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ORGANIZATIONAL AND ECONOMIC MECHANISM OF DIGITAL TRANSFORMATION OF INDUSTRIAL ENTERPRISES

Abstract. *In the article, features of formation of digital transformation of industrial enterprises are examined. Changes that affect industrial enterprises by accelerating or restraining digital transformation are outlined, namely strategic, operational and organizational. The organizational and economic mechanism for digital transformation of industrial enterprises is developed. It is argued that the mechanism structure should contain three key blocks of tools: management tools, financing tools and technical support tools, which effectiveness is determined by efficient use of supporting components and implementation of basic principles of digital transformation. It is argued that management, financing and technical support tools form a triad that ensures successful implementation of digital transformation of the industrial enterprise. It is emphasized that when forming organizational and economic mechanism for digital transformation, industrial enterprises should be guided by the system of principles that determine the approach to implement digital technologies, resource management and development of organizational culture, and are aimed at ensuring consistency, efficiency and sustainability of changes.*

Key words: *organizational and economic mechanism; industrial enterprises; digital transformation; digital technologies; digitalization, management tools, financing tools, technical support tools, Industry 4.0.*
Fig.: 3. References: 22.

Statement of the problem. Digital transformation is complex, multi-dimensional process that combines technological, organizational and economic changes and is one of the key trends in modern industrial development. It involves using digital technologies to fundamentally change business processes, management models and create new opportunities to increase competitiveness of entities of the real sector of the economy. Digital transformation is not only associated with implementation of individual technologies, such as the Internet of Things (IoT), smart contracts, artificial intelligence (AI), machine learning, cloud computing and others,

but is also systemic in nature, encompassing strategic, operational and organizational changes. It is these changes that affect industrial enterprises, accelerating or restraining digital transformation.

Analysis of recent research and publications. Features of digital transformation of industrial enterprises are discussed in the research of the scientists as follows: Bulger M., Taylor G., Homner N., Sakao T., Vogt Duberg J., Hams A., Wing L., Zorchenko N., Van Giffen B., Annanth V., Chimeudeonwo N., Nath S., Zhou K., Lasi H., Schumacher A., Kagermann H., Kiehne I., Bodrov V., Xie I., Li H. and others.

Highlighting unexplored parts of the general problem. Noting significant achievements of scientists on this issue, it should be noted that insufficient attention has been paid to development of organizational and economic mechanism for digital transformation of industrial enterprises, and therefore these issues require further study and analysis.

Purpose of the article is to develop organizational and economic mechanism for digital transformation of industrial enterprises.

Presentation of the main material. In recent years, there has been increasing number of scientific publications that relate to theoretical and applied aspects of implementing new approaches to digital transformation by adapting industrial enterprises to changes caused by the present.

Strategic changes are associated with transformations in high-level plans of the industrial enterprise, including those related to overall direction of development, mission, goals and objectives. In addition, they create the foundation for making and implementing operational and organizational decisions. For example, the strategy of implementing digital business models affects the need to modernize operational processes and train personnel to work with new technologies.

Application of digital technologies at strategic level expands possibilities for creating new business models, such as “data-driven models” (Data-Driven Business Models (DDBM) or Product-as-a-Service (PSM) [1-6]. For example, companies can use big data analytics to identify new market opportunities or create personalized offers for customers.

Operational changes are modifications to day-to-day activities that enable strategic goals to be achieved through improved internal processes and cost reduction. These modifications may include automation of production processes or implementation of data analysis platforms that enable efficiency defined by strategic priorities (Fig. 1).

