

Digital transformation of higher education institutions in the context of modern challenges and risks

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ABSTRACT: The aim of the research is to analyze the conceptual and managerial foundations of the digital transformation of higher education institutions in the context of modern challenges and risks. The focus is on identifying key strategic areas, institutional components, and models of digital maturity that form the transition to a digital university model. The methodological basis of the research is a qualitative approach that allows us to study the processes of implementing data-driven management, modernizing digital infrastructure, transforming services, and improving the digital competencies of all participants in the educational process. It is determined that the efficiency of digital transformation depends on the combination of a project approach with systematic models for assessing digital maturity, which ensures the coherence of changes and the sustainability of institutional development. The results of the research allow outlining methodological guidelines for the formation of an adaptive, innovative, and academically open model of a digital university.

KEYWORDS: digital transformation, digital university, digital maturity, digitalization, project approach, data-driven management.

I. INTRODUCTION

The current stage of development of higher education is characterized by profound transformations due to the intensive spread of digital technologies, globalization of the educational space, and increasing requirements for the quality of educational services. Universities are increasingly seen not only as centers of knowledge but also as active participants in the digital society, able to quickly adapt to changes, generate innovations, and form new models of education, management, and academic interaction. In this context, digital transformation is emerging as one of the key strategic vectors for the development of higher education institutions, which includes not only technical modernization but also changes in organizational culture, management practices, and educational paradigm.

Digital transformation is understood as a systematic process of implementing digital technologies, automation tools, data analytics, and intelligent platforms aimed at increasing the efficiency, flexibility, and transparency of the university's activities. Its implementation involves a deep integration of technological, managerial, and pedagogical changes, which should take place within the framework of a coherent digital development strategy. At the same time, the success of this process largely depends on the ability of universities to develop digital maturity as an institutional characteristic of readiness for transformation based on managerial, infrastructural, cultural, and human resources factors.

Despite a significant amount of scientific research, the issue of building a holistic model of digital transformation of a higher education institution that takes into account the peculiarities of internal processes and external challenges requires further conceptual and applied development. The study of such components of digital transformation as strategic management, institutional readiness, risk management, digital competencies of staff, as well as the project approach and models for assessing digital maturity, is becoming increasingly relevant.

The aim of the article is to define the conceptual and applied foundations of the digital transformation of higher education institutions in the context of current challenges and risks, as well as to analyze the key areas, tools, and models that ensure the sustainable development of a digital university.

II. LITERATURE REVIEW

In recent years, the problems of digital transformation of higher education have been actively studied in interdisciplinary academic discourse, due to the rapid development of digital technologies, the growing role of data in management, and the need to adapt educational systems to new socio-economic challenges.

The research by Kortemeyer, Dittmann-Domenichini, and Merki (2025) analyzes the benefits of full-time, hybrid, and online learning in the post-pandemic reality. The authors concluded that the flexibility of the digital environment has a significant impact on students' educational motivation and performance. The work by Kortemeyer and Nöhl (2025) focuses on the importance of using artificial intelligence in knowledge assessment, which emphasizes the trend towards automating educational monitoring and increasing objectivity.

Digital services are increasingly seen as the basis for the development of innovative educational models. Kolodinska, Sklyarenko, and Nikolaevskyi (2022) point out the need for strategic implementation of digital services in business education, and Sklyarenko and co-authors (2024) emphasize the efficiency of digital interactive technologies in creating a personalized learning environment. Khomenko, Paustovska, and Onyshchuk (2024) advocate a similar position, emphasizing the importance of the impact of innovative digital approaches on the development of students' creativity and cognitive activity.

The transformation of university management models has been the subject of research by Krap, Bataiev, Bobro et al. (2024), who analyze the impact of digital changes on organizational structure and corporate management in education. The work of Kubiv, Bobro, Lopushnyak et al. (2022) examines the institutional prerequisites for digital modernization based on European practices. At the same time, Kozynech (2024) emphasizes the motivational environment as an important factor in the digital maturity of the institution.

