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STRATEGIC APPROACHES TO THE DIGITAL TOOLS APPLICATION BY ENTERPRISES IN INDUSTRY 4.0 ENVIRONMENT

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Key words:
Industry 4.0, digital strategy, digital transformation, digital tools, business processes, automation, artificial intelligence, innovation.

Strategic approaches to the implementation of digital tools by enterprises in the context of Industry 4.0 are investigated in this paper. The authors substantiate the importance of digital transformation as a comprehensive process including intellectualization, automation, integration of artificial intelligence, the Internet of Things, Big Data, cloud technologies and digital platforms.
The evolution of scientific approaches to the formation of digital strategy, its role in increasing the competitiveness of enterprises and adaptation to the dynamic digital environment are considered. The concept, essence, purpose, main objectives and main tools for implementing the digital strategy of enterprises are investigated. The main tools of digital transformation such as: digital marketing, digitalization of business processes, online presence, e-commerce, and busines- flexibility management are identified
Particular attention is paid to the analysis of successful digitalization examples among Ukrainian companies, including PrJSC «Ternopil Dairy Plant», LLC «Agroprod-service», LLC «Nova Poshta» and LLC «Leoni Wiring Systems UA GmbH», which indicates the ability of Ukrainian enterprises to adapt to the challenges of the digital economy. The strategic application of digital tools is considered not only as a technological innovation, but as an integrated management concept that ensures increased efficiency of business processes, flexibility to changes in the external environment, and the formation of long-term competitive advantages.
The model for implementing the digital strategy is proposed. This model includes five key stages: assessment of the digital readiness of the enterprise, strategic vision formation, development and implementation of digital solutions, their integration into operational activities, monitoring and adjustment of the strategy.
It is emphasized in this paper that the formation and implementation of the digital strategy should be considered as systemic and interdisciplinary process that covers not only technological, but also economic, organizational, social, and personnel aspects of enterprise development in the digital era.

СТРАТЕГІЧНІ ПІДХОДИ ДО ВИКОРИСТАННЯ ЦИФРОВИХ ІНСТРУМЕНТІВ ПІДПРИЄМСТВАМИ В УМОВАХ ІНДУСТРІЇ 4.0

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Ключові слова:
Індустрія 4.0, цифрова стратегія, цифрова трансформація, цифрові інструменти, бізнес-процеси, автоматизація, штучний інтелект, інновації.

У статті досліджено стратегічні підходи до впровадження цифрових інструментів підприємствами в умовах Індустрії 4.0. Автори обґрунтовують важливість цифрової трансформації як комплексного процесу, що охоплює інтелектуалізацію, автоматизацію, інтеграцію штучного інтелекту, інтернету речей, великих даних, хмарних технологій та цифрових платформ.
Розглянуто еволюцію наукових підходів до формування цифрової стратегії, її роль у підвищенні конкурентоспроможності підприємств та адаптації до динамічного цифрового середовища. Досліджено поняття, сутність, мету, основні цілі та основні інструменти реалізації цифрової стратегії підприємств.

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Визначено основні інструменти цифрової трансформації: цифровий маркетинг, діджиталізація бізнес-процесів, присутність в Інтернеті, e-commerce та управління бізнес-гнучкістю.
Особливу увагу приділено аналізу прикладів успішної цифровізації українських компаній, серед яких ПрАТ «Тернопільський молокозавод», ТОВ «Агропрод-сервіс», ТОВ «Нова пошта» та ТОВ «Леоні Ваерінг Системс УА ГмбХ», що свідчить про здатність українських підприємств адаптуватися до викликів цифрової економіки. Стратегічне використання цифрових інструментів розглядається не лише як технологічна інновація, а як інтегрована управлінська концепція, що забезпечує підвищення ефективності бізнес-процесів, гнучкість до змін зовнішнього середовища та формування довгострокових конкурентних переваг.
Запропоновано модель реалізації цифрової стратегії, що включає п'ять ключових етапів: оцінка цифрової готовності підприємства, формування стратегічного бачення, розробка й впровадження цифрових рішень, їх інтеграція в операційну діяльність, моніторинг та коригування стратегії.
У статті підкреслено, що формування та реалізація цифрової стратегії має розглядатися як системний та міждисциплінарний процес, який охоплює не тільки технологічні, а й економічні, організаційні, соціальні та кадрові аспекти розвитку підприємства в умовах цифрової епохи.

