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THE IMPACT OF DIGITAL UNIVERSITIES ON THE TRANSFORMATION OF THE EDUCATIONAL BUSINESS MODEL

Summary. *The article examines the impact of digital universities on the transformation of the educational business model in the context of the rapid development of digital technologies and the growing demand for online learning. The relevance of this issue is due to the need for flexible adaptation of universities to rapid changes in the digital economy and the labor market, as well as the implementation of customer-oriented educational strategies using innovative business architecture. The author analyzes the theoretical and practical aspects of the digital maturity of universities, emphasizing the importance of integrating modern technologies such as artificial intelligence, data analytics, and interactive educational platforms. Particular attention is paid to the concept of business architecture, which is a key factor in the transformation of educational activity of a digital university. The essence and structure of technological architecture, which consists of information architecture and application solutions architecture, are defined. Information architecture describes business processes, their role in the structure of interaction between the subjects of the educational environment, components of information models, digital infrastructure, and information management. Application solutions architecture includes software products and interfaces that ensure the interaction of participants in the educational process with information systems. The importance of these components for ensuring efficiency, transparency, and controllability of educational processes is substantiated. It is established that the implementation of business architecture allows universities to create a single integrated system that combines curricula, digital tools, and business processes within the university. It is indicated that such integration provides a high level of flexibility and adaptability of educational services, improves the quality of education, and contributes to better meeting the personalized needs of students. It is concluded that the development of the business architecture of the digital university contributes to its competitiveness, creates prerequisites for effective communication between all stakeholders, and ensures the long-term strategic stability of higher education institutions. Promising areas for further research on the methodology for implementing modern IT solutions in the activities of universities and analyzing the effectiveness of integrating artificial intelligence into educational practice are identified.*

Key words: *digital university, educational business model, information architecture, digitalization, customer-oriented approach, digital technologies, educational processes.*

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ВПЛИВ ЦИФРОВИХ УНІВЕРСИТЕТІВ НА ТРАНСФОРМАЦІЮ ОСВІТНЬОЇ БІЗНЕС-МОДЕЛІ

Анотація. *У статті досліджено вплив цифрових університетів на трансформацію освітньої бізнес-моделі в умовах стрімкого розвитку цифрових технологій та зростаючого попиту на онлайн-навчання. Актуальність цієї проблематики обумовлена необхідністю гнучкої адаптації університетів до швидких змін у цифровій економіці та на ринку праці, а також запровадження клієнтоорієнтованих освітніх стратегій з використанням інноваційної бізнес-архітектури. Автор аналізує теоретичні та практичні аспекти цифрової зрілості університетів, наголошуючи на важливості інтеграції сучасних технологій, таких як штучний інтелект, аналітика даних та інтерактивні освітні платформи. Особливу увагу приділено поняттю бізнес-архітектури, яка виступає ключовим фактором трансформації освітньої діяльності цифрового університету. Визначено сутність та структуру технологічної архітектури, яка складається з інформаційної архітектури та архітектури прикладних рішень. Інформаційна архітектура описує бізнес-процеси, їхню роль у структурі взаємодії суб'єктів освітнього середовища, складові інформаційних моделей, цифрової інфраструктури та управління інформацією. Архітектура прикладних рішень включає програмні продукти та інтерфейси, що забезпечують взаємодію учасників освітнього процесу з інформаційними системами. Обґрунтовується значення цих компонентів для забезпечення ефективності, прозорості та керованості освітніх процесів. Встановлено, що впровадження бізнес-архітектури дозволяє університетам створити єдину інтегровану систему, яка поєднує навчальні програми, цифрові інструменти та бізнес-процеси в межах університету. Вказано, що така інтеграція забезпечує високий рівень гнучкості й адаптивності освітніх послуг, підвищує якість навчання та сприяє кращому задоволенню персоналізованих потреб студентів. Зроблено висновок, що розвиток бізнес-архітектури цифрового університету сприяє його конкурентоспроможності, створює передумови для ефективної комунікації між усіма стейкхолдерами та забезпечує довгострокову стратегічну стабільність закладів вищої освіти. Визначено перспективні напрями подальших досліджень щодо методології впровадження сучасних IT-рішень у діяльність університетів та аналізу ефективності інтеграції штучного інтелекту в освітню практику.*