A systemic evaluation of digital transformation requires consideration of the socio-economic context. Lopushnyak, Chala, and Poplavska (2021) explore the ecosystem approach to sustainable development, emphasizing the role of digital technologies in supporting the sustainable development goals of higher education. In this context, Kozhyna (2022) substantiates the importance of inclusive digitalization strategies, in particular in the fight against poverty and inequality, which expands the analytical framework of digital transformation beyond the technical dimension.

A number of works are devoted to the practical implementation of the latest digital solutions. Bobro and co-authors (2024) study the role of artificial intelligence in forming marketing strategies in the education sector, as well as in automating the protection and detection of cyber threats (Lysenko, Bobro et al., 2024). Bobro (2025) emphasizes the economic feasibility of introducing digital avatars into the educational process as a tool for personalization and engagement.

The experience of the Swiss Federal Institute of Technology Zurich (ETH Zurich) deserves special attention, where digital transformation is implemented through the Innovedum program, which integrates pedagogical experiments and technological innovations into a single model of a digital university. According to ETH Zurich's open sources, the digitalization of education is seen as a conceptual change in the ways of interaction, teaching, and learning (ETH Zurich, n.d.).

The analysis of the modern scientific literature confirms that the digital transformation of higher education is a multidimensional process that includes technological, organizational, pedagogical, and social components. It requires systematic management, strategic assessment of digital maturity, and a focus on sustainable development of the university ecosystem.

III. RESULTS AND DISCUSSION

RESULTS

The concept of "digital transformation" in higher education is interpreted as a comprehensive transformation of the activities of participants in the educational process, which involves the transition to new models of management, communication, organization of the learning environment, and a culture of interaction based on data and digital technologies. The analysis of modern approaches in the scientific and applied literature allows us to define the key content of digital transformation as a systematic process of implementing data-driven management (.). As part of this approach, universities are adapting management, academic, and administrative processes to the principles of digital logic, where data is the basis for decision-making, performance evaluation, and strategic planning.

In the process of transformation, strategic areas that reflect the level of digital maturity of a higher education institution are important. First of all, it is about developing digital infrastructure, automating management processes, digitalizing educational content, creating platforms for analytics and data visualization, ensuring information security, and improving the digital competencies of staff and students. These areas define not only the current state of digital modernization but also set benchmarks for further improvement of university management systems according to national and global strategies for the development of higher education.

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An important part of digital transformation is evaluating the efficiency of implemented projects, particularly in the context of long-term goals. Initiatives aimed at building a flexible, sustainable digital infrastructure, optimizing financial costs, personalizing educational trajectories, developing digital pedagogy, and integrating artificial intelligence into management and education are becoming relevant. The success of digital transformation directly depends on the university's ability to anticipate risks, respond to challenges, and integrate innovative approaches into its strategic activities. The key areas of digital transformation of higher education institutions are shown in Figure 1.

TABLE 1. KEY AREAS OF DIGITAL TRANSFORMATION OF HIGHER EDUCATION INSTITUTIONS

Areas of digital transformation	Description of the areas	Strategic goals for achieving digital maturity
Users and digital services	Digital services covering the main management, educational, and administrative processes for students and employees	Ensuring full transition to digital formats of services; creating a single integrated platform for user interaction
Information systems	Availability and development of systems for managing educational processes, document flow, resources, and analytics	Implementation of business intelligence (BI) systems to monitor processes and support decision-making in real time
Data management	The use of data as a strategic resource in management, education, and research	Formation of a unified data management policy; creation of educational data hubs and digital registries
Digital infrastructure	The level of development of hardware and software infrastructure, including multimedia, server, network, and educational equipment	Updating and modernizing the entire material and technical base according to the requirements of digital transformation
Human capital	Development of digital competencies of administration, teachers, students; formation of digital culture	Establishment of digital transformation teams; improvement of digital literacy of all participants in the educational process; implementation of continuous digital learning programs

The analysis of the proposed table allows us to summarize the key vectors of digital transformation of higher education institutions, emphasizing not only the technical but also the organizational and managerial dimensions of this process. The five areas highlighted - users and services, information systems, data management, digital infrastructure, and human capital - represent an integrated model of digital maturity that encompasses all levels of university functioning.

