під час російсько-української війни. Висунуто гіпотезу щодо позитивного накопичувального ефекту від використання інноваційних технологій у процесі управління та оцінки проєктних ризиків підприємств будівельної галузі. Використано загальнонаукові методи (моніторинг, абстрагування, аналіз та синтез) і спеціальний метод оцінки ризику. Інформаційним підґрунтям дослідження є публікації вітчизняних та закордонних дослідників і результати спостережень незалежних учених. Виявлено специфіку функціонування підприємств будівельної галузі, проаналізовано процес управління ризиками в проєктах підприємств будівельної галузі та оцінено проєктні ризики і визначення можливих шляхів їх зниження. Встановлено тенденцію до зростання сукупного середньорічного темпу приросту обсягів українського ринку будівельних матеріалів у грошовому еквіваленті: у 2.56 раза більше за світовий. Окреслено найпоширеніші проблеми функціонування підприємств будівельної галузі та основні кроки вибору концепту їх продукції чи послуг. Доведено комплексний і складний характер процесів оцінки й управління ризиками, що зумовлює необхідність систематичного підходу,

risk assessment and management and the need for a systematic approach to them, which should be clearly described in the enterprise documentation (risk register) for the convenience of their classification and subsequent transfer to work to specific employees to personalize responsibility for their mitigation or complete leveling. A risk calculation formula is presented, the use of which shows the impact of risks on the expected cost of performing work by the enterprise. The main prospect for the development of project risk management and assessment of enterprises in the construction industry of Ukraine was determined to involve automated systems based on the latest technologies.

Keywords: construction, construction industry enterprises, risk management, project risk assessment, new technologies, building materials market.

чітко задокументованого у внутрішніх регламентах підприємства (реєстрі ризиків) з метою зручності їх класифікації й подальшого передання до роботи конкретним працівникам для персоналізації відповідальності. Наведено формулу розрахунку ризику, використання якої показало вплив ризиків на очікувану вартість виконання підприємством робіт. Основною перспективою розвитку управління та оцінки проєктних ризиків підприємств будівельної галузі України визначено залучення автоматизованих систем на базі новітніх технологій.

Ключові слова: будівництво, підприємства будівельної галузі, управління ризиками, оцінка проєктних ризиків, новітні технології, ринок будівельних матеріалів.

JEL Classification: D24, D81, L70.

Introduction

Construction remains one of the most developed sectors of the Ukrainian economy even in wartime. This is confirmed by the fact that the total revenue of the 10 largest domestic construction enterprises has increased by more than USD 13 billion over the past year (Opendatabot, n. d.). Despite such success, the issue of effective management and adequate assessment of project risks that arise during their professional activities is extremely relevant for construction enterprises.

Construction is impossible without the development of other industries, as evidenced by its dependence on the products of mechanical engineering, metal rolling, forestry and chemical industries (Zhovtyak & Volokhova, 2020). This connection forms the need for successful economic activity of construction enterprises themselves, since they create demand for products of other industries, developing the domestic market and the domestic economy.

The features of project risk management and assessment of construction industry enterprises have been studied by both Ukrainian and foreign scientists. In particular, Deneka et al. (2020) studied the management of construction industry enterprises in the context of digitalization, which helped them determine a change in the management paradigm towards a combination of strategic and operational approaches. Ilyashenko et al. (2024) considered various aspects of profitability management of construction industry enterprises, emphasizing the need for their integration into the overall enterprise management system as a set of business processes. The features of the functioning of construction industry enterprises in conditions of war and crises were determined by Kryvdyk and Aleksienko (2023), emphasizing that key crisis phenomena are formed by financial and economic, material and resource and personnel components. Leonova et al. (2024)

analyzed the current state of the construction industry and proposed their own marketing strategies to minimize the financial risks of enterprises in conditions of post-war recovery. Naichuk-Khrushch and Shchur (2023) substantiated the need to form a scientific and methodological basis for effecttive management of innovative development of enterprises in the construction industry. Naumkin and Kiporenko (2025) considered the essence and significance of economic security for enterprises in the construction industry in modern conditions and identified cash flow management, planning and cost control as the basis of financial stability. Ovsienko (2021) paid special attention to the peculiarities of marketing activities of enterprises in the construction industry, outlining the content of her work on studying the target audience for which the sales department is designed.