Ключові слова: *цифровий університет, освітня бізнес-модель, інформаційна архітектура, цифровізація, клієнтоорієнтований підхід, цифрові технології, освітні процеси.*

Relevance of the problem. The issue of transforming the educational business model of universities in the context of the rapid development of digital technologies is extremely relevant given the rapid growth in demand for online learning and the need to ensure the flexibility of educational processes according to the dynamic requirements of the labor market. A modern digital university must meet the challenges of the digital economy, which requires not only expanding the range of online educational services but also implementing an innovative business architecture that can quickly adapt educational content and business processes to the needs of students and other stakeholders. In this context, the need to develop and implement client-oriented educational strategies that can meet the personalized needs of students, as well as effectively use the capabilities of artificial intelligence, data analytics, and other digital technologies to ensure a high level of quality of educational services, is becoming more urgent. Given the above, there is a need

for a detailed study of the role of digital universities in the transformation of educational business models as an important factor in ensuring the competitiveness of higher education institutions in the context of the digital transformation of society.

Analysis of recent research and publications. The peculiarities of the transformation of educational business models in the context of digitalization are being actively studied by both foreign and Ukrainian scholars. In particular, the theoretical and applied aspects of the formation of the maturity of digital universities and methodological approaches to assessing their effectiveness are presented in the works of E. Tocto-Cano, S. Paz Collado, J.L. López-Gonzales and J.E. TurpoChaparro (2020), who conducted a systematic review of the application of maturity models in universities. In turn, the study by N. Kadoić, V. Đurek, Ž. Dobrović (2018) highlights the peculiarities of assessing the digital maturity of higher education institutions and proposes a metamodel of digital development of universities using the analytical network procedure (ANP) and DEX approach for decision-making.

The issue of using digital interactive technologies and their role in the modernization of educational processes was studied by Ukrainian scientists O.V. Skliarenko, S.M. Yahodzinskyi, O.Yu. Nikolaievskyi, and A.V. Nevzorov (2024), who emphasize that interactive technologies have become an integral part of the modern educational process, providing flexibility and adaptability of curricula. At the same time, Ya.O. Kolodinska, O.V. Skliarenko, and O.Yu. Nikolaievskyi (2022) considered the practical aspects of implementing innovative business ideas through the use of digital services, emphasizing the need to adapt educational business models to the digital economy.

O.O. Khomenko, M.V. Paustovska, and I.A. Onyshchuk (2024) studied the impact of interactive technologies on the educational process and development of higher education applicants, focusing on the need to take into account the individual needs of students when creating educational products. P.V. Huk and O.V. Skliarenko (2022) focused on the economic feasibility of modernizing enterprises using automated systems, which is also important in the transformation of the university business model.

Despite the significant number of works that cover certain aspects of the digitalization of education and the implementation of interactive technologies, the issues of complex transformation of educational business models of universities in the context of the development of digital ecosystems remain insufficiently studied, which makes further research in this area relevant and important.

Definition of the aim and main objectives of the research. The aim of the article is to theoretically substantiate the possibilities of using the business architecture of digital universities as a tool for transforming the educational business model and to determine the prospects for its development in the context of education digitalization.

The objectives of the article are: to define the essence and structure of the technological and business architecture of digital universities; to analyze the advantages and features of using business architecture in the management of educational processes of a digital university; to highlight the role of a client-oriented approach in the transformation of the educational business model of a digital university; to outline the advantages of digital universities in the market of educational services from the point of view of business architecture and educational products offered by them.

Presentation of the main material of the research. The "technological architecture" concept is increasingly used to justify the development of educational institutions in the digital economy. This term means an information-analytical and technical justification of the key components of the organizational structure of a university, including a digital one, or other educational institution (Huk & Skliarenko, 2022).

Technology architecture consists of two main components:

– information architecture;

– application solutions architecture.

Information architecture includes knowledge about business processes in a digital university, their place and role in the overall structure of interaction between the subjects of the educational environment. This area defines the constituent elements of information models and digital infrastructure, as well as the structure of information flows and principles of information management (in particular, the specifics of storing knowledge bases and data warehouses).

