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TRANSFORMING INFORMATION ARCHITECTURE IN THE CONTEXT OF UNIVERSITY DIGITALIZATION

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The article examines the transformation of information architecture within universities in the context of digitalization. Digital technologies have become a cornerstone of social and economic progress, with profound implications for education. As universities face increasing demands for technological innovation, the effective management of information flows has emerged as a critical factor in ensuring efficient operations and adapting to the digital economy. Despite advancements in informatization, many universities struggle with fragmented information systems, resulting in inefficient processes, data duplication, and unreliable reporting.

The study highlights the challenges posed by insufficient IT strategies, inadequate staff competencies, and underdeveloped infrastructure, which hinder the successful implementation of digital transformation. Traditional approaches to knowledge delivery, primarily reliant on the exchange of electronic documents, remain prevalent, underscoring the need for a more integrated and advanced approach. Existing systems often lack a unified vision, as departments independently develop specialized solutions that fail to interconnect, leading to inefficiencies in information management.

The article emphasizes the importance of adopting an architectural approach to reorganizing information architecture in universities. Such an approach involves a comprehensive analysis of both horizontal and vertical information flows, identifying points where information quality is compromised. By implementing a unified concept for data collection and optimizing these flows, universities can significantly enhance management efficiency. A staged development of information and analytical systems tailored to the specific needs of higher education institutions is proposed as a resource-intensive but effective solution. Figures illustrating typical and optimized information flows demonstrate the benefits of an integrated digital system. Key advantages include optimized information flows, improved interdepartmental communication, enhanced data reliability, reduced reporting errors, and increased efficiency of information systems. These improvements address the critical gaps left by fragmented informatization efforts and prepare universities to better meet the demands of the digital economy.

The study concludes that successful digital transformation in universities requires not only the adoption of advanced technologies but also a holistic restructuring of information architecture. This approach fosters improved collaboration across departments, reduces inefficiencies, and enhances the overall resilience of the educational system. To achieve these outcomes, universities must prioritize the development of tailored digital transformation strategies, invest in adequate IT infrastructure, and ensure continuous professional development for staff. These measures will enable universities to align their operations with the dynamic requirements of the digital era, ultimately driving innovation and sustainable growth.

Keywords: *digitalization, information architecture, universities, management efficiency, digital transformation*

Problem statement. The digitalization of universities has become a cornerstone of modern educational transformation, significantly altering traditional approaches to management and the organization of educational processes. At the same time, many universities face challenges such as fragmented information systems, data duplication, and inefficiencies in management. In this context, the transformation of universities' information architecture emerges as a critical foundation for successful digital transformation.

Analysis of recent research and publications. Scholars increasingly examine the role of digital technologies in higher education. For instance, Ya.Kolodinska and O.Skliarenko explore interactive technologies as an integral part of the modern educational process, emphasizing their potential to enhance student engagement [1]. S.Yahodzinskyi highlights the impact of information networks on management strategies amidst digital transformation [2]. However, research reveals persistent challenges related to fragmented information flows and low system integration in most universities. International studies further underline the need for a unified architectural approach to optimize information systems [3].

Identification of previously unresolved aspects of the general problem. Despite significant progress in the digitalization of education, the creation of integrated information architecture for universities remains underexplored. There is a pressing need to unify information flows, develop adaptive data management systems, and resolve inconsistencies between internal university subsystems.

Formulation of the article's goals. The aim of the article is to develop a conceptual approach to transforming the information architecture of universities in the context of digitalization. This includes analyzing the current state of universities' information systems, identifying the primary challenges caused by fragmented information flows, and substantiating the relevance of adopting an architectural approach to optimize these systems.

Presentation of the main research material. In recent decades, digital technologies have become integral to social development, acting as a powerful driver of economic growth and societal transformation. The widespread integration of computer systems across various sectors has heightened the need for developing effective algorithms, creating intelligent data analysis systems, and ensuring cybersecurity. As digitalization accelerates, the need for technological innovation and advanced information processing methods continues to grow, particularly in the educational sector.