Sokolovska and Kasich (2022) emphasize the need to develop a model for implementing digitalization tools in the management system of construction companies to achieve the trend of performing work based on cloud applications. Tyurina et al. (2023) focused on the issue of managing the competitiveness of construction industry enterprises in the context of creating and integrating a strategic plan into the overall management system during the distribution of functions. Fenyk et al. (2024) identified the main risks that construction industry enterprises may face in martial law, among which the economic ones are a decline in demand, rising inflation rates, and an imbalance in the financial system.

Foreign researchers draw attention to the fact that general success factors are not a universal set that will contribute to the success of each individual implemented project of construction industry enterprises, since their implementation takes place in a turbulent environment (Gebczynska & Piwowarczyk, 2022). Bahamid et al. (2022) investigated modern risk management practices in the construction industry using the example of construction enterprises in Yemen. They identified reactivity, lack of structure, and necessary material resources as the main challenges of this process. Ching et al. (2021) identified aspects of risk culture among Malaysian construction companies, as well as those responsible for their assessment, among which top management and the risk manager play a key role. Mo et al. (2023) proved that in the context of climate risks for construction enterprises, losses caused by extremely low temperatures exceed losses from high temperatures and precipitation. Drabkova and Pech (2022) noted that in the context of risks in the operational sphere and financial and investment activities, the leading share – 19.62% – was occupied by construction enterprises. Tu et al. (2023) assessed the impact of the COVID-19 pandemic on the business performance of small and medium-sized enterprises in the construction industry through the prism of operational and financial risks that caused production disruptions and shortages of materials and labor.

According to scientists, the solution to this problem is the implementation of adaptive strategies to increase the efficiency of business activities of enterprises.

Despite the large number of studies conducted on various aspects of project risk management and assessment of construction enterprises, most of them have certain shortcomings. In particular, the lack of universality: as a rule, scientists consider the specified issues on the basis of specific examples or surveys, which are not always considered reliable. At the same time, the disadvantage of research by domestic scientists is excessive immersion in the theory of the issue of project risk management and assessment, which sometimes does not reflect real processes.

The aim of the research is to determine the features of project risk management and assessment of construction enterprises at the current stage of its development. To achieve this aim, the following tasks are envisaged: identifying the specifics of the functioning of construction enterprises; analyzing the risk management process in construction enterprise projects; providing an assessment of project risks and identifying possible ways to reduce them.

The research hypothesizes that there is a positive cumulative effect from the use of innovative technologies in the process of project risk management and assessment of construction enterprises.

The information base of the research was publications of domestic and foreign researchers and the results of observations of independent experts and open sources, in particular specialized information sites. To achieve the aim, general scientific and special methods were used. Since the most common of them (monitoring, abstraction, analysis and synthesis) were used among the general scientific ones, the statistical method is described in detail, which makes it possible to identify losses from the negative consequences of the implementation of decisions. This method requires a significant amount of analytical and statistical information of enterprises, which, in turn, is a commercial secret, therefore its application is limited in the article. The study also briefly mentions other methods of assessing project risks, but, unlike the statistical method, the algorithm for their implementation is not considered due to the need to involve experts.

The article consists of three sections, the first of which reveals the economic specifics of the functioning of specific enterprises in the construction industry. The second section considers the process of risk management in projects of enterprises in the construction industry, assesses project risks and identifies ways to reduce them. The third section is devoted to the prospects for the development of management and assessment of project risks of enterprises in the construction industry of Ukraine, provided that the latest technologies and experience of leading Western companies are involved.

1. The functioning of construction companies and their place in the economy

The global building materials market in 2023 was worth $1,320.01 billion and in 2024 it grew from USD 1,369.86 billion to USD 1,867.16 billion by 2032, exhibiting a compound annual growth rate (CAGR) of 3.9% over the forecast period (Fortune Business Insights, 2025, March 17).

In Ukraine, before the full-scale invasion of the russian federation, the volume of the building materials market in monetary terms was estimated at USD 16 billion, with a CAGR growth rate of 10% (European Business Association, 2024, August 12).

Thus, the CAGR growth rate of the Ukrainian building materials market was 2.56 times higher than the global one, which indicates the critical importance of this industry for the Ukrainian economy. This also emphasizes the high role of construction industry enterprises as producers of these materials in the domestic economy.

Despite their crucial role in construction, construction industry enterprises face a number of systemic problems that complicate their stable operations (*Table 1*).