Application solutions architecture includes software products and interfaces that ensure the interaction of participants in the educational process with university information systems (Skliarenko at all, 2024). Such application systems include:

– programs for processing online transactions;

– software products for analytical research and monitoring of the learning process;

– solutions for creating and maintaining databases, functioning of the software, and ensuring the cybersecurity of the educational environment;

– business solutions for automating management and learning processes that meet the strategic goals of a digital university.

Business architecture is an important component that combines information architecture and application solutions architecture (Kozhyna, 2022). It serves as a semantic and graphical representation of all organizational processes of a digital university both at the level of the institution as a whole and at the level of individual structural units, such as faculties, departments, or digital learning centers. This allows for systematizing the management of the ecosystem of training courses, where each educational discipline has its own main and auxiliary processes supported by the relevant applied information systems (Saxena at all, 2020).

Table 1 presents the main components of business architecture (organizational strategy, business process registers, and organizational communication context) and indicates the factors that provide benefits when integrating them into the structure of a digital university.

Therefore, the benefits of business architecture for a digital university and the development of its ecosystem of educational courses are as follows:

– A holistic view of the entire digital university system, including business processes, the use of software, other digital products, and services in them, as well as an assessment of the degree of staff and external stakeholders' engagement in organizational operations.

– The possibility of qualitative and quantitative analysis of the effectiveness of the digital university architecture implementation, including an assessment of the risks associated with the use of software in the implementation of business processes and the degree of impact of these risks on the sustainability of the educational environment architecture.

– The development of business architecture makes it possible to update the state of educational and administrative processes of a digital university in time dynamics, having data on past, current, and projected processes in a common repository.

– A structured business architecture simplifies the process of developing business, functional, non-functional, and system requirements for specific projects (for example, implementing new educational models or creating software for staff training).

Business architecture performs the function of the structural ordering of all processes of internal and external interaction of a digital university. Achieving this goal is possible with the involvement of project and product managers, business and system analysts, and organizational systems architecture specialists in the process (Tocto-Cano at all, 2020).

The result of this work should be the creation of:

– graphical models of business processes and organizational structure of the university;

– models of system architecture;

– strategy maps and analytical graphs;

– multi-page electronic documents containing textual, graphical, and tabular descriptions of all processes;

Table 1

Business architecture components and their role in the functioning of a digital university

Component	Value in business architecture	Application in the architecture of a digital university
Organizational strategy	Determines the directions of the organization's development to improve business processes according to the structure and strategic goals	Formation of a strategy for the development of a digital university and its educational programs based on the overall strategy of the organization; definition of goals for the transformation of educational processes
Register of business processes	Full description of process units at different levels of decomposition to increase transparency of operations	Creating a structured model of a digital university and educational processes; improving the quality of requirements for learning support information systems at different levels of architecture
Context of organizational communication	Enables coordinated functioning of various units to achieve key indicators	The need for integrated communication between the administrative, academic, and technical units of a digital university to achieve the goals of educational activity and its coordination

– digital university guides on the structure and modeling of educational programs and software products.

The absence of a systematic and structured approach, on the other hand, leads to fragmented storage of architectural documentation in different sources without a single database. This format complicates the design of both the business and technological architecture of a digital university, reduces the efficiency of the management model, and slows down its updating and optimization.

The structured business architecture of a digital university significantly affects the overall level of digital maturity of an educational organization. The criteria for assessing digital maturity are shown in Figure 1.

Within the digital course ecosystem of a digital university, business architecture is of particular importance. In particular, when creating a single database of educational products, it is necessary to take into account not only internal educational developments but also external educational programs of higher education institutions and EdTech aggregators, which significantly increases the number of managed processes (Khomenko at all, 2024).

It is interesting that the business processes of a digital university, including their communication aspect in the process of creating educational courses and staff development, are largely reduced to the integration of IT systems. This forms a cycle of repeated actions in the development of a training course and related digital tools. Online learning is impossible without the use of modern digital platforms, software, and a clearly defined algorithm for interacting with educational content (Kolodinska at all, 2022).