Statement of the problem

Under modern conditions of dynamic development of the global economic space and growing competition between business entities in the world market, the formation of effective strategic approaches to the implementation of digital technologies is of particular importance. This is due to the transformational processes caused by the Fourth Industrial Revolution – Industry 4.0, which significantly changes the paradigm of the enterprise operation, reorienting their activities towards intellectualization, automation, digitalization of business processes and the use of cyber-physical systems.

In the context of the rapid development of innovative technologies, particularly artificial intelligence, the Internet of Things (IoT), cloud computing, Big Data, machine learning, and blockchain technologies, there is an urgent need for comprehensive understanding of the strategic principles of digital transformation. These principles should take into account not only technological, but also organizational, economic, social, and legal aspects of implementing digital tools in the production and management activities of enterprises in various industries.

The relevance of this investigation is caused by the need of national business to adapt to the new challenges of the digital era, optimize management decisions in the digital environment, increase the level of competitiveness and innovative capacity of enterprises by developing effective strategic guidelines and application of modern digital tools as a key factor in ensuring sustainable development in the context of Industry 4.0.

Analysis of available researches and publications

A number of scientists have studied the strategic guidelines for the application of digital tools by enterprises in the context of Industry 4.0. It is necessary to note among them the works by Ostrovska H.Y., Ostrovskyi O.T. [1], Klevtsevych N.A. [2], Melnyk L.H., Karintseva O.I., Kalinichenko L.L., Kharchenko M.O., Tarasenko S.V. [3], Chernikov D.I., Hryshko S.V. [4], Zubkov A., Maigurova D., Misiunia R. [5], Shynkovych A.V., Vasylieva N.B., Romanenko O.V. [6] and others. Each of the above mentioned scientists presented their own scientific research on defining strategic approaches to the application of digital tools by enterprises. In particular, Ostrovska H.Y. and Ostrovskyi O.T. [1] note the specifics of digital transformation in modern conditions, emphasizing its key features, including: new wave of technological development, growing demand for digital technologies, shortening the life cycle of technologies, new impulses of digitalization due to the consequences of the COVID-19 pandemic, the growing importance of knowledge culture as well as technological and social risks.

The authors of the study emphasize that in the future, the priority areas of technological development that will attract significant attention from the industrial sector will be neurotechnology, artificial intelligence, innovative wireless communication tools, advanced manufacturing technologies, as well as virtual and augmented reality technologies. In the context of these trends, the digital transformation of industry will gradually evolve towards the development of flexible, highly adaptive, efficient and decentralized networked production, based on digital platforms capable of integrating all participants in the value chain into a single functional ecosystem.

Scientist N.A. Klevtsevych [2] investigated the evolution of modern approaches to business process management in the context of digitalization, focusing on their classification according to the level of change radicality – from gradual to innovative. She substantiated that the key competitive advantages of the enterprise are ensured by integrated management of resources and business processes based on digital technologies.

The team of scientists [3] carried out comprehensive investigation of the digital transformation of business processes in the Ukrainian economy, focusing on the adaptation of Ukrainian and foreign enterprises to the latest technological changes. They analyzed key strategies, tools, and stages of implementing digital innovations in various industries, taking into account industry specifics

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and the needs of business models. The main challenges of digitalization are outlined and the role of the state and stakeholders in creating favorable environment for sustainable digital business development in the future is defined.