Table 1

The most common problems facing construction companies

Problems	Description
Supply chain disruptions	This industry relies heavily on a smooth supply chain for the timely procurement of raw materials and delivery of finished products
Quality Control	Ensuring consistent quality of construction materials is critical. Any compromise on quality can lead to structural issues, safety, and potential legal liability
Regulatory Compliance	Companies must adhere to strict regulations, from environmental standards to safety regulations. Failure to comply can result in large fines and damage to a company's reputation
Workforce Safety	The manufacturing process in this industry can pose a threat to worker safety. Ensuring a safe work environment is not only a regulatory requirement, but also a key factor in maintaining productivity and morale
Environmental Impact	The activities of businesses in this industry have a significant impact on the environment. Therefore, there is increasing pressure to reduce this impact through sustainable practices and the use of environmentally friendly materials

Source: compiled by the authors based on (Kaplan, n. d.).

These problems cannot be overcome, although the impact of some of them can be reduced by using the latest technologies and methodological approaches to economic activity. The choice of products or services that the enterprise will produce or provide is based on an analysis of market needs, which will demonstrate what resources and in what quantities need to be involved in fulfilling the order. The main steps of this process are shown in *Figure 1*.

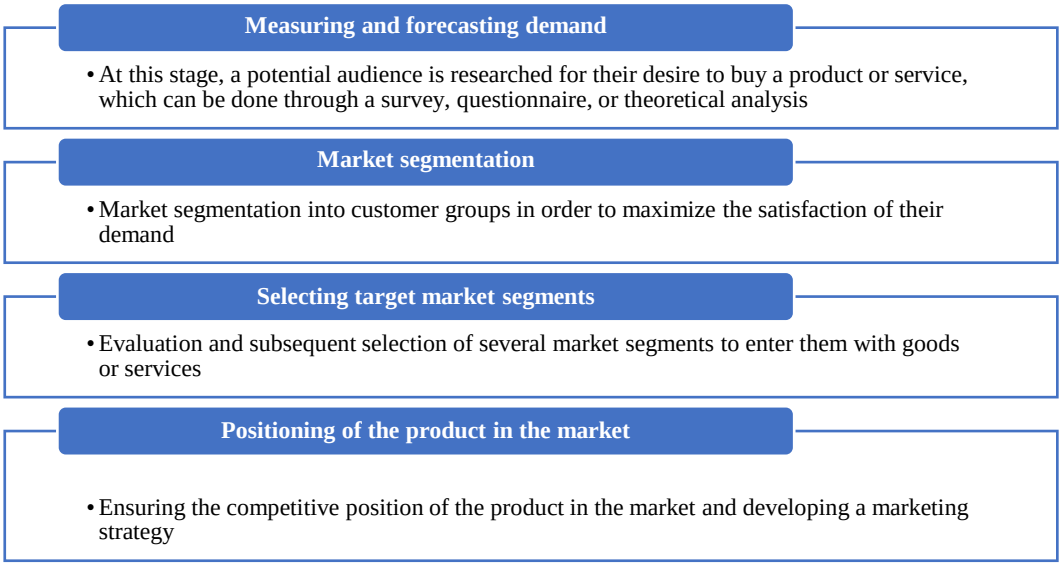

Figure 1. Basic steps in choosing a product or service concept

Source: compiled by the authors based on (Litvak & Velichko, 2021).

The results of the market prospects analysis of construction enterprises indicate minimal differences in this process compared to enterprises in other industries. One of the key features is the extensive cooperation of such enterprises with state and local authorities, which allows some of them to reduce dependence on private customers, directing their own production capacities to the implementation of state projects. This became relevant in the context of war, when the field of military construction began to develop. In particular, there is an increased sensitivity of Ukrainian construction enterprises to the dynamics of changes in the macroeconomic environment.

Another trend in the construction industry of Ukraine is its monopolization, namely, 5 domestic construction companies have 76% of the revenue of the entire construction market (Opendatabot, n. d.).

2. Project risk analysis of management and assessment of construction companies

The implementation of projects in the construction industry is largely focused on risk management, which involves controlling and reducing risks due to the high complexity, duration and scale of construction work. Large and long-term construction projects are affected by a wide range of risks, so it is important to identify them at the very beginning, control and reduce the level of risks during project implementation. One of the main aspects of the implementation of construction projects is effective work with risks, since cost control for compliance with deadlines is critical to achieving the set goals.

The uncertainty that is characteristic of construction business processes determines the features of risk assessment in this industry (*Figure 2*).

