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**MAIN DIRECTIONS OF INNOVATIVE ACTIVITY OF CONSTRUCTION
ENTERPRISES**

Ihor Ivanytsky, Postgraduate

<https://orcid.org/0009-0008-3267-8015>

e-mail: ihor.b.ivanytskyi@lpnu.ua

Lviv Polytechnic National University, Ukraine, Lviv

Roman Zhyshko, Postgraduate

<https://orcid.org/0009-0002-1087-7466>

e-mail: roman.r.zhyshko@lpnu.ua

Lviv Polytechnic National University, Ukraine, Lviv

Introduction. In the current conditions of globalization and technological revolution, the construction industry is undergoing significant changes that require rethinking traditional approaches to the organization of production processes. The growth of requirements for quality, environmental friendliness, and energy efficiency of construction projects necessitates the implementation of innovative solutions at all stages of the project life cycle. Innovative activity is becoming not just a competitive advantage, but a prerequisite for the successful development of construction enterprises. However, the lack of a comprehensive approach to the classification of innovation areas in construction hinders the effective implementation of innovation strategies.

Purpose. The main purpose of this study is to analyze existing scientific approaches to the classification of innovation areas in the construction sector, systematize the main areas of innovation by key characteristics (technological, economic, social, environmental, infrastructure) and develop practical recommendations for activating the

innovative activity of construction enterprises in the context of digitalization and growing environmental challenges.

Materials and methods. The work used methods of content analysis of scientific publications, comparative analysis of various approaches to the classification of innovations, methods of systematization and generalization. To achieve the set goal, modern scientific research on the topic of innovative activity in construction was processed.

Results. As a result of the study, it was determined that the main areas of innovative activity of construction enterprises are: technological innovations; economic innovations; social innovations; environmental innovations; infrastructure innovations.

Prospects. Further research should be aimed at developing specific models for implementing innovations at construction enterprises of various scales, assessing the economic efficiency of individual innovative solutions, studying the features of managing innovative activities in small and medium-sized construction companies. It is also important to study the impact of digitalization on changing the employment structure in the construction industry and identifying opportunities for forming sustainable urban environments using the latest construction technologies.

Keywords: *innovation, construction, technological innovation, green construction, digitalization of the construction industry.*

аспірант, Іваницький Ігор, аспірант Жишко Роман Основні напрями інноваційної діяльності будівельних підприємств / Національний університет «Львівська політехніка», Україна, Львів

Вступ. У сучасних умовах глобалізації та технологічної революції будівельна галузь зазнає істотних змін, що вимагають переосмислення традиційних підходів до організації виробничих процесів. Зростання вимог до якості, екологічності, енергоефективності будівельних об'єктів зумовлює необхідність

впровадження інноваційних рішень на всіх етапах життєвого циклу проєктів. Інноваційна діяльність стає не просто конкурентною перевагою, а обов'язковою умовою успішного розвитку будівельних підприємств. Проте відсутність комплексного підходу до класифікації напрямів інновацій у будівництві стримує ефективну реалізацію інноваційних стратегій.

Мета. Основною метою даного дослідження є аналіз існуючих наукових підходів до класифікації напрямів інноваційної діяльності в будівельній сфері, систематизація основних напрямів інновацій за ключовими ознаками (технологічною, економічною, соціальною, екологічною, інфраструктурною) та розробка практичних рекомендацій щодо активізації інноваційної діяльності будівельних підприємств в умовах цифровізації та зростання екологічних викликів.

Матеріали і методи. У роботі використано методи контент-аналізу наукових публікацій, порівняльного аналізу різних підходів до класифікації інновацій, методи систематизації та узагальнення. Для досягнення поставленої мети були опрацьовані сучасні наукові дослідження з тематики інноваційної діяльності в будівництві.

Результати. У результаті проведеного дослідження було визначено, що основними напрямами інноваційної діяльності будівельних підприємств є: технологічні інновації; економічні інновації; соціальні інновації; екологічні інновації; інфраструктурні інновації.

Перспективи. Подальші дослідження мають бути спрямовані на розроблення конкретних моделей впровадження інновацій на будівельних підприємствах різного масштабу, оцінку економічної ефективності окремих інноваційних рішень, вивчення особливостей управління інноваційною діяльністю у малих і середніх будівельних компаніях. Важливими є також дослідження впливу цифровізації на

зміну структури зайнятості у будівельній галузі та виявлення можливостей для формування стійких міських середовищ за допомогою новітніх будівельних технологій.

***Ключові слова:** інновації, будівництво, технологічні інновації, екологічне будівництво, цифровізація будівельної галузі.*

Problem statement. In today's conditions of rapid changes in the technological environment and growing requirements for the quality and energy efficiency of buildings, innovative activity is becoming a key factor in the development of construction companies. The construction industry, which was traditionally considered quite conservative, is currently experiencing a period of deep transformation. The use of the latest technologies, the introduction of digital solutions, the use of environmentally friendly materials and methods of "green" construction are becoming not only a competitive advantage, but also an objective necessity for the successful operation of companies in the market.

Innovative development directions cover all stages of the construction process - from design and preparation for construction to the operation of facilities. The use of BIM technologies (Building Information Modeling), 3D printing, process automation, energy-efficient systems, as well as the integration of sustainable development principles are setting new standards in the construction industry. Innovative project management is also gaining particular importance, which allows you to optimize costs, reduce work deadlines and improve the quality of the final product.

The relevance of the study is due to the need to find effective mechanisms for introducing innovations into the activities of construction enterprises, taking into account the growing competition in the domestic and international markets. A systematic approach to the development and implementation of innovation strategies is the key to increasing the

competitiveness of enterprises, their financial stability and compliance with modern challenges.