Chernikov D.I. and Hryshko S.V. [4] studied the specifics of implementing Industry 4.0 and Industry 5.0 technologies, focusing on the development of the system of strategic risks that arise during the implementation of digitalization projects at enterprises of the key sectors of the Ukrainian economy. Within their study, they analyzed the key factors in the development of both concepts and proposed the approach to systematizing strategic risks, covering eight classes of such risks. An important result of the study is the identification of the characteristics of each type of risk, including technological, financial, brand-related, personnel, and hybrid impact risks, which makes it possible for enterprises to manage threats during the digital transformation process more effectively.

Zubkova A., Maigurova D., and Misiunia R. [5] carried out a comprehensive scientific research dedicated to the comparative analysis of the key characteristics of Industry 4.0 and Industry 5.0 focusing on technological tools enabling the digital transformation of international enterprises. In their research, the authors identified common and distinctive features between two industrial concepts, described the possibilities of using innovative software in various industries, and analyzed modern challenges associated with the implementation of the latest technologies. Special attention in the research is paid to the integration of artificial intelligence, automation, and human-machine interaction as defining components of Industry 5.0, which opens new prospects for incresing the efficiency and flexibility of manufacturing processes in the global business environment.

Researchers – scientists Shynkovych A. V., Vasilieva N. B. and Romanenko O. V. [6] carried out thorough research of innovative approaches to enterprise management in the context of digital transformation, focusing on strategies for adapting business to dynamic technological changes. In their research, the authors analyzed the impact of digital technologies – such as artificial intelligence, the Internet of Things, automation, and Big Data – on the formation of modern business models, the optimization of operational processes, and the enhancement of enterprises' digital resilience. They proved that the integration of innovation strategies focused on digitalization contributes to enhancing business competitiveness and creates the foundation for its long-term development in the context of external environmental challenges.

Summarizing the main researches and publications on the investigated topic, it should be noted that scientists pay significant attention to the analysis of the enterprise digital transformation, investigation of Industry 4.0 and 5.0 features, as well as determination of strategic directions for the application of digital technologies in business process management.

The researches cover a wide range of aspects: from the classification and evaluation of business models to risk management, from the industry-specific features of digitalization to the creation of adaptive organizational environment. Carried out analyses indicate the presence of various scientific approaches to understanding the essence of digital transformations, in particular through the prism of innovative development, technological integration, and strategic management. The emphasis is placed on the importance of implementing digital platforms, artificial intelligence, the Internet of Things, automation, and data analytics as key tools for increasing enterprise efficiency in the digital age.

At the same time, problems related to the practical implementation of strategic approaches to the use of digital tools by enterprises in the context of Industry 4.0 remain insufficiently developed. In particular, the problems of integrating digital solutions into business processes, taking into account industry specifics, organizational culture, and the level of digital maturity of enterprises, require further consideration. It is also important to carry out in-depth investigation of the mechanisms for developing, implementing, and evaluating the effectiveness of digital strategies in conditions of high external environment turbulence, which requires systemic approach and interdisciplinary analysis.

The objective of the scientific investigation is comprehensive justification and development of strategic approaches to the application of digital tools in the context of Industry 4.0, taking into account the latest technological trends, challenges of digital transformation, and the needs of enterprises to improve the efficiency of production, management, and communication processes. This will contribute to the formation of innovation-oriented development model, ensure business flexibility, increase competitiveness at the national and international levels, and create the foundation for sustainable economic growth in the digital economy.

Statement of the task

In order tj achieve the objective set in the scientific research, the following tasks were identified, in particular: determining the essence and content of the digital strategy of the enterprise; studying the purpose, goals and tools used in the formation of the digital strategy of enterprises; determining the specifics of the digital strategy toolkit; presenting examples and features of the use of digital tools in the practice of Ukrainian enterprises; developing a sequence of stages for implementing the digital transformation strategy at the enterprise; determining the advantages of using the model for implementing the digital transformation strategy at the enterprise.

The following methods were used to present the main results of this scientific study: grouping, generalization, comparison, synthesis and analysis, planning, and forecasting.