Digital services are not just a set of tools, but a means of creating a new educational environment focused on flexibility, accessibility, and personalization. This area involves the development of single integrated platforms for the full interaction of all participants in the educational process, which ensures transparency and convenience of service provision.

Information systems are the architectural basis of a digital university. Their improvement is aimed at automating operational processes, supporting analytics, and implementing real-time monitoring systems. This approach ensures the transition to data-driven management, which significantly increases the efficiency of decision-making.

Data management is a strategic resource for digital transformation. Universities formulate data management policies, create databases and analytical hubs that provide information support for educational, research, and administrative processes. This contributes to the formation of a culture of evidence-based management and increased transparency.

Digital infrastructure is the material and technical basis that determines the university's ability to adapt to digital changes. Its modernization includes updating the technical park, server systems, network solutions, and multimedia equipment, which ensures the stability of the digital environment.

Human capital is a critical factor in successful transformation. Improving the digital competencies of all staff - teachers, administrators, students - is the key to effective implementation of digital strategies. Formation of digital transformation teams and implementation of continuous learning programs strengthen the adaptability of the educational system.

Together, these areas form a holistic model of digital development of universities - interconnected, flexible, and focused on the long-term quality of education in the digital reality.

The digitized educational space of higher education requires not only technological upgrades but also a comprehensive rethinking of organizational processes, interaction models, and management approaches. Achieving the digital maturity of higher

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education institutions requires the systematic implementation of a number of processes that form the basis of the transformation movement. These include the automation of routine and administrative tasks using artificial intelligence tools, robotic systems, and other digital solutions. This area makes it possible to significantly improve the accuracy, speed, and reliability of operations, freeing up resources for strategic tasks.

Improving the quality of services is another basic element of digital transformation. It means optimizing the processing of requests, increasing transparency, and personalizing communication, which together contribute to the growth of user satisfaction, both for students and teachers. Universities that implement digital service channels demonstrate higher efficiency in responding to the needs of the community.

Digital transformation also significantly changes the logic of resource management, helping to reduce costs and increase productivity. At the same time, it provides greater flexibility and adaptability of the institution to changes in the external environment, including the requirements of the digital labor market, innovation economics, and new educational demands. Flexibility is manifested in the ability to quickly change learning formats, management models, and service structures to meet new challenges.

An essential factor of digital maturity is the simplification of communications between the university and its audience. The use of digital platforms, mobile applications, chatbots, and other services contributes to building a convenient and transparent interaction environment. This not only optimizes service but also creates a new digital culture of trust between the institution and its users.

From a strategic perspective, digital transformation opens up new opportunities for growth, namely access to global markets, expansion of educational products, integration of innovative technologies such as blockchain, Internet of Things, virtual and augmented reality, cloud computing, and quantum solutions. The introduction of these technologies allows universities not only to adapt to changes but also to become leaders of innovation in their field.

Digital transformation also stimulates the rethinking of business models of higher education institutions. In particular, platform models are emerging that involve not only broadcasting educational content but also creating an environment for interaction between teachers, students, employers, and technology partners. All of this indicates a transition from linear models of development to networked and interdependent educational ecosystems, where the university is not only an educational but also a digital hub of innovation.

The experience of leading universities, such as the Swiss Federal Institute of Technology Zurich (ETH Zurich), is interesting, as it demonstrates a strategic focus on integrating innovative digital technologies with pedagogical practice based on the values of evidence, academic autonomy, and interdisciplinarity. One of the key platforms for implementing changes is the Innovedum Fund, an internal university fund that supports educational and focused projects aimed at qualitatively updating the educational process. In particular, the focus theme "Digitalisierung in der Lehre" is aimed at developing digital pedagogy, experimenting with new teaching formats, introducing adaptive learning, blended learning models, and collaboration platforms. ETH Zurich considers digitalization not as a technical upgrade, but as an opportunity to transform the very logic of learning - from a one-way transfer of knowledge to an interactive, student-centered model with a high degree of autonomy and personalization.

