UDC 338.45

MANAGEMENT OF INNOVATIVE ACTIVITY OF ENTERPRISES IN THE CONTEXT OF DIGITAL TRANSFORMATION

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The article is devoted to the study of the theoretical and practical aspects of managing innovative activity in enterprises within the context of digital transformation. The purpose of the article is to substantiate the theoretical and methodological foundations of managing innovative activity of enterprises under digital transformation conditions and to identify factors affecting the efficiency of the innovation process.

The historical development of innovation management theory has been examined, from classical linear models to modern digital models that address the challenges of the Fourth Industrial Revolution. The necessity of integrating digital technologies, including artificial intelligence, the Internet of Things, cloud computing, and big data, into all stages of the innovation cycle is substantiated, which ensures increased flexibility, speed, and scalability of innovative activity. A comparative analysis of innovation management models, "technology-push," "market-pull," interactive, open, and digital models has been provided, considering their characteristics, advantages, and limitations. It was found that the digital model, which actively uses digital platforms and ecosystems, is the most effective under conditions of rapid change and high technological dynamics.

The study identified key aspects of digital transformation in innovation management, including the integration of digital tools (ERP, CRM, AI, and big data), the network nature of innovation interactions, the transformation of corporate culture, and the development of new managerial competencies. It is established that successful digital transformation requires a high level of digital maturity of enterprises and investments in digital infrastructure.

The article also presents factors that restrain innovative activity in the digital era, based on the example of Ukraine. Their analysis highlights the complexity of problems hindering the effective implementation of innovation in Ukraine. Insufficient funding for R&D limits the ability to develop new products and technologies, directly affecting an enterprise's competitiveness. The use of outdated technologies reduces product quality and increases operational costs, worsening enterprises' market positions. Poor digital infrastructure quality creates significant barriers to digital transformation, restraining the development of modern management and production practices. The absence of a clear innovation policy at the company level results in a lack of a systematic approach and demotivates personnel from participating in innovation activities.

Keywords: management, innovation management, digital transformation, innovative activity, digital technologies, open innovation, digital competencies.

https://doi.org/10.31891/mdes/2025-16-41

Стаття надійшла до редакції / Received 11.04.2025
Прийнята до друку / Accepted 04.05.2025

PROBLEM STATEMENT

Modern economic conditions are characterized by the rapid development of digital technologies, which radically change the business environment and the principles of functioning of enterprises. Processes. The need to integrate digital tools, data analytics, automation, cloud services, and artificial intelligence into the innovation management system is becoming urgent. At the same time, new challenges arise related to organizational culture, digital maturity of personnel, and management risks, which determine the relevance of the study.

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

The issue of managing innovation activity in the context of digital transformation is thoroughly examined in modern scientific research. Chesbrough substantiated the concept of open innovation, which involves the active use of both external and internal sources of knowledge to enhance the efficiency of innovation processes and accelerate their implementation [2]. Tidd, J., and Bessant, J. emphasize the need to integrate technological, market, and organizational changes in innovation management, highlighting the role of digital technologies in transforming business models and operational processes [3].

Porter M.E. and Heppelmann J.E. described the impact of smart technologies and interconnected products on the transformation of enterprises, which opens new opportunities for innovation through the collection and analysis of large amounts of data [4]. J. West and M. Bogers focused their work on the current state of open innovation, digital platforms, and collaborative networks [5].

Domestic researchers also pay considerable attention to this topic, as noted by Grynko T. V., Kozik V. A. analyzed the problems of managing the innovative development of industrial enterprises in Ukraine, drawing attention to the need to modernize the technological base and improve the management system [6]. Illiashenko S.M. considered the theoretical foundations of innovation management, emphasizing the importance of the strategic approach and competencies of managers [7]. L. Hr. Melnyk, O. M. Matsenko, and others explored the economic aspects of digital transformations, emphasizing the transition from linear to non-linear thinking and the development of innovation potential [8]. Tomakh V. V., Sigaeva T. E. and

Martynenko M. V. emphasized the role of digital technologies in the sustainable development of Ukrainian enterprises, focusing on creative and innovative solutions and the transformation of management practices [9].

The purpose of this study is to substantiate the theoretical and methodological foundations of managing innovation activities in enterprises within the context of digital transformation and to identify factors that affect the efficiency of the innovation process.

To achieve this goal, it is necessary to systematize innovation management models, analyse the impact of digital technologies on the innovation cycle, and investigate barriers and drivers of innovation activity in the Ukrainian business environment.