Presentation of the main research material

In the current context of technological shifts driven by the transition to the Industry 4.0 concept, the strategic use of digital tools is becoming crucial for ensuring the competitiveness of enterprises. Digitalization of business processes, automation of production, integration

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of artificial intelligence, Big Data and the Internet of Things are radically changing approaches to resource management, interaction with consumers and the formation of value chains. In this context, strategic approaches to the implementation of digital technologies should be comprehensive, flexible, and adaptive to the challenges of the dynamic digital environment.

In scientific literature, the term "digital strategy" is distinguished as the basis for implementing digital transformations in the long term.

The research of scientific approaches to the concept of "digital strategy" indicates a variety of interpretations that reflect different aspects of its formation and implementation in the activities of enterprises. Let us consider each of the presented approaches and give our own assessment of their significance.

According to the definition of Matt S., Hess T., and Benlian A., digital strategy is understood as the identification of future business opportunities through the integration of new digital technologies. This approach emphasizes the role of technology as a key driver of enterprise transformation, enabling the development of long-term competitive advantages. In our opinion, the presented approach is fundamental, as it defines digital strategy as the basis of innovative development. However, it should be supplemented with analysis of the impact of digital changes on organizational processes and the human factor.

Ismail M., Khater M., and Zaki M. consider digital strategy as transforming the enterprise into digital organization with personalized approach to customers and data-driven decision-making. This approach focuses on digital interaction and business adaptability to changes in the external and internal environment. The presented approach reflects current trends in customer-centric and analytics-driven business and is relevant for enterprises striving for flexibility and competitiveness.

Voskoboieva O., Romashchenko O., Kirzhetska M., and Kirzhetskyi Yu. interpret digital strategy as a component of corporate strategy that is integrated into the operational and functional strategies of the enterprise. This approach emphasizes the need to align digital initiatives with the overall business strategy to ensure synergy. Such integration is critically important for the integrity of strategic management, as it avoids fragmentation and ensures the comprehensive development of the organization.

The approach by Panchuk A.S. and Malkova K.O. considers the digital strategy of the enterprise as the process of coordinating the digitalization of key areas of activity – business models, customer experience and operational processes carried out taking into account the overall strategic direction. The main aim of this approach is to create or increase the value of products, services and solutions in the context of the digital economy. This approach has comprehensive and systemic nature, as it recognizes that digital transformation is not limited to the implementation of individual technologies, but is coordinated change in all key areas of an enterprise activities. Special attention is paid to customer experience, which meets modern market requirements, where individualization and quality of interaction with the customer determine competitiveness.

Summarizing the approaches of the scientist, it should be noted that digital strategy is comprehensive approach to planning and implementing digital technologies and tools aimed at achieving the strategic goals of the enterprise, optimizing business processes, and increasing its competitiveness in the conditions of digital market transformation. Digital strategy encompasses the selection of technological solutions, organizational changes, and management practices that enable more effective adaptation to the rapidly changing technological environment and maximize value creation for all stakeholders.

The goal of implementing the digital strategy is to ensure the enterprise competitiveness through the comprehensive digital transformation of its business models, operational processes, and customer experience, taking into account modern technological trends and the requirements of the digital economy. All above mentioned involves not only the implementation of the latest digital tools, but also the optimization of the company activities to create added value and increase efficiency.

At the same time, the main goals of ensuring the implementation of the digital strategy at Ukrainian enterprises are:

– increase of the operational flexibility and adaptability of the enterprise to the external environment changes;

– integration of digital technologies into key business processes for automation and optimization of operations;

– improvement of customer experience by personalization of products and services, as well as the development of digital interaction channels;

– creation of new income sources due to innovative digital products and services;

– strengthening market positions by improving the quality, speed and transparency of business processes;

– ensuring digital security and managing risks associated with digital transformation.

The goals of digital strategy for small business enterprise will be achieved due to its key tools (Fig. 1) [10, pp. 12–13]: digital marketing; digitalization of business processes; online presence; e-commerce; and business agility management.