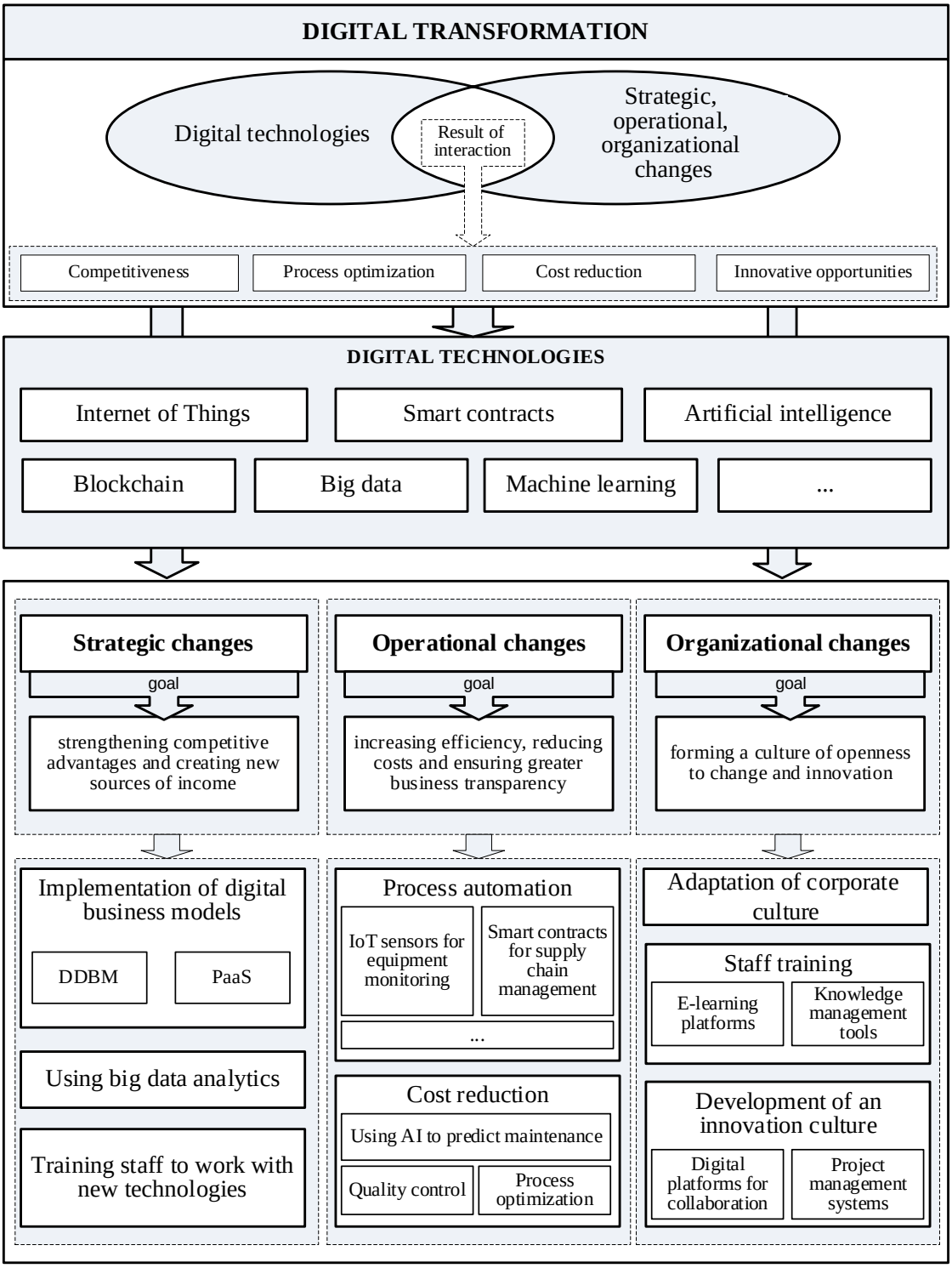

Fig. 1. Essence and content of digital transformation

Source: *developed by authors based on [1-11].*

Digital technologies, including the Internet of Things (IoT), smart contracts, artificial intelligence (AI), and others allow you to automate routine processes, reduce costs, and increase accuracy of task performance. Thus, introduction of IoT sensors into production lines of industrial enterprises allows you to monitor equipment condition involved in production process in real time, preventing breakdowns and downtime.

Smart contracts can be used to automate supply, namely to manage supply chains, automatically initiating payment to suppliers upon receipt of goods or confirmation of their quality, which, among other things, minimizes delays and optimizes use of personnel, and therefore costs incurred by the enterprise.

Artificial intelligence is one of the most promising tools for predictive maintenance, optimization of operational processes in industry, and product quality control. Its use allows reducing costs, increasing efficiency, and improving product quality. For example, General Electric uses AI in its Predix platform to analyze turbine and engine health data, which helps prevent downtime [7; 8]. Siemens uses AI to control production in its factories, which helps reduce energy consumption and improve product quality [9; 10]. BMW uses computer vision systems to inspect car paintwork, which helps reduce errors [11].

Organizational change supports strategic and operational initiatives by ensuring that corporate culture is adapted and staff are trained to embrace digital technologies. Without creating agile organizational environment, even the best strategy or operational optimization will not produce expected results. Digital collaboration platforms, knowledge management systems, and distance learning tools contribute to staff development and formation of innovative corporate culture. For example, using e-learning platforms helps to quickly adapt employees to work with new technologies, and digital project management tools contribute to more effective teamwork.

It is worth noting that effectiveness of digital transformation depends on harmonious interaction of these three components of change, which are interconnected and interdependent. For example, the production automation strategy (strategic aspect) must take into account the need for

new technologies (operational aspect) and training of personnel for their use (organizational aspect). Therefore, it is systemic approach to change that allows industrial enterprises to achieve sustainable success in digital transformation.

Digital transformation of industrial enterprises is one of key conditions for their competitiveness in the context of the Fourth Industrial Revolution (Industry 4.0) [12-15].

The organizational and economic mechanism of digital transformation is essentially practical tool that integrates approaches and models into activities of the enterprise, that is, ensures implementation of models and approaches in practice. In view of this, there is a need to develop the specified mechanism for industrial enterprises capable of ensuring systematic and consistent process of digital transformation aimed at increasing efficiency and competitiveness of the enterprise.

By “organizational and economic mechanism of digital transformation (OEMCT)” we mean the integrated system that combines organizational, economic and technical tools to ensure effective implementation of digital solutions in the activities of industrial enterprises to ensure their sustainable functioning and development.

Defining the key elements of this mechanism allows us to create the structure that promotes harmonization of technologies, management processes and resources. In our opinion, the mechanism structure should include three key blocks of tools (management tools, financing tools and technical support tools), which effectiveness is determined by effective use of supporting components (regulatory, information and resource support), and implementation of the basic principles of digital transformation (Fig. 2).

In the structure of *management tools,* three main blocks were identified (strategic management, operational management, control and monitoring), each of which has its own functional purpose.

Thus, functional purpose of strategic management is to form the long-term digital transformation strategy, identify key priorities (technology, business processes, personnel), and develop the roadmap for implementing digital solutions.