The peculiarity of ETH Zurich's approach is that digital tools are not implemented in isolation, but as part of conceptual educational experiments that have a clear methodological basis and are subject to systematic evaluation. Thus, initiatives to use augmented reality, virtual modeling, or digital laboratories are accompanied by pedagogical design focused on critical thinking, reflection, and interdisciplinary interaction. This approach strengthens the role of a teacher as a moderator of the learning environment and stimulates active participation of students in knowledge creation. It is clear that ETH Zurich is developing a model of a digital university where transformation encompasses not only tools but also an educational philosophy based on innovation, openness, and trust.

However, even in developed educational ecosystems, digital transformation is accompanied by a number of challenges that pose potential risks to its sustainable implementation. As the analysis of current problems shows, one of the most significant barriers is the lack of specialists with digital and analytical competencies capable of working with new technologies. This deficit is exacerbated by the rapid development of digital tools, which requires constant updating of competencies, as well as by the unevenness of staff training across regions and educational institutions. Universities have to invest not only in infrastructure but also in human capital development, which requires long-term support programs.

The second important barrier is resistance to change. The implementation of digital solutions is often accompanied by psychological and professional tension among staff, especially in an environment that has long operated under a traditional model. Fear of job loss, reduced control over processes, and uncertainty about new responsibilities can all reduce motivation to participate in transformation processes. This requires not only organizational flexibility but also the implementation of a change strategy with proper communication, support, and education.

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The financial aspect of digital transformation also remains a vulnerability. The high costs of purchasing equipment, developing or adapting software, ensuring cybersecurity, and training staff put a serious burden on university budgets, especially in a context of limited funding. In this context, it is crucial to assess the economic efficiency of digital projects and look for co-financing models, including through public-private partnerships.

The issue of personal data protection and cybersecurity is becoming increasingly important. With the growing volume of digital information, constant risks of data leakage and attacks on educational systems, security is becoming a strategic priority rather than a technical detail. This involves building an information security system, internal security policies, and raising digital awareness among all participants in the educational process.

Legal and regulatory challenges pose a particular difficulty. The pace of change in the technological environment is much faster than the pace of adaptation of legislation and the regulatory framework. The lack of clear standards, consistent procedures, and legal guarantees slows down digital transformation and creates legal uncertainty for universities. Therefore, the institutional level needs to be proactive in forming the legal framework for digital education.

DISCUSSION

The modern digital transformation of higher education institutions is increasingly being understood not as a set of individual innovations but as a holistic strategic project. In this context, the project approach is gaining a systemic role as it allows universities to structure complex digital change processes, ensuring phasing, quality control, risk, and resource management. Digital transformation project management involves setting specific goals, creating an action plan, calculating resources, implementing planned initiatives, and evaluating them. This sequence forms the basis for ensuring sustainable digitalization dynamics, especially in a highly complex educational environment.

Within the framework of transformational dynamics, the dimension of digital maturity as an integral characteristic of an institution's ability to effectively implement digital changes is of particular relevance. For an analytical assessment of digital maturity, it is relevant to refer to typologies that combine institutional, technological, managerial, and social components of transformation. In this context, it is advisable to summarize two interrelated approaches: project management as a tool for implementing changes and digital maturity models as a means of strategically assessing the current state and development potential. The main characteristics of these approaches are summarized in Table 2.

TABLE 2. TOOLS AND MODELS FOR ENSURING THE DIGITAL TRANSFORMATION OF HIGHER EDUCATION: PROJECT APPROACH AND MEASUREMENT OF DIGITAL MATURITY