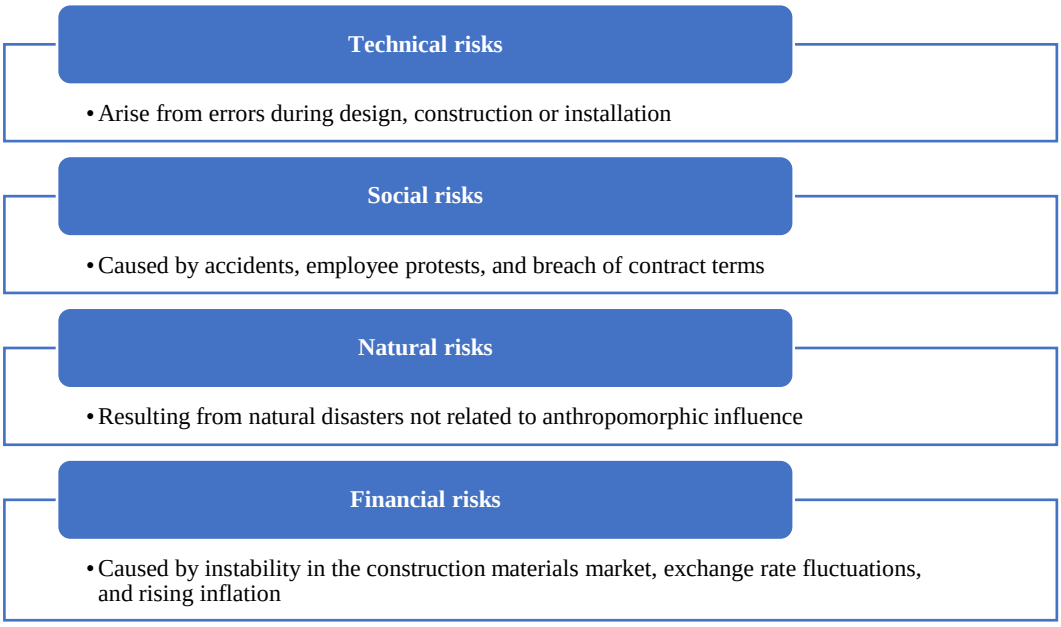

Figure 2. Main risks in the construction industry

Source: compiled by the authors based on (Golovatska, 2018).

Risk assessment of construction companies is a complex process (study *Figure 2*), which requires competence in various areas of life. This indicates the need for collective decision-making during its systematization. To effectively systematize risk management, it is necessary to conduct their analysis. Risk analysis is a systematic approach to understanding their impact so that the company's decision-makers can take them into account in emergency planning, as well as plan to mitigate risks.

Risk assessment is a complex process that goes through several phases, and during risk generation, the evaluator must review all risks in the project and their changes. The risk management structure is shown in *Figure 3*. This is a strictly sequential process that requires not only the skills of an analyst from a responsible employee or department of the enterprise, but also a reaction – making a certain decision that will allow you to eliminate the risk or minimize its consequences for business activities.

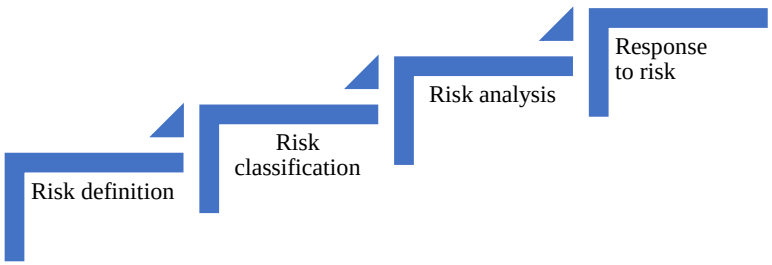

Figure 3. Risk management structure

Source: compiled by the authors.

Risk identification involves a thorough analysis of all aspects of a construction project, from on-site safety hazards to contractual and financial uncertainties. Risk classification allows for the formation of whole clusters that are much easier to analyze than doing it for each risk individually. The analysis helps to prioritize risks based on their severity and likelihood of occurrence. Tools such as risk matrices are used to make the analysis effective. Risk response involves developing strategies to address the identified risks and their subsequent implementation (MacKinnon, 2024, February 19).

The research identified four main purposes for conducting a risk analysis:

- to establish project funding requirements when budgeting or obtaining spending authorization;
- to assess the highest risk elements at different stages of the project to plan mitigation measures;
- to return excess contingency funds during project implementation to more profitable use in other areas;
- to set a "high bar" for the project team.

For construction companies in the design and tender stages, the general risks are related to the design approval and cost estimation, as well as the preparation of a cost plan within realistic limits. Therefore, at the stage of preparation for the provision of construction services or the production of building materials, it is very important to manage all project risks and organize the design according to the task, as well as minimize the increase in the budget.