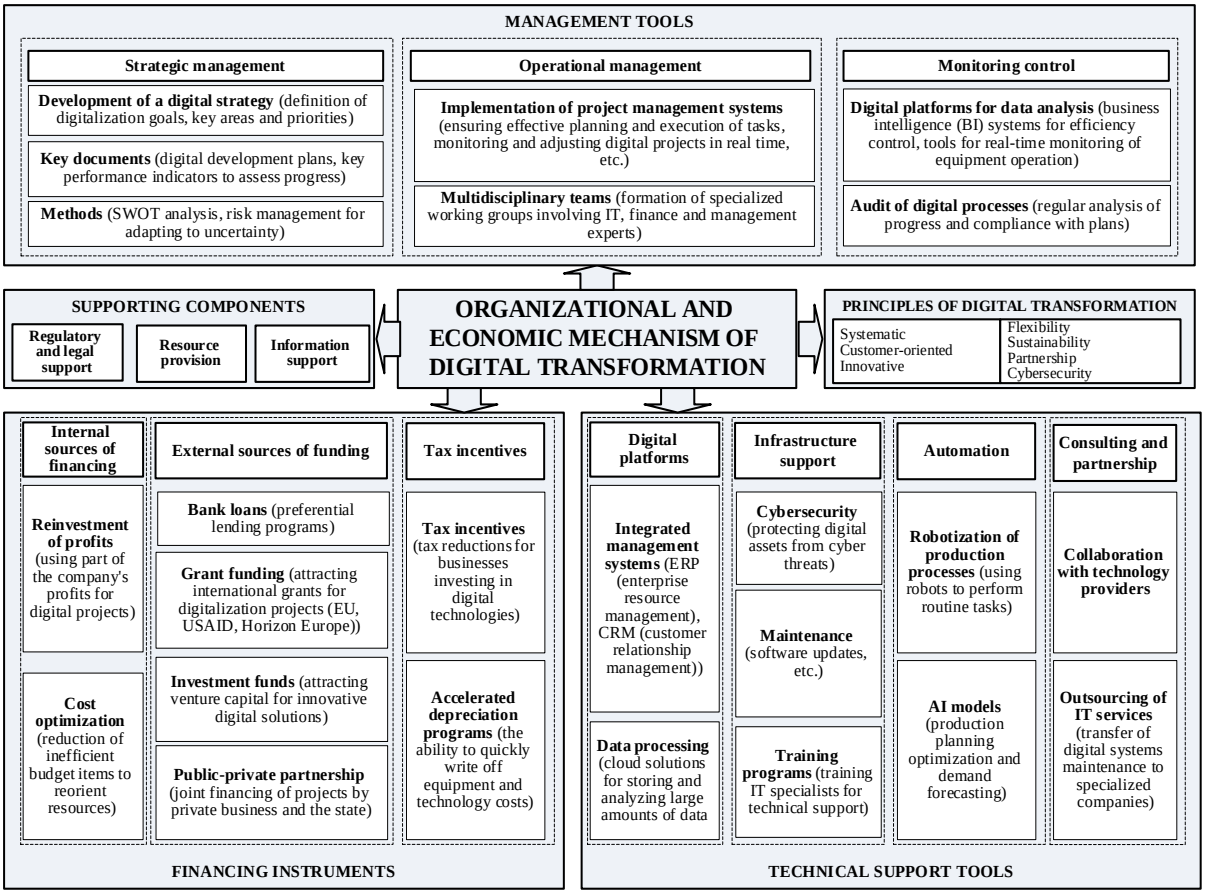

Fig. 2. Organizational and economic mechanism of digital transformation of industrial enterprises

Source: *developed by authors based on [16-22].*

Functional purpose of the operational management unit is to coordinate daily activities related to implementation of digital technologies, allocate resources between projects, manage risks, organize cooperation with technology suppliers and contractors, manage supply chains, create conditions for the organization to adapt to digital changes, work with personnel resistance, and support innovation culture. As for the control and monitoring unit, its functional purpose is to assess progress of projects compared to plans, measure effectiveness of implementation of digital solutions, and analyze data for decision-making.

Generalizing the spectrum of functions of management tools gives grounds to assert that they play the key role in coordinating all stages of digital transformation. This is due to the fact that management tools:

– determine the main goals of digital transformation, priorities and sequence of actions;

– serve as means for adapting the overall strategy to specific conditions of the enterprise;

– ensure consistency between different stages of transformation: from analyzing the current state to integrating digital solutions;

– promote effective interaction between departments, contractors and technology partners;

– support the analysis of large amounts of data to select optimal strategies and technologies;

– allow you to quickly identify deviations from the plan and make timely adjustments;

– project implementation digitalization;

– allow you to assess progress and achievement of key performance indicators (KPIs);

– ensure management of organizational, cultural and technological changes;

– help overcome resistance to change among staff.

In addition, management tools create the basis for strategic planning, coordination between departments, and monitoring results of implementing digital solutions, thereby playing a key role in ensuring consistency, efficiency, and continuity of all stages of digital transformation of industrial enterprises.

Financing instruments are one of key components of the organizational and economic mechanism of digital transformation, providing industrial enterprises with necessary financial resources to implement strategic, operational and organizational changes required by digital transformation. Functional purpose of blocks of financing instruments (external and internal financing, tax incentives) is to attract and distribute financial resources, maintain financial stability of the industrial enterprise, optimize costs, as well as monitor and evaluate efficiency.