PRESENTATION OF THE MAIN RESULTS OF THE STUDY

Under the current conditions of digital transformation, the management of innovation activities within enterprises is undergoing significant changes due to the introduction of new technologies, growing competition, changing business models, and an increasing role for digital data. Innovations become the basis of a competitive strategy, and their effective management is a prerequisite for the sustainable development of enterprises in a dynamic environment. The successful functioning of companies increasingly depends on their ability to quickly generate, implement, and scale innovative solutions using digital technologies, including artificial intelligence, the Internet of Things, cloud computing, and big data.

Innovation activity is considered a holistic process of creating, developing, implementing, and commercializing new products, processes, or organizational solutions. Classical approaches to innovation management were developed in the works of J. Schumpeter, who was the first to link innovation with economic growth, highlighting the entrepreneur as the carrier of innovative breakthroughs [1].

The historical development of the theory of innovation management reflects the constant complication of the economic environment, increased competition, and the growing role of technological changes—initial ideas about the innovation process centered on technological breakthroughs that triggered changes in production and the market. However, with the shift in management paradigms, digitalization, and the strengthening of global integration processes, traditional models of innovation management have undergone significant transformation.

At the beginning of the development of the theory of innovations, linear models were distinguished, which predicted a sequence of actions without considering feedback. In the "technology-push" model, innovation activity is initiated by research departments, and new products are developed as a result of technological breakthroughs. In the "market-pull" model, on the other hand, the source of innovations is the market, specifically the needs of consumers, which determine the direction of product development. Such models were suitable for stable environments but proved ineffective in situations of rapid change.

In response to the limitations of the linear approach, an interactive model was developed, which accounts for the relationships between all stages of the innovation process and incorporates constant market feedback. This approach is considered more flexible because it takes into account the interaction between departments, consumers, partners, and the external environment.

The concept of open innovation, proposed by Chesbrough [2], was of revolutionary importance for the development of innovation theory. It involves the active use of both internal and external sources of knowledge as well as cooperation with universities, startups, incubators, and external technology developers. This approach enables businesses to minimize research and development costs, accelerate innovation, and adapt to changing market conditions.

The final stage of evolution was the digital model of innovation management, a response to the challenges of the Fourth Industrial Revolution (Industry 4.0). It involves the integration of digital technologies into all stages of the innovation cycle, from generating an idea to scaling and commercializing it. The use of cloud computing, artificial intelligence, big data, the Internet of Things (IoT), blockchain solutions, and digital twins provides the ability to quickly analyze, identify trends, create digital prototypes, and personalize products. At the same time, the digital model transforms the structure of innovation activities within the enterprise, requiring the introduction of agile management methods (such as Scrum), digital cooperation platforms, and a new organizational culture focused on constant change.

Table 1 presents a generalization of the characteristics of models for managing innovation activity in enterprises.

Table 1

Models of management of innovation activity of enterprises

Model	Distinctive feature	A source of innovation	Management features	Disadvantages
«Technology-push»	Innovation is initiated by scientific research	Research centers, laboratories	Sequential planning: scientific development, then production, then marketing	Lack of feedback from the market
«Market-pull»	The market forms the need for innovation	Consumers, market demand	Market research then product development	Limited innovation, focus only on meeting existing needs
Interactive	Interaction of all stages of the innovation process	Internal environment, external market	Feedback between research, production and market	High coordination complexity
Open innovation	Cooperation with external sources of knowledge	Partners, universities, startups	Innovation Management in Open Networks	Risks of knowledge leakage, the complexity of IP protection
Digital Innovation Model	Integration of digital technologies into all stages of the innovation process	Big Data, Digital Platforms, AI, IoT	Digital Transformation, Agile Governance, Use of Digital Ecosystems	The need for digital infrastructure and digital literacy

Source: systematized by the author according to [2-6]

The systematization of existing models of innovation management has revealed the evolution of approaches from simple linear schemes to complex digital ecosystems. Traditional models of "technology-push" and "market-pull" demonstrate limited flexibility and an insufficient ability to adapt to changes in the external environment, particularly technological changes. The open innovation model has become a logical response to the challenges of globalization, providing enterprises with the opportunity to attract external knowledge and partners; however, it also exacerbates the problems of intellectual property protection. The digital model of innovation, which is now becoming dominant, offers the highest level of integration, flexibility, and scalability in innovation activities through the use of digital technologies. At the same time, it requires a high level of digital maturity in the enterprise, the presence of digital competencies among the staff, and significant investments in infrastructure.