In recent years, numerous publications have emerged in the scientific literature addressing the application of digital technologies in education. For instance, Ya. Kolodinska et al. examine the practical aspects of utilizing digital services to foster innovative business ideas, highlighting the need for universities to implement digital solutions in response to new economic challenges [1]. Similarly, S. Yahodzinskyi underscores the significance of global information networks within a socio-cultural framework, impacting management strategies amidst digital transformation [2]. These insights suggest that universities, as socio-cultural institutions, must develop management models tailored to the demands of the digital economy.

Further research confirms the importance of digital technologies for improving the efficiency of management processes in higher education institutions. In their work, O.Skliarenko et al. considered interactive technologies as an integral part of the modern educational process, which contributes to increasing student engagement and learning efficiency [3]. O. Khomenko et al. emphasize the impact of these technologies on student development and their integration into the educational process [4]. This approach to the use of digital technologies allows universities not only to improve educational processes, but also to increase managerial sustainability in the new economy.

Scientific research has identified several barriers that impede the successful implementation of digital transformation in educational institutions. Key obstacles include insufficient employee competencies and knowledge, low motivation for change, a lack of

qualified specialists, and the absence of a clearly defined IT strategy. Consequently, despite a significant increase in the informatization of educational processes, there have been few dramatic changes in the structure of knowledge delivery in recent years. As was the case prior to digital transformation, the predominant method of knowledge exchange remains the transfer of electronic documents [5;6]: the teacher sends a file in .doc or .docx format with an assignment and receives a completed file in the same format. Another challenge to digital transformation in education is often the underdeveloped IT infrastructure [7, p. 260].

However, even with sufficient technical support, not all issues are resolved. Information systems used to manage educational program resources in universities are often implemented as separate, unconnected systems, lacking a unified vision. Given that universities are complex organizations with long-established interaction structures – often suboptimal and redundant – departments tend to develop and implement highly specialized solutions. These solutions frequently involve differing formats and data sets, leading to duplication and inefficiencies in information management.

Inefficiently designed information architecture disrupts the balance within the managed system, and rather than enhancing management efficiency, such informatization leads to a range of problems. These include the creation of excessive data sets, the generation of incorrect reports, process duplication, and the loss of critical information. Figure 1 illustrates typical information flows in a university facing such issues