Studying functional purpose of blocks of financing instruments allows us to formulate importance of this block of instruments and to formulate their main purpose, which is:

– financial and resource support for transformation;

– ensuring efficient allocation of resources between different projects, digitalization to achieve strategic goals of operation and development of the industrial enterprise;

– using financing instruments to diversify risks associated with implementation of innovative technologies;

– providing access to investment funds, grants and other sources of financing for development and implementation of innovative solutions.

– assessing economic feasibility of digital projects through the analysis of performance indicators.

Financial instruments create financial prerequisites for implementation of modern technologies, support for innovative solutions, and ensure sustainable development of industrial enterprises in the digital economy.

Technical support tools are key to implementation, integration and effective use of digital technologies in industrial enterprises. Functional purpose of these tools is to provide technical basis for implementation of digital solutions, automation of production processes, analytics and data management, cybersecurity and personnel training. Urgency of this group of tools can be formulated as follows. Technical support tools:

– promote integration of the latest technologies into production processes;

– support adaptation of the enterprise to modern technological standards;

– ensure stable functioning of digital platforms, equipment and software;

– prevent technical failures and minimize downtime;

– contribute to automation of routine operations, which allows you to focus on strategic tasks;

– ensure accuracy and speed of operations;

– protect the company's digital assets from cyber threats;

– ensure compliance with regulatory requirements in data protection;

– provide training for employees to work with new technologies;

– support development of digital competencies.

In addition, technical support tools provide fundamental basis for successful implementation of digital innovations by industrial enterprises. They integrate modern technologies into production and management, ensure their stability, security and continuous development, thereby creating competitive advantages for enterprises.

Management, financing, and technical support tools form a triad that ensures successful implementation of digital transformation. Their interrelationship allows you to coordinate transformation, provide it with resources, and integrate necessary technologies into production, creating harmonious system of changes (Fig. 3).

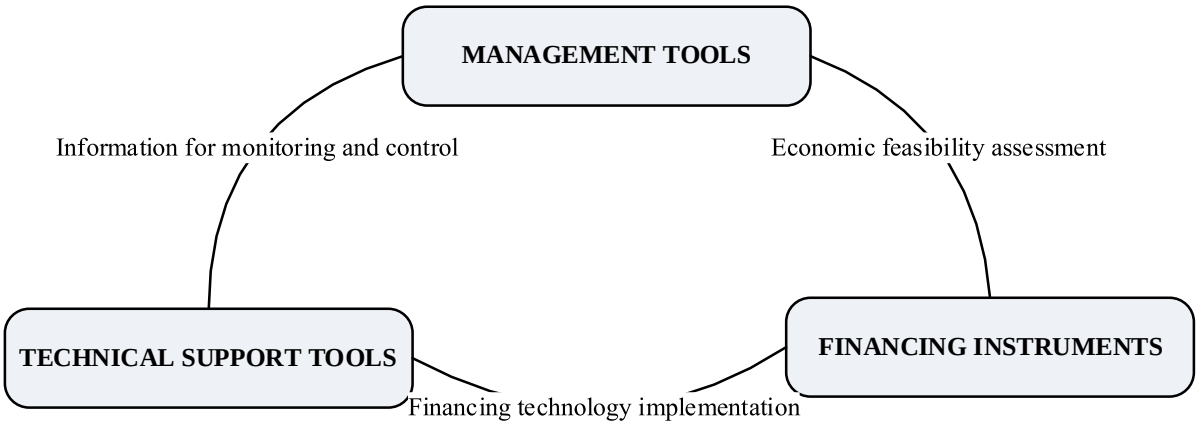

Fig. 3. Relationship between management, financing and technical support instruments

***Source**: developed by authors.*

The research conducted on these tools allows us to formulate following explanations for interrelationship of tools of the mechanism. "Management Tools → Funding Tools" – determine project priorities and resource planning, which affects funds allocation. **"**Financing Instruments → Technical Support Instruments" – provide financial resources for implementation of technologies and ensuring their functioning.

"Technical Support Tools → Management Tools" – provide data for monitoring, analysis and control that assist in making management decisions. "Management Tools → Technical Support Tools" – coordinate integrating technical changes into production and management. "Financing Tools → Management Tools" – provide assessment of economic feasibility of initiatives, which influences management decisions.

It should be noted that when forming organizational and economic mechanism for digital transformation, industrial enterprises should be guided by the system of principles that determine the approach to implementation of

digital technologies, resource management and development of organizational culture and are aimed at ensuring consistency, efficiency and sustainability of changes. In our opinion, such principles are:

– *principle of systemicity,* which is that digital transformation should cover all aspects of industrial enterprise of activities, including production, management, marketing, supply, etc.;

– *principle of customer orientation*, which involves creating added value for customers through personalization, quality and innovation;

– *principle of innovation*, which requires constant search for new solutions that can increase efficiency and competitiveness of the enterprise;

– *principle of flexibility*, which characterizes ability of the industrial enterprise to quickly adapt to changes in market conditions, customer requirements and innovation and technological environment;

– *principle of sustainable development*, based on integration of environmental, social and economic aspects into digital innovations of industrial enterprises;

– *principle of partnership*, which consists of collaborating with technology partners, suppliers and academic institutions to ensure successful digital transformation;

– *Principle of cybersecurity* is expressed in protection of the enterprise's digital assets from cyber threats.