Let us consider the features of using each of the tools in the digital strategy of enterprises in detail. In particular, digital marketing involves the use of various digital channels and technologies to attract the target audience, build a positive image, and increase sales. The peculiarity of digital marketing is the ability to target consumers precisely and make optimal use of the marketing budget.

Digitalization of business processes includes the implementation of information technologies to automate, optimize, and increase the transparency of an enterprise internal operations. It contributes to the increase of operational efficiency, costs reduction, and improvement of management decisions.

Online presence is necessary condition for ensuring communication with customers and partners, increasing brand awareness, and expanding market opportunities; at

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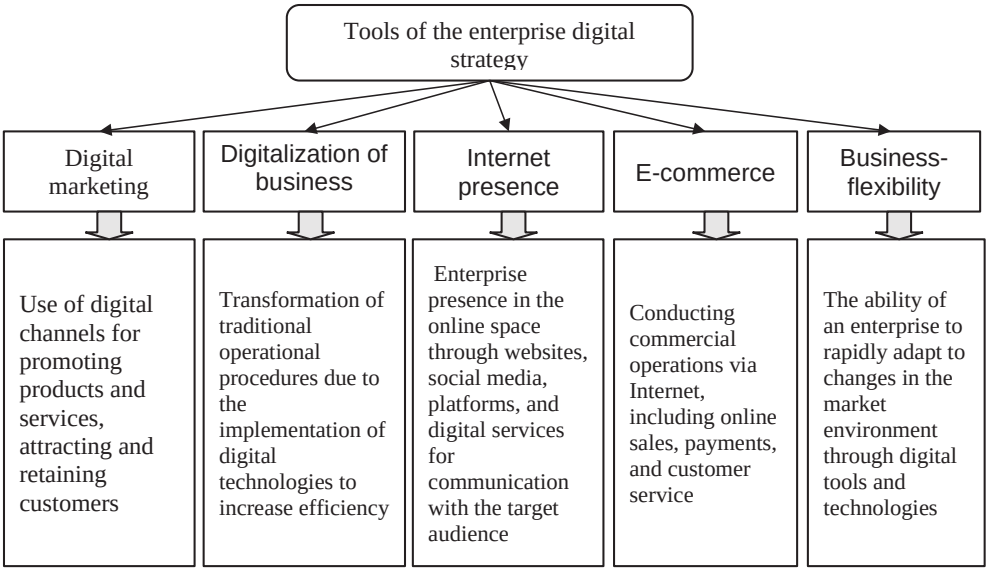

Fig. 1. Types of enterprise digital strategy tools [10, p. 13]

the same time it includes website development, activity on social networks, and the use of other digital platforms.

E-commerce involves organization of the sale of goods and services through Internet channels, which contributes to the expansion of the customer base and optimization of the sales processes. An important component is the selection of appropriate digital platforms and services for payment processing and logistics.

Business agility management involves creation of the digital environment that enables rapid adaptation to changes in both external and internal conditions due to the digital integration of business models, processes, and offerings, thereby ensuring the stability of the enterprise in of market instability conditions.

Accordingly, the application of the above mentioned digitalization tools is a decisive factor for the successful operation and development of various enterprises in the modern conditions of Industry 4.0.

Positive examples of implementing digital strategy using digitalization tools are already actively applied in the activities of Ukrainian enterprises and indicate gradual transition of businesses toward the innovative development model. Thus, the well-known Ukrainian PrJSC "Ternopil Dairy Plant" [12] implemented an ERP system, automated quality control and CRM, making it possible to improve control over production processes, increase product quality and the efficiency of interaction with customers. The use of IoT for monitoring the quality of dairy products has become particularly important.

LLC "Agroprod-Service" [13] implemented precision farming, the use of Big Data for agroanalytics, and automation of document management, thereby optimizing production costs and significantly increasing crop yields.

One of the leaders in digital transformation in the service sector is LLC "Nova Poshta" [14], which has implemented ERP system, mobile application, automated sorting terminals, and digital addresses. This has significantly increased the speed of parcel processing, minimized errors, and ensured a high level of service for customers.