Component	Content/stages	Role in digital transformation
Project Approach	1. Definition of project goals and objectives. 2. Planning timelines, resources, and budget. 3. Implementation and execution of planned actions. 4. Monitoring and control. 5. Evaluation of results and impact	Provides structured management of digital initiatives, minimizes risks, and supports the achievement of digitalization goals
Byhichevych Redel's model	Readiness for change - Transformation - Results	Focused on strategic preparation and awareness before implementing digital changes
Ifenthaler's model (level model)	Levels: initial - repeatable - controlled - measurable - optimized	Allows for a gradual assessment of the digital maturity of the HEI and identifies the strengths and weaknesses of the transformation
Ifenthaler and Egloffstein's model	Five domains: people - processes - technology - data - infrastructure	Comprehensive analysis of all key areas of transformation, focused on a holistic reform of the educational ecosystem

As we can see from Table 2, ensuring the digital transformation of higher education requires a combination of management tools and strategic assessment models. The project approach represents the instrumental basis of the transformation process. Its structure allows for formalizing complex processes of digital innovation implementation and avoiding fragmentation of actions. Project management ensures not only effective planning and control of resources, but also consistent tracking of the impact of digital initiatives on key areas of the university's activities. This approach allows creating well-functioning mechanisms for adapting to changes, minimizing risks, and fostering an organizational culture of flexible response.

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Digital maturity models, in turn, create a methodological basis for analytical support of transformation. Byhichevych Redel's model focuses on the phase of preliminary readiness for changes, which is critical to avoid the so-called "digital inertia" - a situation where the introduction of technologies is not accompanied by profound organizational changes. Its three-component structure (readiness - transformation - results) allows us to understand transformation not as a one-time innovation, but as a gradual and controlled process with measurable results.

Ifenthaler's model presents digital transformation as a development from the initial to the optimized level, which involves not just the introduction of digital solutions, but their gradual institutionalization. Thanks to this model, universities can identify gaps between the desired and actual state, track the dynamics of digital evolution, and build in self-correction mechanisms.

Finally, Ifenthaler and Egloffstein's model provides systemic complexity by considering digital transformation through five functional domains: people, processes, technology, data, and infrastructure. This approach is the most suitable for building an integrated digital ecosystem, where each subsystem develops in a balanced manner and digitalization is not limited to technical equipment. This avoids technological reductionism by emphasizing the importance of human capital, process logic, and data culture.

The combination of the project approach and digital maturity models ensures the methodological integrity and practical effectiveness of digital transformation. This not only allows us to optimize current processes but also lays the foundation for the sustainable development of a digital university as an open, adaptive, and innovative educational system.

IV. CONCLUSIONS

The results of the research showed that digital transformation in higher education is not only a technological process, but a systemic change in management, educational, and communication models based on the transition to data-driven management. This paradigm involves the deep integration of digital technologies into all levels of university functioning: from service support to strategic management of knowledge, infrastructure, and human capital. It has been established that the level of digital maturity of universities depends on five key areas: digital services, information systems, data management, digital infrastructure, and digital competencies of staff, which together form a holistic model of institutional development.

It has been found that effective implementation of digital changes is possible only if a project approach is used, which ensures a structured transformation process, minimizes risks, and achieves the planned results. In addition, the expediency of applying digital maturity models, in particular the models of Byhichevych Redel, Ifenthaler, and Ifenthaler and Egloffstein, which allow for a phased assessment of the readiness, scale, and depth of digital transformation in the university environment, has been proven. The summarized analysis confirms that the combination of project management with multidimensional diagnostics of digital maturity creates a methodological basis for building an adaptive, innovative, and sustainable model of a digital university.

In the future, digital transformation has the potential not only to modernize infrastructure and services but also to rethink the role of the university as an integrated educational, scientific, and social hub in the digital society. It involves a transition to flexible educational trajectories, new forms of academic interaction, mixed business models, and expanded global presence. Thus, digital transformation in higher education is a strategic tool for increasing competitiveness, institutional autonomy, and quality of the educational process in an unstable and technologically dynamic environment.