These principles form the basis of digital transformation of industrial enterprises, ensuring systematic, effective and sustainable transition to new business conditions. Their adherence helps enterprises increase competitiveness, reduce costs and risks, and adapt to new market challenges.

The outlined mechanism as a system, in addition to specified constituent elements, must also use supporting components (regulatory, information, resource support), which perform important functions for its effective functioning. Regulatory and legal support forms legal basis for the implementation of the mechanism, establishes the obligations and rights of participants, and regulates their interaction. Information support is a system for collecting, processing, analyzing and disseminating information related to the activities of the mechanism and includes both internal and external sources of information that allow making informed decisions based on current data. Resource support - involves providing the mechanism with the

necessary material (raw materials, energy, etc.) and human resources and includes planning and management of resources to achieve goals of the system. Thus, comprehensive provision of the outlined components creates favorable conditions for functioning of the mechanism as a system, increasing its efficiency and resilience to external challenges.

Conclusions and suggestions. The conducted scientific research gave grounds to assert that digital transformation of industrial enterprises is a complex, multi-level process that requires integration of strategic approaches, models and tools within organizational and economic mechanism. The organizational and economic mechanism of digital transformation is comprehensive tool that integrates managerial, financial and technical solutions to ensure sustainable development of industrial enterprises in the digital economy.

Structure of the mechanism identifies three key blocks of tools, namely: management tools, financing tools and technical support tools, which effectiveness is determined by effectiveness of use of supporting components and implementation of the basic principles of digital transformation. Management tools create the basis for strategic planning, coordination between departments and monitoring results of the implementation of digital solutions and thereby play a key role in ensuring the coherence, efficiency and continuity of all stages of digital transformation of industrial enterprises. Financial tools create financial prerequisites for implementation of modern technologies, support innovative solutions and ensure sustainable development of industrial enterprises in the digital economy. In addition, technical support tools provide fundamental basis for successful implementation of digital innovations by industrial enterprises, integrate modern technologies into production and management processes, ensure their stability, security and continuous development, thereby creating competitive advantages for enterprises.

It has been proven that when forming organizational and economic mechanism for digital transformation, industrial enterprises should be guided by the system of principles that determine the approach to implementation of digital technologies, resource management, and development of organizational culture and are aimed at ensuring consistency, efficiency, and sustainability of changes.

References

1. Bulger, M., Taylor, G., & Schroeder, R. (2014). Data-driven business models: challenges and opportunities of big data. *Oxford Internet Institute. Research Councils UK: NEMODE, New Economic Models in the Digital Economy*. https://www.oii.ox.ac.uk/wp-content/uploads/old-docs/nemode_business_models_for_bigdata_2014_oxford.pdf.

2. Data & Analytics Data-Driven business models: What you need to know. https://www.linkedin.com/pulse/data-driven-business-models-what-you-need-know.

3. Homner, N., Bellin, P., Fielt, E., & Matzner, M. (2024). Data-driven business models. *Elsevier International Encyclopedia of Business Management, Amsterdam, Netherlands*. https://www.researchgate.net/profile/Pepe-Bellin/publication/379413136_Data-Driven_Business_Models/links/669ba864cb7fbf12a45fc5b1/Data-Driven-Business-Models.pdf.

4. Sakao, T., & Nordholm, A. K. (2021). Requirements for a product lifecycle management system using Internet of Things and big data analytics for product-as-a-service. *Frontiers in Sustainability*, *2*, 735550. https://www.frontiersin.org/journals/sustainability/articles/10.3389/frsus.2021.735550/full

5. Vogt Duberg, J., & Sakao, T. (2024). How can manufacturers identify the conditions for financially viable product-as-a-service? *Frontiers in Manufacturing Technology*, *4*, 1498189. https://www.frontiersin.org/journals/manufacturing-technology/articles/10.3389/fmtec.2024.1498189/full.

6. Hams, A., & Osman, R. (2024). Offering Products as a Service: The Advantages and Costs of Offering a Product as a Service: A Case Study at NPB Automation. https://www.diva-portal.org/smash/get/diva2:1879871/FULLTEXT01.pdf.

7. Winig, L. (2016). GE's big bet on data and analytics. *MIT Sloan Management Review*, *57*(3), 1-22. http://surl.li/wtfyqg.

8. Zorchenko, N.V., Tyupina, T.G., & Parshutin, M.E. (2024). Technologies Used by General Electric to Create Digital Twins for Energy Industry. *Power Technology and Engineering*, 1-6. https://link.springer.com/article/10.1007/s10749-024-01839-2.

9. Van Giffen, B., & Ludwig, H. (2023). How Siemens Democratized Artificial Intelligence. *MIS Quarterly Executive*, *22*(1). https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=15401960&AN=162315253&h=fTSRocsw5qrop2N58%2FqzbRlSMrjfc%2Bu6y50ZPXe4jmc0R26c83adoSkuUgHAMdQaODtlgrTfbsanZJqe09eHyw%3D%3D&crl=c.