Therefore, digital transformation has radically changed the conceptual foundations of innovation management, transforming it from a linear, isolated process into a dynamic, open, technologically integrated system. The essence of digital transformation lies in the deep introduction of digital technologies into all areas of enterprise functioning, which leads to a rethinking of managerial approaches, including in the field of innovation [8-9]. In such conditions, innovation management requires taking into account several new features due to both technological and organizational factors.

In the context of digital transformation, tools and conceptual approaches to innovation management are changing. This requires a reevaluation of the roles of technology, organizational culture, interaction structure with the external environment, and personnel competencies. Digital tools create new opportunities for an enterprise's innovative potential. However, at the same time, they necessitate the introduction of new management models based on the principles of openness, flexibility, and interdisciplinarity. A generalization of the aspects of innovation management in the context of digital transformation is presented in Table. 2.

Table 2

Aspects of Innovation Management in the Context of Digital Transformation

Management aspect	Essence	Expected effect
Digital Integration	The use of ERP, CRM, Big Data, cloud services, blockchain, artificial intelligence in management processes. Providing analytical support and automation of the innovation cycle	Transparency, speed and accuracy of management decisions, identification of new market opportunities, risk reduction
Network nature of innovation	Interaction with external innovative actors: universities, startups, IT companies, venture funds. Formation of open innovation ecosystems, joint development and exchange of innovations	Expanding sources of ideas, accessing technology, reducing costs and accelerating the innovation cycle
Transformation of corporate culture	Fostering a culture of flexibility, tolerance to error, openness to change, support for experimentation and an interdisciplinary approach. Stimulation of creativity, self-organization, team interaction	Increasing the adaptability of the organization, stimulating the innovative activity of personnel
New managerial competencies	The need for digital literacy, proficiency in analytical tools, understanding of artificial intelligence technologies, agile, lean, design thinking methodologies, etc.	Strengthening the efficiency of managers, reducing the digital divide, increasing readiness for transformation

Source: improved by the author

Let us consider each of the above aspects in detail:

the integration of digital technologies into the innovation process management system involves the use of ERP systems, CRM platforms, big data analytics, cloud services, blockchain, and artificial intelligence, which allows for transparency, efficiency, and accuracy in managerial decision-making; the identified digital tools contribute to increasing the efficiency of the implementation of innovative projects, more accurate identification of market opportunities, adaptation to changes in consumer demand, and assessment of risks and forecasting the impact of innovations;

the network nature of the innovation process, which involves the involvement of modern enterprises in interaction with innovation ecosystems (universities, research centers, technology startups, IT companies, accelerators, incubators, venture funds, etc.); cooperation allows you to reduce the time and cost of developing innovations, expand sources of ideas, access to new technologies and markets, which forms an environment of open innovations;

profound shifts in the corporate culture of enterprises, which require enterprises to be ready for constant change, accept uncertainty, support experimentation, and tolerance for errors; a new paradigm of innovation culture is being formed based on flexibility, transparency, learning orientation, inclusivity, and interdisciplinarity;

The need to form new management competencies involves digital literacy, knowledge in the field of data processing, the use of analytical platforms, an understanding of the principles of working with artificial intelligence, and knowledge of agile management methodologies (Agile, Lean, Design Thinking, Scrum).

Empirical data confirm the relevance of the above aspects. According to a study by Deloitte, more than 70% of companies that actively implemented digital innovations reported an increase in operational efficiency, cost reduction, and improved customer experience. At the same time, the presence of a digital strategy, agile teams, and cross-functional collaboration are defined as powerful drivers of success [10].

In Ukrainian realities, the digital transformation of innovation activity is only at the initial stage. According to the State Statistics Service, the share of innovatively active industrial enterprises in 2023 was only 16.5%, which indicates a low level of involvement in the innovation process [11]. Among the primary constraints, it is necessary to highlight the insufficient level of R&D funding, outdated technologies, poor quality of digital infrastructure, and the lack of a formulated innovation policy at the company level (Table 3). Additionally, a gap exists between supply and demand for digital competencies, exacerbating the personnel shortage problem in innovation management.