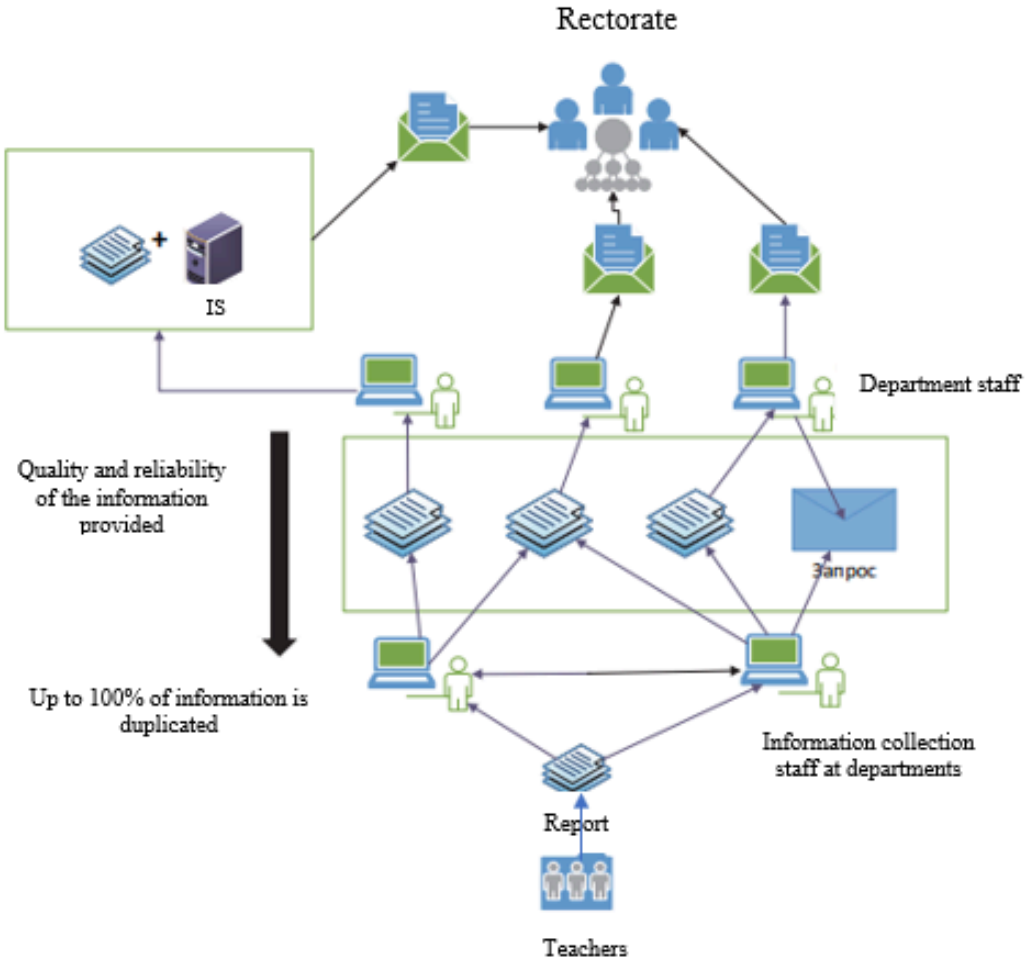

Figure 1. Typical Information Flows at a University

The challenge of implementing more advanced technological solutions in the field of information technology lies in several obstacles, including a lack of relevant competencies among staff and a lack of understanding among management regarding the importance of these transformations. In such circumstances, off-the-shelf solutions are not only expensive but also insufficient in addressing the comprehensive range of issues faced by the university.

To address the issues arising from the underestimation of the role of information architecture, it is essential to adopt an architectural approach – a proven tool for managing complex systems. The specific steps required for implementing digital transformation depend on the unique needs of the organization and should be planned and executed as part of a unified, pre-designed plan that considers the requirements not only of individual departments but also of the organization as a whole.

In certain cases, a resource-intensive yet effective approach is to develop an information and analytical system in stages, tailored to the specific requirements of higher education institutions and grounded in an architectural approach. A key component of such a system should be an electronic document management system.

To overcome the aforementioned issues at the level of information architecture, the necessary steps include analyzing both horizontal and vertical information flows across all management levels at the university. This analysis aims to identify key points where information quality is compromised, establish a unified concept for information collection, and optimize information flows while incorporating the tools of the information system.

The university's information flows following the implementation of the information system are shown in Figure 2.

