

1.2. INVESTMENT AND ECONOMIC ASPECTS OF THE DIGITALIZATION OF CLASSICAL UNIVERSITIES IN THE CONTEXT OF DIGITAL TRANSITION

The digital transformation of the higher education system has become one of the key trends of the twenty-first century, covering not only the technological renewal of university infrastructure, but also radically changing its economic model, institutional logic, and management paradigm. Universities are increasingly operating in the complex environment of the knowledge-based economy, where information, data analytics, digital platforms, and intellectual capital determine not only the competitiveness of educational services but also the financial sustainability of academic institutions (Kozhyna, 2022).

The deployment of digital strategies in higher education is accompanied by a growing volume of investments in information and communication technologies, automated management systems, analytical dashboards, and platform solutions, which requires universities to reconsider their approaches to assessing economic efficiency, funding models, and resource allocation (Kubiv et al., 2020). In this context, it is important to analyze not only the technical parameters of digitalization, but also its economic consequences, such as cost optimization, revenue diversification, formation of digital assets, and changes in the structure of the educational market. Therefore, the digitalization of higher education appears as a multidimensional process that combines innovative, economic, managerial, and social factors, influencing university development strategies.

Despite considerable attention to the technological aspects of digital transformation, the investment and economic component of this process requires further scientific understanding, in particular in terms of measuring the effectiveness of digital investments, developing new business models for the academic sector, determining the role of digital assets as a source of added value, and building long-term financial sustainability of universities. Having a strategically sound digital policy focused on maximizing institutional profitability and integration into the global educational space is becoming a prerequisite for the growth of universities as autonomous economic agents in the digital age.

The purpose of this article is to systematically analyze the investment and economic aspects of the digitalization of classical universities in the context of digital transition. The paper reviews theoretical positions, empirical studies, and applied models that allow assessing the effectiveness of digital transformation in terms of financial return, flexibility of operations, scalability of services, and generation of digital assets. Particular attention is paid to the analysis of new sources of income, the impact of digital tools on reducing transaction costs, and the possibilities of creating business models focused on sustainable development.

Digitalization has become a defining vector of university development in the digital age, significantly affecting their economic logic and efficiency (Bobro, 2025). The analysis of theoretical sources confirms that the digital transformation of classical universities not only modernizes the educational process but also acts as an important factor in the economic growth and competitiveness of institutions. In particular, the implementation of digital technologies in higher education contributes to the development of innovative solutions, the emergence of new forms of interaction between universities and the labor market, and adaptation to global challenges by integrating the academic sector into the digital economy. Thus, the research results unanimously indicate that digitalization has become a strategic necessity for universities seeking long-term sustainability in the digital transition (Dushchenko, 2021; Reed, 2023). This is confirmed by both quantitative estimates and practical results: the most successful modern universities invest in technological innovation and digital transformation, which is a common factor in their rapid growth and financial sustainability (*EdTech: Technology Solutions That Drive Business*, n.d.).

At the same time, a number of researchers emphasize that the digital transition of universities is a systemic process that covers all areas of their activities: from the direct provision of educational services to integration into the knowledge-based economy. That is why this transition requires

a thorough, scientifically grounded approach that will ensure a sustainable and long-term effect (Andrushchenko, 2021).

One of the most important results of the digitalization of universities is an increase in the economic efficiency of their functioning. The implementation of information systems and digital platforms allows for the optimization of internal management processes and the reduction of costs associated with traditional infrastructure and bureaucratic procedures (Karpliuk, 2019).

The use of digital technologies, including the automation of routine administrative tasks (electronic document management, educational process management systems, etc.), allows the same functions to be performed faster and with fewer resources. For example, the transition to electronic communication and digital archives minimizes the need for paperwork and reduces the overhead costs of maintaining physical premises. Such measures not only reduce direct costs but also increase staff productivity by releasing time from routine operations. At the same time, digital tools (learning management systems, analytical dashboards, etc.) ensure more transparent and rational use of university resources, which also increases the economic return on their use.

The savings effects of digitalization are particularly evident in the long run due to economies of scale. Although the implementation of a modern IT infrastructure requires a significant initial investment, the marginal cost of servicing additional users or training courses is relatively low. It is noted that to launch online learning, a university needs to purchase licenses for platforms, server equipment, and provide IT support – these costs are significant at the start, but they practically do not increase with the number of courses or students.

As the number of users of digital educational infrastructure grows, the costs of supporting it are proportionally distributed, which leads to a reduction in the cost of educational services per student. Thus, the costs that may seem economically burdensome at the initial stage of implementing digital solutions are transformed, when scaled up, into a financially sustainable model due to economies of scale.

Research data shows that systems that are resource-intensive in a narrow implementation format demonstrate high efficiency in conditions of a wide application. Moreover, the development of distance learning helps to optimize the use of the university's existing material and technical base. In particular, the use of online courses can reduce the operational load on physical infrastructure (educational buildings, libraries, laboratories, etc.), which in turn helps to reduce the cost of energy supply, maintenance and depreciation of facilities (Huls, 2022; Komljenovic & Birch, 2023). Although such savings may not be immediately tangible, they accumulate over time, increasing the financial efficiency of the institution.