10. Annanth, V.K., Abinash, M., & Rao, L.B. (2021, July). Intelligent manufacturing in the context of industry 4.0: A case study of siemens industry. In *Journal of Physics: Conference Series* (Vol. 1969, No. 1, p. 012019). IOP Publishing. https://iopscience.iop.org/article/10.1088/1742-6596/1969/1/012019/pdf.

11. Chimeudeonwo, N.B. (2023). *Review on the AI technologies used in the manufacturing of electric cars* (Doctoral dissertation, Technische Hochschule Ingolstadt). https://opus4.kobv.de/opus4-haw/frontdoor/index/index/docId/4316.

12. Nath, S. V., Dunkin, A., Chowdhary, M., & Patel, N. (2020). *Industrial Digital Transformation: Accelerate digital transformation with business optimization, AI, and Industry 4.0*. Packt Publishing Ltd. https://books.google.com.ua/books?hl=uk&lr=&id=26EGEAAAQBAJ&oi=fnd&pg=PP1&dq=Digital+Transformation+Framework:+From+Strategy+to+Optimization.+&ots=Hfvav4uN4N&sig=3q3PddRmSOT-bQMfX6ppCTGfVoso&redir_esc=y#v=onepage&q=Digital%20Transformation%20Framework%3A%20From%20Strategy%20to%20Optimization.&f=false.

13. Zhou, K., Liu, T., & Zhou, L. (2015, August). Industry 4.0: Towards future industrial opportunities and challenges. In *2015 12th International conference on fuzzy systems and knowledge discovery (FSKD)* (pp. 2147-2152). IEEE. https://ieeexplore.ieee.org/abstract/document/7382284.

14. Lasi, H., Fettke, P., Kemper, H.G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business & information systems engineering*, *6*, 239-242. https://core.ac.uk/download/pdf/301363122.pdf.

15. Gökalp, E., Şener, U., & Eren, P. E. Development of an Assessment Model for Industry 4.0: Industry 4.0-MM. https://www.researchgate.net/profile/Ebru-Goekalp/publication/319640255_Development_of_an_Assessment_Model_for_Industry_40_Industry_40-MM/links/5a0c6895a6fdcc39e9bf7cca/Development-of-an-Assessment-Model-for-Industry-40-Industry-40-MM.pdf.

16. Schumacher, A., Erol, S., & Sihn, W. (2016). A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises. *Procedia Cirp*, *52*, 161-166. https://www.sciencedirect.com/science/article/pii/S2212827116307909.

17. Kagermann, H., Wahlster, W., & Helbig, J. (2013). *Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0*. Final Report of the Industrie 4.0 Working Group.

18. Kagermann, H., & Wahlster, W. (2022). Ten years of Industrie 4.0. *Sci*, *4*(3), 26. https://www.mdpi.com/2413-4155/4/3/26.

19. Kiehne, J., & Olaru, M. (2017). Implementing Industrie 4.0 strategies: beyond technical innovations. In *Basiq International Conference: New Trends in Sustainable Business and Consumption* (pp. 363-371). https://basiq.ro/papers/2017/Kiehne.pdf.

20. Bodrov, V.G., Lazebnyk, L.L., Hurochkina, V.V., & Lisova, R.M. (2019). Conceptual scheme of digital transformation of business model of industrial enterprises. *International Journal of Recent Technology and Engineering*, *8*, 107-113. https://www.researchgate.net/profile/Viktoriya-Hurochkina/publication/338103658_Conceptual_Scheme_of_Digital_Transformation_of_Business_Model_of_Industrial_Enterprises/links/5dfe72f44585159aa490012f/Conceptual-Scheme-of-Digital-Transformation-of-Business-Model-of-Industrial-Enterprises.pdf.

21. Xie, J., Zhang, T., & Zhao, J. (2023). Research on the mechanism of digital transformation to improve enterprise environmental performance. *Industrial Management & Data Systems*, *123*(12), 3137-3163. https://www.emerald.com/insight/content/doi/10.1108/imds-03-2023-0187/full/html.

22. Li, H., Yang, Z., Jin, C., & Wang, J. (2023). How an industrial internet platform empowers the digital transformation of SMEs: theoretical mechanism and business model. *Journal of Knowledge Management*, *27*(1), 105-120. https://www.emerald.com/insight/content/doi/10.1108/jkm-09-2022-0757/full/html.

Список використаних джерел

1. Bulger, M. Data-driven business models: challenges and opportunities of big data [Electronic resource] / M. Bulger, G. Taylor, R. Schroeder // *Oxford Internet Institute. Research Councils UK: NEMODE, New Economic Models in the Digital Economy*. – 2014. – Accessed mode: https://www.oii.ox.ac.uk/wp-content/uploads/old-docs/nemode_business_models_for_bigdata_2014_oxford.pdf.

2. Data & Analytics Data-Driven business models: What you need to know [Electronic resource]. – Accessed mode: https://www.linkedin.com/pulse/data-driven-business-models-what-you-need-know.

3. Data-driven business models [Electronic resource] / N. Homner, P. Bellin, E. Fielt, M. Matzner // Elsevier International Encyclopedia of Business Management, Amsterdam, Netherlands. – 2024. – Accessed mode: https://www.researchgate.net/profile/Pepe-Bellin/publication/379413136_Data-Driven_Business_Models/links/669ba864cb7fbf12a45fc5b1/Data-Driven-Business-Models.pdf.