In particular, the ADDIE methodology involves the processes of designing training courses, collecting information on the topic, implementing this information in the educational process, and analyzing the feedback received (Kubiv at all, 2022). This allows for standardizing the interaction with the ecosystem of digital educational courses, making the business architecture of the educational environment flexible, adaptive, and structured.

Therefore, business architecture is becoming a key tool for the development of a digital university, ensuring strategic coherence of educational activity with the overall goals of the institution, increasing the efficiency of business process implementation, and optimizing communication between the structural units of the educational environment.

It is important to note that the business architecture of a digital university is a set of diverse and interconnected business processes that ensure the functioning of an educational institution as a single system. The regulatory or supporting elements of these processes are internal regulatory documents, information systems, and knowledge bases of a digital university.

Depending on the level of managerial competencies of the management personnel and their ability to interact effectively, the implementation of business tasks can be either systematic and planned or chaotic and situational (Lopuschnyak at all, 2021).

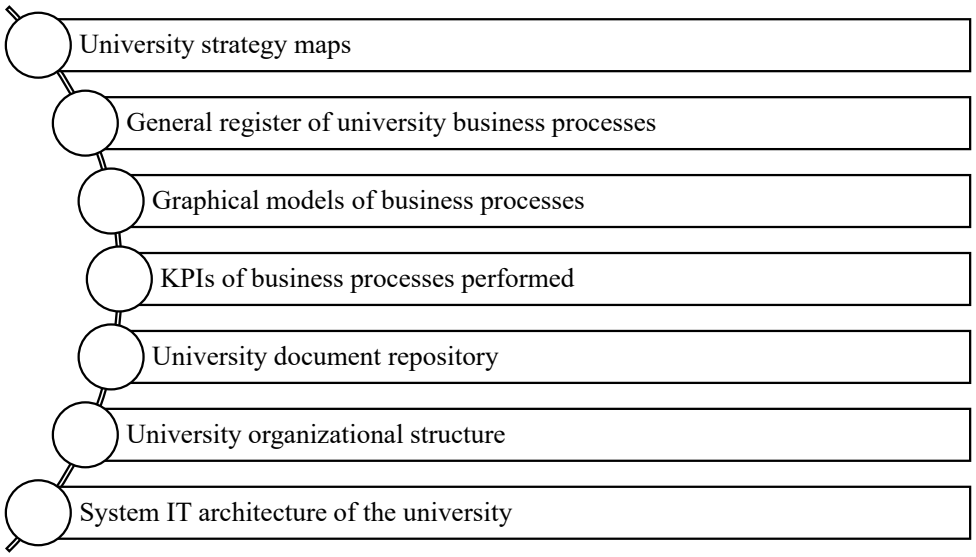

Fig. 1. Components of the university business architecture necessary to assess its digital maturity

The use of an architectural approach to modeling the digital university activity allows for standardizing organizational processes and bringing them in line with clearly defined algorithms and rules. However, when reengineering business processes or switching from one organizational paradigm to another, certain counteracting factors may arise:

– staff resistance to change;

– managers' lack of practical experience in working with processes, poor communication and leadership skills, insufficient empathy, and declarative management style;

– inconsistency between strategic goals and actual actions taken within the organization of business processes;

– poorly developed internal organizational communication;

– limited financial resources to implement changes.

Optimization of the business architecture of a digital university should be accompanied by a thorough analysis of existing business processes and a search for ways to transform them, taking into account interaction with all participants in the educational process. The quality of the changed business processes will directly affect the level of motivation of the participants in the educational environment in choosing a learning path.

In a highly competitive educational services market, educational organizations (universities, online schools, corporate universities) have to constantly improve the quality of their activities. In this regard, to strengthen the reputation of a digital university as an attractive EdTech platform for receiving education, it is necessary to develop a customer-oriented approach (Kadoić at all, 2018).

In the context of a digital university, a client-oriented approach means a comprehensive activity of an organization aimed at meeting the educational needs of students, employees, and other participants in the educational process, including analysis of educational market trends, research of past and future user expectations, development of strategies and their implementation with prompt response to risks.