The key factors for calculating risk are the deviation from the initially determined value (cost) and the probability that such a deviation may occur. If the estimated cost of construction work is A, the maximum expected variation has the value B with probability C, then the expected cost D is calculated using the following formula:

$$A + BC = D.$$

This formula is an example of using a statistical method for risk assessment with a limited amount of data, which should determine the gradation of risk in the range from minimal to catastrophic. Along with the statistical method, construction companies also use expert assessment, cost-effectiveness analysis, and scenario analysis methods to assess project risks. The first of these is based on the involvement of qualified evaluators who are experts in various fields of activity and can provide a competent assessment of each relevant risk. The expert assessment method is used specifically to obtain quantitative values of economic indicators that arise as a result of stochasticity (Tugay et al., 2024). The biggest drawback of this assessment method is the human factor, which does not allow it to be used without combining it with other specified methods. In turn, the cost-effectiveness analysis method provides an opportunity to understand whether

it is worth spending money on risk minimization measures at all. This method requires the accounting of information about the cost of the project, which indicates the relative simplicity of its implementation (Shurda, 2020). Scenario analysis allows us to consider different scenarios and their consequences for projects. Its disadvantage is its long duration, which also affects the increase in the cost of the project itself being analyzed. This method is usually integrated into the financial planning process (Malykhina et al., 2024).

An important component of risk management in construction companies is the creation of a risk register. The risk register is a document that must be updated regularly, as it is one of the key documents in the project. It should describe all risks and all risk management actions to reduce or control risks. For all risks, the response can be acceptance, reduction, transfer or avoidance. It is important for an employee or department working with risks to propose actions to management based on the current situation during the project. Each risk should be assigned to a specific owner, and a completion date should be determined for each risk, which personalizes them and makes employees more responsible in performing their job duties.

3. Prospects for the development of project risk management and assessment in the construction industry in Ukraine

Ukrainian construction companies are characterized by their conservatism in the context of using the latest technologies or methodologies. The reason for this is the low level of customer orientation, which is due to the lack of competition, and a large number of government orders. The relatively low wages in the construction sector of Ukraine are also a factor in the lack of interest in it by foreign companies. Despite this, since most infrastructure construction projects demonstrate stochasticity, nonlinear probabilistic artificial intelligence (AI) models are dominant for risk assessment (Dekker, 2013). Hybrid methods based on AI algorithms have been widely used for risk assessment in complex projects over the past decade. The popularity of these methods has been a consequence of the shortcomings demonstrated by classical methods of project risk assessment in construction companies.

AI algorithms are the basis for neural networks, which generally provide more accurate results of project risk assessment compared to other traditional methods. This is due to the fact that neural networks are able to demonstrate nonlinear relationships between risk factors, which is extremely important for the implementation of large construction projects characterized by uncertainty in risk information (Afzal, 2021). Therefore, the prospects for the development of project risk management and assessment of enterprises in the construction industry of Ukraine relate to the use of ready-made automated systems based on AI algorithms. They can analyze huge amounts of data to predict potential risks and delays, analyze historical project data,

weather conditions, employee behavior, and equipment performance to identify patterns and anomalies that may signal potential risks. AI also provides a comprehensive risk assessment by assessing the probability and impact of identified risks, which allows developing more accurate and proactive mitigation strategies. AI tools can automatically create and adjust project schedules based on real-time data, reducing employee effort and ensuring efficient task completion.

Thus, with limited financial resources and minimal time, the latest technologies make it possible to mitigate risks in advance, stopping serious problems that can critically affect the economic activities of enterprises in the construction industry of Ukraine. This, in turn, can slow down the decline of the domestic economy during the post-war reconstruction period. Although the use of such automated systems does not require programming knowledge, their configuration is a task for information technology specialists, which will require enterprises to increase the number of qualified workers and exchange experience between them. All this indicates the possibility of implementing these processes only in parallel with the creation of a favorable remuneration regime at domestic enterprises in the construction industry and conditions for career growth.

Conclusions

The research confirmed the hypothesis of a positive cumulative effect of the use of innovative technologies in the process of managing and assessing project risks of construction enterprises, which contributes to increasing personnel remuneration and creating conditions for career growth as important factors of the competitiveness of any modern enterprise.

Among the main features of assessing project risks of construction enterprises, a high degree of uncertainty and stochasticity of factors were identified, which reveals the result as a set to which a statistical method is applied. Such significant methods of assessing project risks of construction enterprises were identified as the human factor and durability, which affect the final cost of projects. It was found that the functioning of construction enterprises has its own characteristics in Ukraine. This is an orientation towards government orders, a high level of market monopolization and the lack of competition with foreign companies in the domestic market.