Analysis of recent research and publications. Stelmashchuk A.M. determines that “Directions for the development of innovative activity of enterprises in the construction industry should be based on the principles and methods of innovation activity itself, and also take into account the technological features of construction enterprises” [1, p. 65]. Zinchenko M.M., summarizing numerous studies, notes that the main directions of innovative activity of construction enterprises are grouped into the following groups: “technological, involving the development and implementation of new technologies for the production of building materials and structures, aimed at optimizing the construction process: reducing the construction cycle; improving the material and technical base; improving the quality of building structures and materials; economic, ensuring the investment attractiveness of construction and the profitability of enterprises; social, creating conditions for meeting consumer needs, preserving architectural monuments, increasing the share of social housing; environmental, improving the environmental safety of production, reducing harmful impacts on the environment and people; infrastructural, creating conditions for the formation of institutional structures for innovative support of production activities - from the creation of a scientific and technical idea to the production and implementation of science-intensive products and technical solutions” [2, p. 168].

Romanova L., Grigierman E. identify the following main modern directions of innovation in construction as "the development of ecological construction, compliance with global energy efficiency standards, implementation of the vector for digitalization, in particular, the concept of a "smart" house, the use of new "smart" materials and innovative construction

technologies, including 3D construction technologies, the development of new approaches to design, etc." [3, p. 99].

Thus, attempts have been made to generalize the list of the main directions of innovations in construction in modern conditions, depending on the various goals of the research. However, in the economic literature, more attention is paid to technological, environmental and partly - infrastructure innovations in construction. However, there is no comprehensive approach to the characterization of the main directions of innovations in construction by specific groups.

Formulation of the objectives of the article (statement of the task). The purpose of this article is to comprehensively determine the main directions of innovation activity of construction enterprises in modern conditions of transformation of the world economy, increasing requirements for environmental friendliness, energy efficiency and manufacturability of construction processes. The study is aimed at generalizing existing approaches to the classification of innovations in construction and developing a systemic vision of the development of innovation processes in the industry.

To achieve the goal, the following tasks are defined in the article:

- to analyze existing scientific approaches to the classification of innovation directions in construction;
- systematize the main areas of innovation activity according to technological, economic, social, environmental and infrastructure characteristics;
- offer recommendations for activating innovation activity in the construction sector in the context of global digitalization and environmental challenges.

Presentation of the main material. Based on the systematization of the analyzed approaches, a generalized structure of the main directions of innovative activity of construction enterprises was formed:

Technological innovations include the introduction of new construction technologies, for example, 3D printing of structural elements, the use of BIM modeling (Building Information Modeling) at all stages of the object's life cycle, the use of "smart" materials with improved properties. Technological innovations contribute to reducing construction times, improving the quality of structures, and reducing operating costs [4].

Economic innovations are associated with the search for new financial instruments for construction, optimizing costs for design and implementation of facilities, developing public-private partnership models, and attracting investments for the implementation of energy-efficient solutions. Digital platforms for managing investment projects are gaining particular importance.

Social innovations involve the development of housing construction with an orientation towards social programs, preserving historical heritage, and increasing the accessibility of housing for the general population. Such innovations also include the creation of a comfortable urban environment through the implementation of smart city concepts and urban spaces.

Environmental innovations are becoming an integral part of construction projects, given the growing demands for sustainable development. The use of energy-efficient materials, zero-carbon technologies, water reuse systems, and the implementation of "green" construction principles are areas that are gaining strategic importance in the international construction business[5].

Infrastructure innovations are aimed at creating conditions for continuous support of the innovation cycle - from scientific developments to their implementation in production practice. This includes the development

of clusters of construction innovations, investments in research and development centers, and the development of educational programs for training new generation personnel.

The results of the analysis allow us to conclude that innovation activities should cover all components of the construction process and be an integrated part of the enterprise's development strategy. An important aspect of efficiency is the combination of different types of innovations within the framework of comprehensive business modernization programs.

Therefore, it is advisable for most construction companies in Ukraine to implement a set of measures to activate innovative activity in the construction sector:

- Creation of internal innovation units at construction companies to coordinate the search, adaptation and implementation of new technologies.
- Active use of digital platforms for project management, progress monitoring, communication with customers and contractors.
- Formation of partnerships with research institutions to develop and implement innovative solutions.
- Implementation of energy management systems at construction sites to achieve energy efficiency standards.
- Development of employee competencies focused on mastering digital tools and principles of sustainable construction.

Thus, the innovative activity of construction companies should become a basic prerequisite for their competitiveness and adaptability in the global environment. Unlike existing approaches, the work focuses on the need to integrate all types of innovations into a single strategy for the transformation of construction enterprises.

Conclusions and prospects for further research. The study has established that innovation is a key factor in increasing the competitiveness of construction enterprises in modern conditions of digital transformation

and increasing environmental challenges. The systematization of areas of innovation activity according to technological, economic, social, environmental and infrastructural characteristics has made it possible to propose a comprehensive approach to the development of innovations in the construction industry. Innovations should cover the entire life cycle of a construction project - from design to operation - and be based on the principles of sustainable development, effective resource management, the use of digital technologies and flexible management.

The scientific novelty of the study lies in the fact that the proposed structure of innovation areas allows taking into account multidirectional factors of the industry's development and integrating them into the development strategies of construction enterprises.

Prospects for further research include developing mechanisms for adapting construction companies to the conditions of the digital economy, assessing the economic efficiency of implementing innovative technologies, developing partnership models with scientific institutions, and analyzing the impact of digitalization on changing the professional structure of employment in the construction sector. Another important area is the study of the impact of environmental innovations on the formation of sustainable cities and the development of "smart" urbanism.

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