Table 3

Constraints on innovation in the digital age

Factor	Description	Consequences for enterprises
Insufficient level of R&D funding	Limited funding for research and development, which hinders the development of innovations	Lack of new products and technologies, loss of competitive advantages, slowdown of the innovation process
Outdated technologies	Use of morally and technically obsolete equipment and methods that reduce competitiveness	Decrease in product quality, increased costs, inability to adapt to market changes
Poor quality of digital infrastructure	Insufficient development of IT systems, network solutions, weak Internet coverage and digital barriers	Limiting the possibilities of digital transformation, reducing the efficiency of data management and processing
Lack of a clear innovation policy	Insufficient strategic planning and support for innovations at the level of enterprises and organizations	Lack of a systematic approach to innovation, chaotic actions, low motivation of employees to innovate

Source: improved by the author

Overcoming the identified obstacles will contribute to increasing the innovation potential of enterprises, enhancing their competitiveness, and facilitating integration into global innovation ecosystems. To achieve this, it is necessary to implement comprehensive measures that include financial support, technological modernization, digital infrastructure development, and the formulation of an effective innovation strategy within enterprises.

CONCLUSIONS

In the current era of digital transformation, the management of innovation activities within enterprises is undergoing profound changes, driven by the introduction of advanced digital technologies, shifts in business models, and the increasing importance of digital data. "Technology-push" and "market-

pull" to interactive, open, and digital models that better meet the challenges of today. The digital innovation model integrates artificial intelligence, the Internet of Things, cloud computing, and big data technologies, ensuring high flexibility, scalability, and speed in innovation processes.

The effectiveness of digital transformation in Ukraine is constrained by several factors, including insufficient R&D funding, outdated technologies, weak digital infrastructure, and the absence of a clear innovation policy at the enterprise level. These obstacles lead to a slowdown in innovative development, loss of competitive advantages, and a decrease in overall innovation activity. Therefore, to increase innovation potential, it is necessary to implement an integrated approach that includes developing digital competencies, modernizing technologies, creating favorable conditions for cooperation in innovation ecosystems, and forming an effective innovation strategy at the enterprise level.

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УПРАВЛІННЯ ІННОВАЦІЙНОЮ ДІЯЛЬНІСТЮ ПІДПРИЄМСТВ В УМОВАХ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ

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Статтю присвячено вивченню теоретичних та практичних аспектів управління інноваційною діяльністю підприємств в умовах цифрової трансформації. Стаття має на меті обґрунтувати теоретико-методичні засади управління інноваційною діяльністю підприємств в умовах цифрової трансформації, та виявити чинники, що впливають на ефективність інноваційного процесу.

Досліджено історичний розвиток теорії інноваційного менеджменту, починаючи з класичних лінійних моделей та до сучасних цифрових моделей, що відповідають викликам четвертої промислової революції. Обґрунтовано необхідність інтеграції цифрових технологій: штучний інтелект, інтернет речей, хмарні обчислення та великі дані, у всі етапи інноваційного циклу, що забезпечує підвищення гнучкості, швидкості та масштабованості інноваційної діяльності. Порівняльно моделі управління інноваціями: «technology-push», «market-pull», інтерактивної, відкриту та цифрову моделі, з урахуванням їх особливостей, переваг і обмежень. Виявлено, що цифрова модель, яка активно використовує цифрові платформи та екосистеми, найбільш ефективна в умовах швидких змін і високої технологічної динаміки. Дослідження дозволило виявити аспекти цифрової трансформації управління інноваційною

діяльністю: інтеграцію цифрових інструментів (ERP, CRM, AI, big data), мережевий характер інноваційної взаємодії, трансформацію корпоративної культури та формування нових управлінських компетенцій. Встановлено, що успішна цифрова трансформація вимагає високого рівня цифрової зрілості підприємств та інвестицій у цифрову інфраструктуру.

В статті також наведено чинники стримування інноваційної діяльності в цифрову епоху на прикладі України. Їх аналіз вказав на комплексність проблем, що перешкоджають ефективному впровадженню інновацій в Україні. Недостатнє фінансування НДДКР обмежує можливості для розробки нових продуктів і технологій, що безпосередньо впливає на конкурентоспроможність підприємств. Використання застарілих технологій знижує якість продукції і збільшує операційні витрати, погіршуючи позиції підприємств на ринку. Низька якість цифрової інфраструктури створює суттєві перепони для цифрової трансформації, що стримує розвиток сучасних управлінських і виробничих практик. Відсутність чіткої інноваційної політики на рівні компаній призводить до відсутності системного підходу і демотивує персонал до інноваційної діяльності.

Ключові слова: управління, управління інноваціями, цифрова трансформація, інноваційна діяльність, цифрові технології, відкриті інновації, цифрові компетенції.