The logistics aspects of digitalization were highlighted at "Leoni Wiring Systems UA GmbH" [15], where the implementation of automated lines, digitization of warehouses and logistics, as well as the use of AI analytics, optimized costs and minimized production delays.

The given examples demonstrate that the strategic implementation of digital technologies not only enhances the internal efficiency of enterprises but also creates long-term competitive advantages for these companies in the market.

To stimulate the development of digital strategy in Ukrainian enterprises, it is necessary to create comprehensive mechanism that provides gradual, step-by-step implementation of digital transformations, taking into account industry specifics, the level of digital maturity, available technical infrastructure, human resources, and the financial capacity of the business entity. Such approach will not only minimize the risks associated with technological upgrades but also ensure the effective use of digital tools at each stage of strategy implementation. The defining stages of implementing the enterprise digital transformation strategy are presented in Fig. 2.

At the first stage, the initial assessment of the company's readiness for digital transformation is carried out. It includes diagnosing existing business processes, IT infrastructure, digital resources, and personnel competencies. The goal of this stage is to identify strengths and weaknesses, barriers, and potential for implementing digital technologies. Analysis of the internal environment of the enterprise is carried out, the degree of process automation, the level of digital tools use, and the availability of the necessary personnel are determined.

At the second stage, strategic vision for the enterprise digital development is formed. It is based on the in-depth analysis of the market, consumer expectations, competitor behavior, and current industry trends. At the same time, key

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areas of digital development are developed, strategic goals, priorities, and performance indicators are determined. It is important that the digitalization strategy aligns with the overall mission and long-term development goals of the enterprise.

At the third stage, specific digital solutions are developed and implemented in order to optimize processes and enhance competitiveness. Such solutions may include enterprise resource planning (ERP) systems, customer relationship management (CRM), e-commerce platforms, cloud services, Big Data analytics, Internet of Things (IoT), artificial intelligence, etc. The choice of tools depends on the specifics of the company activities and available resources.

The fourth stage involves the integration of digital tools into the daily activity of the enterprise. This requires changes of the internal procedures, adaptation of the organizational structure, and the development of employees' digital skills. Special attention is paid to employee training and professional development, as well as to changing corporate culture in favor of openness to innovation, flexibility and creativity. Digitalization tools should become an integral part of operational activities.

At the final, fifth stage, monitoring and evaluation of the results of digital transformation are carried out. The achieved indicators are regularly monitored, the effectiveness of the implemented solutions is analyzed, and areas for further improvement are identified. If necessary, the digital development strategy is adjusted according to changes in the external environment, market conditions, or internal challenges. Continuous monitoring ensures the adaptability of the digital strategy and its sustainability in the long term.

Such logic for digital strategy development provides a number of key advantages for enterprises implementing digital transformation processes, among which the following should be highlighted:

– formation of holistic and phased management model makes it possible to optimize the resource distribution, ensuring more effective investment in the implementation of digital technologies and to minimize the risks of financial losses;

– systematic approach to digital transformation promotes increased flexibility and adaptability of the enterprise to rapidly changing market conditions and technological trends, and is critically important for maintaining competitiveness;

– integration of modern digital tools into business processes improves the quality of management decision-making due to access to up-to-date analytical data and automation of routine operations, and as a result contributes to increased productivity and reduced operating costs;

– consistent implementation of the stages of the digital strategy ensures systematic staff training, forming digital competence culture, and serves as the foundation for the introduction of innovations and further development of the enterprise;

– such management model contributes to the formation of long-term partnerships with customers, suppliers and other stakeholders, due to the transparency of business processes and the increase in the level of service, which significantly increases the reputation and trust of the company in the market.

Accordingly, the implementation of the structured strategic model of digital transformation is strategically important factor in ensuring sustainable development, innovation, and stable growth of Ukrainian enterprises.