The scientific novelty of the article lies in describing the prospects for the development of management and assessment of project risks of enterprises in the construction industry of Ukraine, identifying factors that hinder their implementation, including the lack of customer orientation and low wages, which hinders the improvement of the technical qualifications of enterprise employees.

The authors' contribution to solving this practical problem is the recommendation to use automated systems based on AI algorithms, because the neural networks that use them are able to assess risks independently and provide their own solution to level the impact or mitigate the consequences

of risks. The need for such automated systems is argued by the fact that, unlike classical methods of assessing project risks, they are able to demonstrate nonlinear relationships between risk factors.

Future scientific research should determine the prospects for the development of management and assessment of project risks of enterprises in the construction industry of Ukraine in the context of the development and further application of methodologies that can become the basis for training neural networks for the purpose of their automation. Since these methodologies will be built on the basis of the use of several methods, the main issue of future scientific research should be the rules for their hybridization to create the most effective methodologies.

REFERENCE / СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ

Afzal, F., Yunfei, S., Nazir, M., & Bhatti, S. M. (2021). A review of artificial intelligence based risk assessment methods for capturing complexity-risk interdependencies: Cost overrun in construction projects. *International Journal of Managing Projects in Business*, *14*(2), 300–328. https://www.emerald.com/insight/content/doi/10.1108/ijmpb-02-2019-0047/full/html

Bahamid, R. A., Doh, S. I., Khoiry, M. A., Kassem, M. A., & Al-Sharafi, M. A. (2022). The current risk management practices and knowledge in the construction industry. *Buildings*, *12*(7). https://doi.org/10.3390/buildings12071016

Ching, W. C., Mohd Rahim, F. A., & Chuing, L. S. (2021). Enterprise Risk Management and Risk Culture in Construction Public Listed Companies. *Journal of construction in developing countries*, *26*(2), 17–36. https://doi.org/10.21315/jcdc2021.26.2.2

Dekker, S. W. (2013). Drifting into failure: Complexity theory and the management of risk. In *Chaos and complexity theory for management: Nonlinear dynamics*, 241–253. IGI Global. https://sidneydekker.stackedsite.com/wp-content/uploads/sites/899/2013/01/DekkerDriftRiskChapter2013.pdf

Deneka, V., Fenyk, V., Torbych, A., & Kryvulya, R. (2024). Management of the innovative potential of construction industry enterprises in the context of digitalization. *Academic Visions*, (27), 1–9. https://academy-vision.org/index.php/av/article/ view/936	Денека, В., Феник, В., Торбич, А., & Кривуля, Р. (2024). Управління інноваційним потенціалом підприємств будівельної галузі в умовах цифровізації. *Академічні візії*, (27), 1–9. https://academy-vision.org/index.php/av/article/view/936

Drabkova, Z., & Pech, M. (2022). Comparison of Creative Accounting Risks in Small Enterprises: The Different Branches Perspective. *E&M Economics and Management*, *25*(1), 113–129. https://doi.org/10.15240/tul/001/2022-1-007

European Business Association. (2024, August 12). Challenges and prospects of the construction industry of Ukraine – discussion of the study on the readiness of the construction materials market for the reconstruction of Ukraine. https://surl.li/vnrmbb	European Business Association. (2024, 12 серпня). *Виклики та перспективи будівельної індустрії України – обговорення дослідження стосовно готовності ринку будівельних матеріалів до відбудови України*. https://surl.li/vnrmbb
Fenyk, V., Deneka, V., & Sadovyak, M. (2024). Economic security of construction industry enterprises under martial law. *Academic Visions*, (29), 11–16. https://doi.org/10.5281/zenodo.10695549	Феник, В., Денека, В., & Садовяк, М. (2024). Економічна безпека підприємств будівельної галузі в умовах воєнного стану. *Академічні візії*, (29), 11–16. https://doi.org/10.5281/zenodo.10695549

Fortune Business Insights. (2025, March 17). *Market Segmentation – Construction Materials Market*. https://www.fortunebusinessinsights.com/segmentation/construction-materials-market-107415

Gebczynska, M., & Piwowarczyk, D. (2022). Success Factors in Project Management on the Example of a Selected Construction Industry Enterprise. *Organizacja i Zarządzanie: kwartalnik naukowy*, *1*(57), 25–40. https://doi.org/10.29119/1899-6116.2021.57.3