4. Sakao, T. Requirements for a product lifecycle management system using Internet of Things and big data analytics for product-as-a-service [Electronic resource] / T. Sakao, A. K. Nordholm // Frontiers in Sustainability. – 2021. -Vol. 2. – 735550. – Accessed mode: https://www.frontiersin.org/journals/sustainability/articles/10.3389/frsus.2021.735550/full.

5. Vogt Duberg, J. How can manufacturers identify the conditions for financially viable product-as-a-service? / J. Vogt Duberg, T. Sakao // Frontiers in Manufacturing Technology. – 2024. – Vol. 4. – 1498189. https://www.frontiersin.org/journals/manufacturing-technology/articles/10.3389/fmtec.2024.1498189/full.

6. Hams A.n, R. Offering Products as a Service: The Advantages and Costs of Offering a Product as a Service: A Case Study at NPB Automation [Electronic resource] / A. Hams, R. Osman. – 2024. – Accessed mode: https://www.diva-portal.org/smash/get/diva2:1879871/FULLTEXT01.pdf.

7. Winig, L. GE's big bet on data and analytics [Electronic resource] / L. Winig // IT Sloan Management Review. – 2016. – Vol. 57(3). – Pp. 1-22. – Accessed mode: http://surl.li/wtfyqg.

8. Zorchenko, N.V. Technologies Used by General Electric to Create Digital Twins for Energy Industry [Electronic resource] / N.V. Zorchenko, T.G. Tyupina, M.E. Parshutin // Power Technology and Engineering. – 2024. – Pp. 1-6. – Accessed mode: https://link.springer.com/article/10.1007/s10749-024-01839-2.

9. Van Giffen, B. How Siemens Democratized Artificial Intelligence [Electronic resource] / B. Van Giffen, H. Ludwig // MIS Quarterly Executive. – 2023. – Vol. 22(1). – Accessed mode: https://search.ebscohost.com/login.aspx?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl=15401960&AN=162315253&h=fTSRocsw5qrop2N58%2FqzbRlSMrjfc%2Bu6y50ZPXe4jmc0R26c83adoSkuUgHAMdQaODtlgrT-fbsanZJqe09eHyw%3D%3D&crl=c.

10. Annanth, V.K. Intelligent manufacturing in the context of industry 4.0: A case study of siemens industry [Electronic resource] / V. K. Annanth, M. Abinash, L. B. Rao // Journal of Physics: Conference Series. – 2021. – Vol. 1969, No. 1. – Pp. 012019. – Accessed mode: https://iopscience.iop.org/article/10.1088/1742-6596/1969/1/012019/pdf.

11. Chimeudeonwo, N. B. (2023). *Review on the AI technologies used in the manufacturing of electric cars* : Doctoral dissertation, Technische Hochschule Ingolstadt / N. B. Chimeudeonwo. – Accessed mode: https://opus4.kobv.de/opus4-haw/frontdoor/index/index/docId/4316.

12. Industrial Digital Transformation: Accelerate digital transformation with business optimization, AI, and Industry 4.0 [Electronic resource] / Nath S. V., A. Dunkin, M. Chowdhary, N. Patel. – Packt Publishing Ltd., 2020. – Accessed mode: https://books.google.com.ua/books?hl=uk&lr=&id=26EGEAAAQBAJ&oi=fnd&pg=PP1&dq=Digital+Transformation+Framework:+From+Strategy+to+Optimization.+&ots=Hfvav4uN4N&sig=3q3PddRmSOTbQMfX6ppCTGfVoso&redir_esc=y#v=onepage&q=Digital%20Transformation%20Framework%3A%20From%20Strategy%20to%20Optimization.&f=false.

13. Zhou, K., Liu, T., & Zhou, L. (2015, August). Industry 4.0: Towards future industrial opportunities and challenges [Electronic resource] / K. Liu, T., & Zhou, L. // In 2015 12th International conference on fuzzy systems and Zhou knowledge discovery (FSKD) (pp. 2147-2152). IEEE. – Accessed mode: https://ieeexplore.ieee.org/abstract/document/7382284.

14. Industry 4.0. [Electronic resource] / H. Lasi, P. Fettke, H.G., Feld T., Hoffmann M. // Business & information systems engineering. – 2014. – Vol. 6. – P. 239-242. – Accessed mode: https://core.ac.uk/download/pdf/301363122.pdf.

15. Gökalp, E.E. Development of an Assessment Model for Industry 4.0: Industry 4.0-MM [Electronic resource] / E.E. Gökalp. – Accessed mode: https://www.researchgate.net/profile/Ebru-Goekalp/publication/319640255_Development_of_an_Assessment_Model_for_Industry_40_Industry_40-MM/links/5a0c6895a6fdcc39e9bf7cca/Development-of-an-Assessment-Model-for-Industry-40-Industry-40-MM.pdf.

16. Schumacher, A. A maturity model for assessing Industry 4.0 readiness and maturity of manufacturing enterprises [Electronic resource] / A. Schumacher, S. Erol, W. Sihn // Procedia Cirp. – 2016. – Vol. 52. – Pp. 161-166. – Accessed mode: https://www.sciencedirect.com/science/article/pii/S2212827116307909.

17. Kagermann, H. Recommendations for Implementing the Strategic Initiative INDUSTRIE 4.0 [Electronic resource] / H. Kagermann, W. Wahlster, J. Helbig // Final Report of the Industrie 4.0 Working Group. 2013.