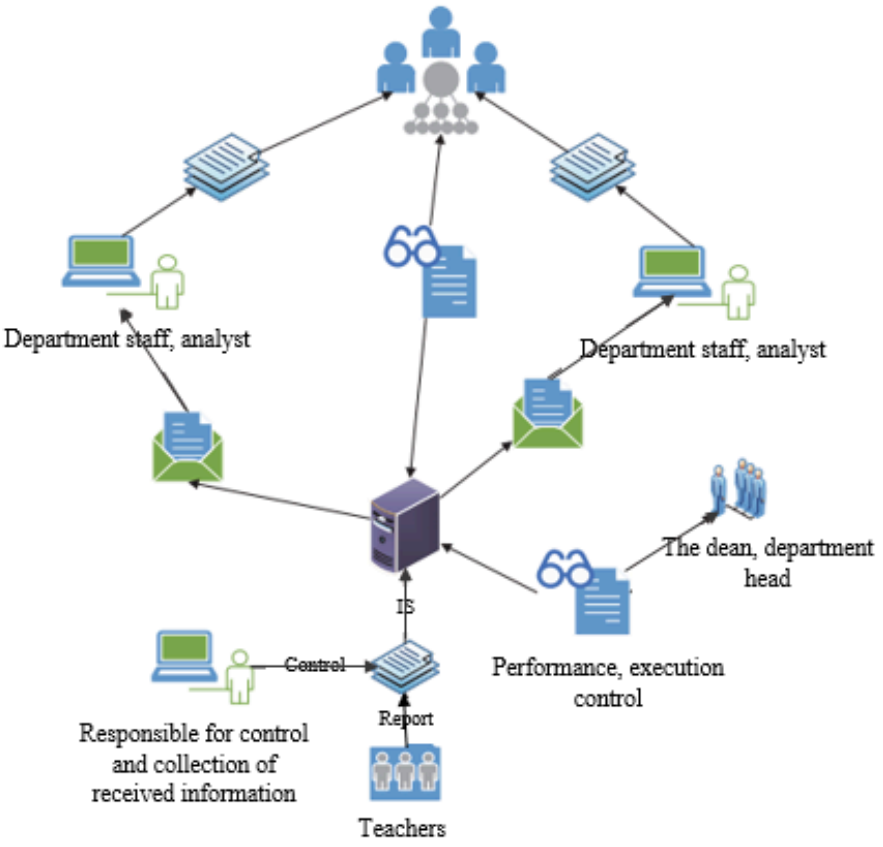

Figure 2. Information Flows with the Presence of a Digital System

Thus, an effective digital transformation should be grounded in an architectural approach, consider the role of information architecture, and provide a comprehensive view of the university's needs as a unified, complex system with numerous internal connections.

Digital transformation implemented through an architectural approach will offer the following advantages at the level of information architecture, compared to the fragmented informatization commonly seen in many universities:

− optimize information flows;
− enhance communication efficiency between departments, executives and administration;
− improve the reliability of the information received, minimizing incorrect reporting and data duplication;
− increase the efficiency of information systems.

The study concludes that the digital transformation of universities requires not only the implementation of advanced technologies but also an integrated approach to reorganizing information architecture. Such an approach will significantly enhance the efficiency of management processes, reduce information duplication, and improve data reliability. Additionally, it will enable universities to better adapt to the digital economy by fostering improved interdepartmental collaboration and increasing the resilience of the educational system amidst rapid changes. Therefore, to achieve a successful digital transformation, it is essential to develop strategies tailored to the specific needs of each institution, while also ensuring adequate staff qualifications and infrastructure capabilities.

Conclusions. The findings demonstrate that the transformation of universities' information architecture requires a systematic and architectural approach to ensure its effectiveness. Such an approach allows universities to optimize information flows, improve the reliability of data, and enhance management efficiency. The introduction of integrated information systems, underpinned by a unified architectural vision, supports departmental integration and significantly reduces inefficiencies arising from fragmented systems. Additionally, it ensures smoother communication between university departments, which is critical for achieving operational harmony in the context of rapid digitalization.

Digital transformation also brings the opportunity to address long-standing challenges in the education sector, including the duplication of processes, inaccuracies in reporting, and the underutilization of data resources. By reimagining information architecture, universities can align themselves with the needs of the digital economy, fostering a more resilient and innovative educational environment. These structural changes not only benefit internal stakeholders, such as staff and students, but also improve the institution's attractiveness to external partners, including investors and collaborators.

Despite these benefits, the study highlights that technological advancements alone are insufficient. Successful digital transformation necessitates significant investment in developing staff competencies, aligning IT strategies with institutional goals, and establishing robust infrastructure capable of supporting the integration of advanced digital tools. Universities must foster a culture of continuous professional development to ensure staff readiness for the dynamic requirements of digital systems.

Prospects for further research. Future research should delve deeper into the development of adaptive platforms specifically tailored to the diverse needs of universities. These platforms should address not only technological compatibility but also operational adaptability to ensure seamless integration across varied institutional frameworks. A significant research focus should be placed on creating scalable solutions that account for the size, resource availability, and strategic goals of different universities.

Moreover, it is crucial to explore advanced methods for enhancing staff qualifications in the use of digital systems. Training programs should be designed to cover emerging

technologies, including artificial intelligence and machine learning, which have the potential to revolutionize information processing and decision-making in education. These programs should also emphasize the importance of cybersecurity, as the increasing digitization of information raises the risk of data breaches and cyber threats.