Holovatska, S. I. (2018). Methodological aspects of accounting and information support for risk-oriented management of a construction enterprise. *Entrepreneurship and Trade*, (23), 70–76. https://doi.org/10.36477/2522-1256-2018-23-12	Головацька, С. І. (2018). Методичні аспекти обліково-інформаційного забезпечення ризик-орієнтованого управління будівельним підприємством. *Підприємництво і торгівля*, (23), 70–76. https://doi.org/10.36477/2522-1256-2018-23-12
Illyashenko, O., Morar, Ye., & Andriyenko, A. (2024). Modeling of business processes for profitability management of construction industry enterprises. *Economy and Society*, (68). https://doi.org/10.32782/2524-0072/2024-68-176	Ілляшенко, О., Морар, Є., & Андрієнко, А. (2024). Моделювання бізнес-процесів управління прибутковістю підприємств будівельної галузі. *Економіка та суспільство*, (68). https://doi.org/10.32782/2524-0072/2024-68-176

Kaplan, S. (n. d.). *Mastering the Construction Materials Industry: Overcoming Challenges with Digital Solutions*. Praxie.com. https://praxie.com/challenges-in-construction-materials-industry/

Kryvdyk, M., & Aleksiyenko, O. (2023). Peculiarities of strategic development management of construction industry enterprises in times of crisis. *Development Service Industry Management*, (3), 127–133. https://doi.org/10.31891/dsim-2023-3(20)	Кривдик, М., & Алексієнко, О. (2023). Особливості управління стратегічним розвитком підприємств будівельної галузі в умовах кризи. *Development Service Industry Management*, (3), 127–133. https://doi.org/10.31891/dsim-2023-3(20)
Leonova, S., Rudnyk, L., & Basarab, N. (2024). Formation of effective marketing strategies by construction industry enterprises in the conditions of post-war recovery. *Economy and Society*, (69). https://doi.org/10.32782/2524-0072/2024-69-151	Леонова, С., Рудник, Л., & Басараб, Н. (2024). Формування ефективних маркетингових стратегій підприємствами будівельної галузі в умовах повоєнного відновлення. *Економіка та суспільство*, (69). https://doi.org/10.32782/2524-0072/2024-69-151
Lytvak, D. Ya., & Velychko, L. (2021). Managing the development of the economy of construction industry enterprises. *Young Scientist*, *5*(93), 367–371. https://doi.org/10.32839/2304-5809/2021-5-93-71	Литвак, Д. Я., & Величко, Л. (2021). Управління розвитком економіки підприємств будівельної галузі. *Молодий вчений*, *5*(93), 367–371. https://doi.org/10.32839/2304-5809/2021-5-93-71

MacKinnon, I. (2024, February 19). *Guide to Risk Management in Construction*. CHAS. https://www.chas.co.uk/blog/chas-guide-risk-management-construction/

Malykhina, O., Malyarenko, O., Storozhuk, O., Davydenko, O., Chernenko, M., Rachkivska, K., & Gorbach, M. (2024). Formation of the organizational and economic component of the construction development toolkit: modern approaches to managing the interaction of construction stakeholders. *Spatial Development*, (10), 568–581. https://doi.org/10.32347/2786-7269.2024.10.568-581	Малихіна, О., Маляренко, О., Сторожук, О., Давиденко, О., Черненко, М., Рачківська, К., & Горбач, М. (2024). Формування організаційно–економічної складової інструментарію будівельного девелопменту: сучасні підходи до управління взаємодією стейкхолдерів будівництва. *Просторовий розвиток*, (10), 568–581. https://doi.org/10.32347/2786-7269.2024.10.568-581

Mo, G. B., Xu, K., & Dong, K. L. (2023). Extreme Climate Risk and Financial Performance in the Construction Industry: Empirical Evidence from Listed Companies in China. *Journal of Risk Analysis and Crisis Response*, *13*(3), 185–198. https://doi.org/10.54560/jracr.v13i3.383

Naumkin, A., & Kiporenko, I. (2025). Economic security of construction enterprises: essence and significance. *Research and Innovations*, *1*(4), 69–76. https://rni.com.ua/index.php/ri/article/view/50	Наумкін, А., & Кіпоренко, І. (2025). Економічна безпека підприємств будівельної сфери: сутність та значення. *Дослідження та інновації*, *1*(4), 69–76. https://rni.com.ua/index.php/ri/article/view/50
Naychuk-Khrushch, M., & Shchur, T. (2023). The role and importance of successful project financing for the innovative development of an enterprise (on the example of an enterprise in the construction industry). *Economy and Society*, (58). https://doi.org/10.32782/2524-0072/2023-58-88	Найчук-Хрущ, М., & Щур, Т. (2023). Роль та значення успішного фінансування проєктів для інноваційного розвитку підприємства (на прикладі підприємства будівельної галузі). *Економіка та суспільство*, (58). https://doi.org/10.32782/2524-0072/2023-58-88
Opendatabot. (n. d.). *Rating of the best enterprises in the construction industry of Ukraine by revenue in 2025*. https://opendatabot.ua/c/index/2024/construction	Опендатабот. (б. д.). *Рейтинг кращих підприємств будівельної галузі України за виторгом у 2025 році*. https://opendatabot.ua/c/index/2024/construction