18. Kagermann, H. Ten years of Industrie 4.0 [Electronic resource] / H. Kagermann, W. Wahlster // *Sci*. – 2022. – Vol. 4(3). – P. 26. – Accessed mode: https://www.mdpi.com/2413-4155/4/3/26.

19. Kiehne, J. Implementing Industrie 4.0 strategies: beyond technical innovations [Electronic resource] / Kiehne J., Olaru M. // Basiq International Conference: New Trends in Sustainable Business and Consumption. – 2017. – Pp. 363-371. – Accessed mode: https://basiq.ro/papers/2017/Kiehne.pdf.

20. Conceptual scheme of digital transformation of business model of industrial enterprises [Electronic resource] / V. G. Bodrov, L. L. Lazebnyk, V. V. Hurochkina, R. M Lisova. // International Journal of Recent Technology and Engineering. – 2019. – Vol. 8. – Pp 107-113. – Accessed mode: https://www.researchgate.net/profile/Viktoriya-Hurochkina/publication/338103658_Conceptual_Scheme_of_Digital_Transformation_of_Business_Model_of_Industrial_Enterprises/links/5dfe72f44585159aa490012f/Conceptual-Scheme-of-Digital-Transformation-of-Business-Model-of-Industrial-Enterprises.pdf.

21. Xie, J. Research on the mechanism of digital transformation to improve enterprise environmental performance [Electronic resource] / J. Xie, T. Zhang, J. Zhao // Industrial Management & Data Systems. – 2023. – Vol. 123(12). – Pp. 3137-3163. – Accessed mode: https://www.emerald.com/insight/content/doi/10.1108/imds-03-2023-0187/full/html.

22. How an industrial internet platform empowers the digital transformation of SMEs: theoretical mechanism and business model [Electronic resource] / H. Li, Z. Yang, C. Jin, J. Wang // Journal of Knowledge Management. – 2023. – Vol. 27(1). – Pp. 105-120. – Accessed mode: https://www.emerald.com/insight/content/doi/10.1108/jkm-09-2022-0757/full/html.

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ОРГАНІЗАЦІЙНО-ЕКОНОМІЧНИЙ МЕХАНІЗМ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ ПРОМИСЛОВИХ ПІДПРИЄМСТВ

Анотація. *У статті досліджено особливості цифрової трансформації промислових підприємств. Окреслено зміни, які впливають на промислові підприємства, прискорюючи чи стримуючи цифрову трансформацію. Досліджено, що стратегічні зміни пов'язані із трансформаціями у високорівневих планах промислового підприємства, у*

тому числі тих, що стосуються загального напрямку розвитку, місії, цілей та завдань; операційні зміни є модифікаціями повсякденної діяльності, які дозволяють реалізувати стратегічні цілі через покращення внутрішніх процесів та зменшення витрат; організаційні зміни підтримують стратегічні та операційні ініціативи, забезпечуючи адаптацію корпоративної культури та навчання персоналу з питань впровадження цифрових технологій. Розроблено організаційно-економічний механізм цифрової трансформації промислових підприємств.

Аргументовано, що структура механізму має містити три ключові блоки інструментів (інструменти управління, інструменти фінансування та інструменти технічної підтримки), дієвість яких визначається ефективністю використання забезпечувальних складових (нормативно-правового, інформаційного і ресурсного забезпечення), та реалізації основних принципів цифрової трансформації. У структурі інструментів управління виділено три основні блоки (стратегічне управління, оперативне управління, контроль та моніторинг), кожен з яких має своє функціональне призначення.

Доведено, що інструменти управління створюють основу для стратегічного планування, координації між підрозділами та моніторингу результатів впровадження цифрових рішень і тим самим відіграють ключову роль у забезпеченні узгодженості, ефективності та безперервності всіх етапів цифрової трансформації промислових підприємств.

Встановлено, що інструменти фінансування є одним із ключових компонентів організаційно-економічного механізму цифрової трансформації, що забезпечує промислові підприємства необхідними фінансовими ресурсами для реалізації стратегічних, операційних та організаційних змін, які потребує цифрова трансформація; створюють фінансові передумови для впровадження сучасних технологій, підтримки інноваційних рішень і забезпечення стійкого розвитку промислових підприємств в умовах цифрової економіки.

Досліджено, що інструменти технічної підтримки є ключовими для впровадження, інтеграції та ефективного використання цифрових технологій на промислових підприємствах, функціональне призначення яких полягає у забезпеченні технічної основи для реалізації цифрових рішень, автоматизації виробничих процесів, аналітики і управління даними, кібербезпеки та підготовки персоналу. Обґрунтовано, що інструменти управління, фінансування та технічної підтримки формують тріаду, яка забезпечує успішну реалізацію цифрової трансформації промислових підприємств.

Акцентовано увагу на тому, що при формуванні організаційно-економічного механізму цифрової трансформації промислові підприємства повинні керуватись системою принципів, які визначають підхід до впровадження цифрових технологій, управління ресурсами та розвитку організаційної культури та спрямовані на забезпечення системності, ефективності та стійкості змін.

Ключові слова: *організаційно-економічний механізм; промислові підприємства; цифрова трансформація; цифрові технології; цифровізація; інструменти управління; інструменти фінансування; інструменти технічної підтримки; Індустрія 4.0.*

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