REFERENCES

- 1) Kortemeyer, G., Dittmann-Domenichini, N., Merki, C. (2025). Attending lectures in person, hybrid, or online at a technical university: how do students choose after the pandemic, and what about the outcome? *Discover Education*, 4(1), 94. <https://doi.org/10.1007/s44217-025-00500-y>
- 2) Kolodinska, Y.O., Sklyarenko, O.V., Nikolaevskyi, O.Yu. (2022). Practical aspects of developing innovative business ideas using digital services. *Economics and Management*, (4), 53–60. <https://doi.org/10.36919/2312-7812.4.2022.53>
- 3) Kozhyna, A. (2022). Reducing Poverty, Inequality and Social Exclusion in European Countries Based on Inclusive Approaches to Economic Development. In: *Economics and Management of the National Economy, The Crisis of National Models of Economic System*, 29–32. <https://doi.org/10.30525/978-9934-26-269-2-7>
- 4) Kubiv, S.I., Bobro, N.S., Lopushnyak, G.S., Lenher, Y.I., Kozhyna, A. (2022). Innovative potential in European countries: analytical and legal aspects. *International Journal of Economics and Business Administration*, 8(2), 250–264. <https://doi.org/10.35808/ijeba/457>
- 5) Lopushnyak, H.N., Chala, O., Poplavska, H. (2021). Socio-economic determinants of the ecosystem of sustainable development of Ukraine. *IOP Conf. Series: Earth and Environmental Science*, 915, 1–9. <https://doi.org/10.1088/1755-1315/915/1/012019>

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- 6) Kortemeyer, G., Nöhl, J. (2025). Assessing confidence in AI-assisted grading of physics exams through psychometrics: An exploratory study. *Physical Review Physics Education Research*, 21(1), 010136.
<https://doi.org/10.1103/PhysRevPhysEducRes.21.010136>
- 7) Kozyneć, A. (2024). The motivational environment of higher education institutions in international comparison. *Věda a perspektivy*, 12(43), 206–214. [https://doi.org/10.52058/2695-1592-2024-12\(43\)-206-214](https://doi.org/10.52058/2695-1592-2024-12(43)-206-214)
- 8) Krap, A., Bataiev, S., Bobro, N., Kozub, V., Hlevatska, N. (2024). Examination of digital advancements: Their influence on contemporary corporate management methods and approaches. *Multidisciplinary Reviews*, 7(26).
<https://doi.org/10.31893/multirev.2024spe026>
- 9) Sklyarenko, O.V., Yahodzinskiy, S.M., Nikolaevskyi, O.Yu., Nevzorov, A.V. (2024). Digital interactive learning technologies as an integral component of the modern educational process. *Innovative Pedagogy*, 68(2), 51–55.
<https://doi.org/10.32782/2663-6085/2024/68.2.51>
- 10) Khomenko, O.O., Paustovska, M.V., Onyshchuk, I.A. (2024). The impact of interactive technologies on the learning process and the development of higher education applicants. *Scientific Innovations and Advanced Technologies*, 5(33), 1222–1231.
[https://doi.org/10.52058/2786-5274-2024-5\(33\)-1222-1231](https://doi.org/10.52058/2786-5274-2024-5(33)-1222-1231)
- 11) Bobro, N., Hyshchuk, R., Strunhar, A., Bukovskyi, O., Alekseiko, V. (2024). Exploring the role of AI in shaping future marketing strategies: evaluations and outlooks. *Amazonia Investiga*, 13(80), 43–53.
<https://doi.org/10.34069/AI/2024.80.08.4>
- 12) Lysenko, S., Bobro, N., Korsunova, K., Vasylychshyn, O., Tatarchenko, Y. (2024). The Role of Artificial Intelligence in Cybersecurity: Automation of Protection and Detection of Threats. *Economic Affairs*, 69(Special Issue), 43–51.
<https://doi.org/10.46852/0424-2513.1.2024.6>
- 13) Bobro, N. (2025). Use of digital avatars in the learning process as a factor of economic efficiency. In: *International Scientific Conference “Economic Transformation in the Context of Global Challenges: Current Issues”*, Klaipeda, Lithuania, 7–10.
<https://doi.org/10.30525/978-9934-26-529-7-3>
- 14) Eidgenössische Technische Hochschule Zürich. (n.d.). AI in Education Projects. Retrieved from <https://ethz.ch/de/die-eth-zuerich/lehre/ai-in-education/projects.html>



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