Ovsiyenko, N. (2021). Peculiarities of marketing activities of construction industry enterprises. *Economy and Society*, (26). https://doi.org/10.32782/2524-0072/2021-26-26	Овсієнко, Н. (2021). Особливості маркетингової діяльності підприємств будівельної галузі. *Економіка та суспільство*, (26). https://doi.org/10.32782/2524-0072/2021-26-26
Shurda, K. E. (2020). Methods of qualitative and quantitative risk analysis. *Sustainable Nature Management*, (4), 64–72. https://doi.org/10.33730/2310-4678.4.2020.226622	Шурда, К. Е. (2020). Методи якісного та кількісного аналізу ризиків. *Збалансоване природокористування*, (4), 64–72. https://doi.org/10.33730/2310-4678.4.2020.226622
Sokolovska, K., & Kasych, A. (2022). Trends in the development of construction industry enterprises. *Economy and Society*, (41). https://doi.org/10.32782/2524-0072/2022-41-34	Соколовська, К., & Касич, А. (2022). Тенденції у розвитку підприємств будівельної галузі. *Економіка та суспільство*, (41). https://doi.org/10.32782/2524-0072/2022-41-34
Tu, P. A., Toan, D. X., Hanh, N. K., Le Duyen, C. T., & Huong, D. T. (2023). The impact of the Covid-19 pandemic on the business performance of construction industry enterprises in Can Tho City. *Journal of Law and Sustainable Development*, *11*(12), 1–23. https://doi.org/10.55908/sdgs.v11i12.1751	
Tugay, O., Dvornichen, I., Oliynyk, V., Zyakhor, D., & Molodko, O. (2024). Using theoretical and applied tools for optimizing investment and construction projects. *Ways to improve construction efficiency*, *1*(54), 156–163. https://doi.org/10.32347/2707-501x.2024.54(1).156-163	Тугай, О., Дворнічен, І., Олійник, В., Зяхор, Д., & Молодько, О. (2024). Використання теоретико-прикладного інструментарію для оптимізації інвестиційно-будівельних проєктів. *Шляхи підвищення ефективності будівництва*, *1*(54), 156–163. https://doi.org/10.32347/2707-501x.=2024. 54(1).156-163
Tyurina, N. M., Nazarchuk, T. V., & Bakay, A. A. (2023). Managing the Competitiveness of Construction Organizations. *Innovation and Sustainability*, (1), 213–221. https://doi.org/10.31649/ins.2023.1.213.221	Тюріна, Н. М., Назарчук, Т. В., & Бакай, А. А. (2023). Управління конкурентоспроможністю будівельних організацій. *Innovation and Sustainability*, (1), 213–221. https://doi.org/10.31649/ins.2023.1.213.221
Zhovtyak, H. A., & Volokhova, I. V. (2020). State and prospects for the development of enterprises in the construction industry of Ukraine. *Scientific notes of V. I. Vernadsky TNU*, *6*(70), 50–55. Series: Economics and Management. https://doi.org/10.32838/2523-4803/70-6-8	Жовтяк, Г. А., & Волохова, І. В. (2020). Стан та перспективи розвитку підприємств будівельної галузі України. *Вчені записки ТНУ імені В. І. Вернадського,* *6*(70), 50–55. Серія: Економіка і управління. https://doi.org/10.32838/2523-4803/70-6-8

Conflict of interest. The authors certify that they have no financial or non-financial interest in the subject matter or materials discussed in this manuscript; the authors have no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript. Given that two of the authors are affiliated with the institution that publishes this journal, which may cause potential conflict or suspicion of bias and therefore the final decision to publish this article (including the reviewers and editors) is made by the members of the Editorial Board who are not the employees of this institution.

The authors received no direct funding for this study.

Bai, S., & Bukhanenko, I. (2025). Management of project risks for construction industry enterprises. *Scientia fructuosa, 6*(164), 83–95. http://doi.org/10.31617/1.2025(164)06

Received by the editorial office 28.04.2025.
Accepted for printing 01.07.2025.
Published online 16.12.2025.