The client-oriented approach is expressed through the following features:

– full awareness of the requests and needs of students;

– creation of educational courses that meet their expectations;

– readiness to receive feedback and take it into account promptly;

– striving to provide timely support to students;

– continuous improvement of the quality of the educational content created.

In the context of the transformation of the educational business model of digital universities, this approach can be implemented through the creation of interactive forms of learning at all stages of the educational process. Modern EdTech platforms use the following practices:

– personalized educational trajectory;

– synchronous and asynchronous work with educational materials;

– support of graduates in employment issues;

– gamification of the educational process;

– integration of students into thematic online communities;

– division of the whole program into micro-modules;

– organization of a mentoring system;

– work on real practical cases and projects;

– use of AI tools for competence development.

These practices can also be successfully adapted and implemented by digital universities. The client-oriented approach will allow methodologists to create curricula in which students will be able to make decisions about the form of assignments, the procedure for working with course modules, ways to provide feedback, and be in constant interactive contact throughout the entire period of study.

Moreover, modern formats for presenting educational content can be adapted to the individual needs of students, taking into account their personal preferences for the design of materials (font, color scheme, format, etc.) (Huk & Skliarenko, 2022).

Nevertheless, digital universities have a number of competitive advantages in the modern market of educational services. The advantage of a digital university over other educational institutions is its deeper integration into the educational system, the ability to combine formal and non-formal education, and the ability to ensure the long-term development of students' competencies. At the same time, educational programs of digital universities may have a number of other advantages:

– a digital university can flexibly respond to the current demands of students and stakeholders, forming educational programs according to the needs of the modern labor market, thus eliminating the shortage in certain professional areas;

– case studies and practical assignments of courses created by a digital university can be developed based on real business scenarios,

which will help students integrate into the professional environment faster after graduation;

– for students, taking courses at a digital university can mean forming a strong connection with certain professional communities, building confidence in their own competencies, and having a clear vision of their own career path;

– students who invest in their own professional development through digital universities will have a clear understanding of the outcomes and benefits they will receive after completing the course.

In the context of a global shortage of qualified personnel, digital universities are becoming strategically important participants in the educational market, capable of training specialists not only for individual companies but also for entire industries. However, it should be noted that the success of a digital university in forming an ecosystem of educational courses depends primarily on the quality of business processes, the effectiveness of communication between all participants in the educational process, as well as the interactivity and relevance of the content created. The competitiveness of a digital university in the modern educational market will depend on the thoughtfulness of the educational business model focused on end users.

Conclusions and prospects for further research on this issue. In modern conditions of rapid changes in the economic environment, digital universities must have a stable yet flexible educational infrastructure. This will allow for responding quickly to new trends, adapting educational products, and providing quality training for students and staff according to current market needs.

Business architecture is a key factor in transforming the ecosystem of digital educational products and has the following advantages:

– standardization of business processes for organizing training within the educational courses of digital universities;

– systematization of university activity through the formation of a single register of business processes;

– the ability to integrate various digital tools and information solutions into training courses at all stages of the educational process;

– development of analytics and data management based on the collection of information about the learning process, which allows the use of predictive analytics for strategic decision-making;

– improving the user experience through the implementation of interactive forms of education focused on choice and personalization;

– creation of a regulated business architecture of educational courses making them adaptive to rapid changes in the external environment;

– organization of effective internal communication and clear regulation of business processes contribute to the development of corporate culture and the formation of a cohesive educational environment.

Therefore, the effectiveness of implementing changes in the business architecture of digital universities determines the extent to which students will be able to use the available opportunities for their own professional growth and self-realization.

Promising areas for further research include studying the impact of individual components of the business architecture on the effectiveness of the educational process in a digital university, developing methodological approaches to the implementation of flexible educational product management systems using modern IT solutions, and analyzing the relationship between the level of digital maturity of the educational architecture and the satisfaction of the main participants in the educational process. Particular attention should be paid to the study of the effectiveness of artificial intelligence and data analytics tools in transforming the business model of a digital university. Such research will deepen the understanding of the mechanisms for updating the educational environment and expand practical approaches to its modernization.

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