Conclusions

Summarizing the results of the investigation, it should be noted that in modern conditions digital strategy is

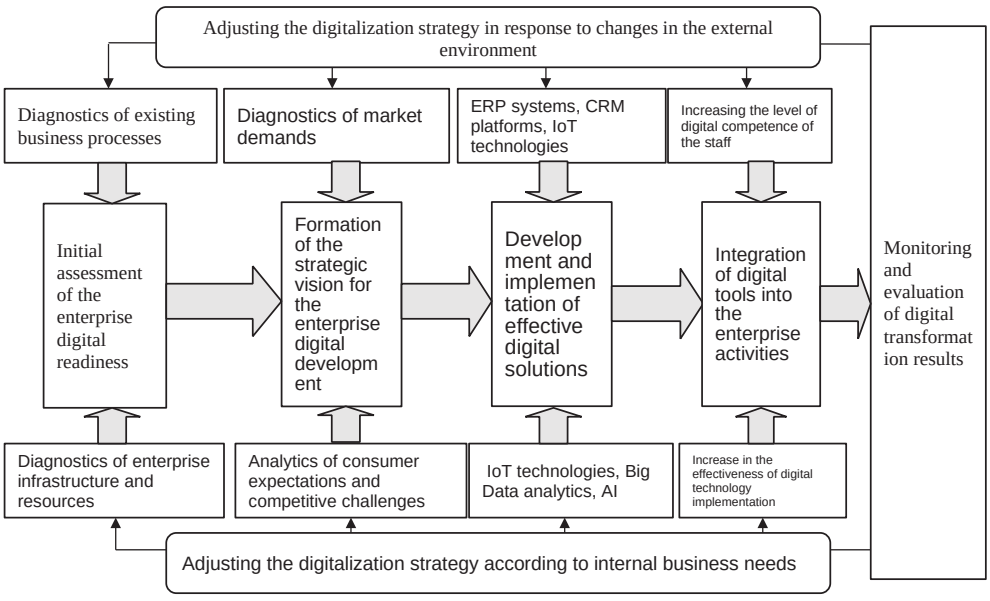

Fig. 2. Main stages of implementing the digital transformation strategy at the enterprise [author's own development]

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considered not only as the implementation of individual technological innovations, but as an integrated system of transformational process management, which ensures the creation of new value for all stakeholders. Successful implementation of digital strategy involves phased approach, which includes: initial assessment of the digital readiness of the enterprise; formation of strategic vision of digital development; development and implementation of appropriate solutions; their integration into operational activities; as well as constant monitoring and adjustment in accordance with internal and external changes.

Five main tools for implementing the digital strategy have been identified: digital marketing, digitalization of business processes, online presence, e-commerce and business agility management. Their application contributes to process automation, cost optimization, improvement of customer service quality, creation of new sales channels and increased flexibility of the enterprise.

Practical examples of the implementation of digital strategies in the activities of Ukrainian companies (PrJSC "Ternopil Dairy Plant", LLC 'Agroprod-service", LLC "Nova Poshta", LLC "Leoni Wiring Systems UA GmbH") confirm the effectiveness of digital transformation in the context of increased productivity, improved product and service quality, strengthened market positions and reduced operational risks.

To stimulate the development of digital strategy, mechanism and sequence of its implementation are proposed. This implementation includes several stages: initial assessment of the enterprise's readiness for digital transformation, formation of strategic vision for the enterprise's digital development, development and implementation of effective digital solutions, integration of digital tools into the enterprise's activities, monitoring and evaluation of the results of digital transformation. This sequence of stages makes it possible to ensure systematic and consistent approach to digital transformation, minimize organizational and technological risks, optimize the use of resources, and achieve consistency between the enterprise's strategic goals and implemented digital solutions. Each stage serves as logical component of the single process that contributes to the formation of adaptive, innovative business environment capable to respond effectively to the challenges of digital economy and to ensure sustainable growth of the enterprise in the long term.

In general, the development and implementation of digital strategy is an integral part of modern strategic management and should be considered as a long-term investment in increasing the innovative potential, efficiency and sustainable enterprise development in the digital economy.

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