Another promising avenue for future studies is the examination of best practices in international collaborations, particularly in the context of shared digital infrastructures and knowledge exchange. Collaborative initiatives could significantly reduce the cost of digital transformation and accelerate the adoption of innovative systems. Universities should also focus on developing partnerships with technology providers to leverage expertise in the design and implementation of tailored solutions.

Lastly, research into the socio-cultural impacts of digital transformation on university communities is essential. This includes evaluating how digitalization influences teaching methodologies, student engagement, and the overall learning experience. Insights from these studies could help institutions balance technological innovation with human-centric approaches to education, ensuring that digital tools enhance, rather than replace, the core values of higher education.

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ТРАНСФОРМАЦІЯ ІНФОРМАЦІЙНОЇ АРХІТЕКТУРИ В УМОВАХ ЦИФРОВІЗАЦІЇ УНІВЕРСИТЕТІВ

У статті досліджено трансформацію інформаційної архітектури університетів в умовах цифровізації. Цифрові технології є основою соціально-економічного прогресу, що має наслідки в освітній сфері. Оскільки університети стикаються зі збільшення попиту на технологічні інновації, ефективне управління інформаційними потоками стало критичним чинником у забезпеченні ефективної роботи та адаптації до цифрової економіки. Незважаючи на прогрес в інформатизації, багато університетів борються з фрагментарними інформаційними системами, що призводить до неефективних процесів, дублювання даних та недостовірної звітності.

Дослідження висвітлює виклики, пов'язані з неефективними IT-стратегіями, недостатньою компетентністю персоналу та нерозвиненою інфраструктурою, що перешкоджає успішному впровадженню цифрової трансформації. Традиційні підходи до передачі знань, що переважно базуються на обміні електронними документами, залишаються домінантними, що підкреслює необхідність упровадження більш інтегрованого та передового підходу. Наявним системам часто бракує єдиного бачення, адже підрозділи незалежно розробляють спеціалізовані рішення, які не взаємопов'язані між собою, що призводить до неефективності в управлінні інформацією.

У статті обґрунтовано важливість архітектурного підходу до реорганізації інформаційної архітектури університетів. Такий підхід передбачає комплексний аналіз як горизонтальних, так і вертикальних інформаційних потоків, виявлення точок, де порушено якість інформації. Упровадивши єдину концепцію збору даних та оптимізувавши ці потоки, університети можуть значно підвищити ефективність управління. Поетапна розробка інформаційно-аналітичних систем, адаптованих до специфічних потреб закладів вищої освіти, пропонується як ресурсомістке, але ефективне рішення. Рисунки, що ілюструють типові та оптимізовані інформаційні потоки, демонструють переваги інтегрованої цифрової системи. Ключові переваги включають оптимізацію інформаційних потоків, покращення комунікації між підрозділами, підвищення надійності даних, зменшення кількості помилок у звітності та підвищення ефективності інформаційних систем. Ці вдосконалення усувають критичні прогалини, залишені фрагментарними зусиллями з інформатизації, і готують університети до того, щоб краще відповідати вимогам цифрової економіки.

У дослідженні зроблено висновок, що успішна цифрова трансформація в університетах вимагає не лише впровадження передових технологій, а й цілісної реструктуризації інформаційної архітектури. Такий підхід сприяє покращенню співпраці між підрозділами, зменшенню неефективності та підвищенню загальної стійкості освітньої системи. Щоб досягти цих результатів, університети повинні визначити пріоритетом розробку спеціальних стратегій цифрової трансформації, інвестувати в адекватну IT-інфраструктуру та забезпечувати безперервний професійний розвиток персоналу. Ці заходи дозволять університетам привести свою діяльність у відповідність до динамічних вимог цифрової епохи, що зрештою сприятиме інноваціям та сталому зростанню.

Ключові слова: цифровізація, інформаційна архітектура, університети, ефективність управління, цифрова трансформація

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