Distance formats also expand the audience that the university can serve without proportionally expanding the material base, which has a positive impact on the cost-to-income ratio. It is important to emphasize that economic efficiency is manifested not only in cost reduction but also in the prevention of potential losses. Thus, flexible blended and online learning formats contribute to the retention of students: in the absence of distance options, some students would simply not be able to continue their studies due to work, family circumstances, or remoteness, which would lead to an outflow of tuition income (Huk & Sklyarenko, 2022).

Therefore, digitalization increases not only operational efficiency but also the efficiency of attracting and retaining students, which directly affects financial results. In general, we can state the economic feasibility of digitalization: when properly implemented, it ensures more productive use of resources and, as O. Khomenko, M. Paustovska, and I. Onyshchuk note, “makes the work of all participants easier, faster, and better” (Khomenko et al., 2024) and thus improves the “cost-result” ratio in the university's activities.

The economic aspects of the digital transformation of universities are inextricably linked to the analysis of the investment component, as the implementation of digital technologies requires significant investments in the development of IT infrastructure, software acquisition, and staff development. In this regard, management decisions on digitalization should be based on a thoroughly justified assessment of the economic feasibility of such investments, considering their potential return in the short and long term. M. Hashim, I. Tlemsani, and R. Matthews

emphasize that the efficiency of digital transformation is largely determined by a clear formulation of the expected results and the identification of relevant indicators of the efficiency of the implemented solutions (Hashim et al., 2024). In other words, there is a request for an ROI (return on investment) approach in the field of EdTech: higher education stakeholders – investors, governing bodies – demand transparent metrics that would demonstrate whether the implementation of a digital solution brings tangible benefits in terms of cost savings, improved quality of educational services, and student performance.

A well-calculated ROI provides confidence that every hryvnia invested is working for the result, in particular, contributing to an increase in student success (retention and graduation rates), reduction of operating costs, and increased productivity (Bobro, 2024). Accordingly, the investment logic of digitalization is based on the principle of resource optimization: financial, technological, and human resources should be directed to those digital projects that will ensure maximum impact and effect.

In practical terms, this means the need for strategic planning of digital investments. The decision to implement a particular digital tool should be made on the basis of a business case, including a detailed cost-benefit analysis. Educational institutions should evaluate not only direct returns – for example, the expected increase in income from a new online program or savings from process automation – but also indirect effects, such as improved reputation, expanded audience, and increased student satisfaction.

Experience in implementing digital innovations shows typical challenges: high initial costs, risk of underutilization of acquired technologies, scaling problems, and difficulty in measuring results (*EdTech: Technology Solutions That Drive Business*, n.d.). Therefore, the investment logic of digital transformation requires a clear prioritization of projects focused on the strategic goals of the institution, as well as the implementation of comprehensive change management.

In this context, the feasibility of avoiding fragmentary or situational implementation of technological innovations that are not integrated into the overall mission and long-term development strategy of the university is reasonably emphasized. It is considered appropriate to focus on the implementation of innovative solutions that are directly aimed at solving the current problems of higher education institutions, in particular, increasing the availability of educational services, improving academic results, or optimizing cost mechanisms. This targeted approach helps to ensure that investment decisions are justified in the long term. The results of analytical studies show that more than 40% of university leaders consider reducing technology costs as one of the key benchmarks of digital transformation, which can only be achieved with a strategically adjusted and systematic approach to the implementation of digital tools (*EdTech: Technology Solutions That Drive Business*, n.d.).

In particular, reallocating budgets and partnering with external technology companies can allow for implementing new solutions without increasing overall costs, as long as existing processes are optimized. The investment model of digitalization is increasingly shifting from one-time costs to a continuous innovation cycle: universities should regularly evaluate the efficiency of implemented technologies and adjust strategies as necessary to avoid a situation of “investment without return”. As Kaku M. notes, technology should bring predictable and manageable results – to facilitate and speed up work, and not become a burden on the budget (Kaku, 2019).

Therefore, the effectiveness of digital investments is ensured only if they are closely linked to the university's strategic priorities and their impact is constantly monitored. If managed properly, digital transformation becomes a tool that increases the flexibility of educational services, the quality of the student experience, and the efficiency of operations, i.e., it has a multiplier effect on the university's mission. On the contrary, if the implementation is haphazard, the university risks getting a “limited return on technology” and diversion of resources without noticeable improvement in results. Thus, the research results clearly show that the investment logic of digitalization should be supported by a clear vision of goals and measurable success indicators, which will allow classical universities to maximize the potential of digital innovations while minimizing financial risks.

Large-scale implementation of digital technologies leads to a significant restructuring of the traditional business model of the university (Abad-Segura et al., 2020). Historically, classical universities have always depended on income from full-time student training (tuition fees, state funding per student) and a steady increase in enrollment as the main source of income growth. However, this model is running out of steam: demographic and market trends no longer guarantee a steady increase in student enrollment, and tuition increases have limits due to competitive pressures and the need for affordable education.

Today, the traditional business model of higher education has experienced a structural crisis, as institutions can no longer rely solely on the growth of tuition fees from the main category of students as a key source of financial stability. In response, universities must look for new approaches to forming their income and value proposition. Digitalization opens up opportunities for these business model innovations. In particular, the widespread implementation of digital platforms provides universities with an opportunity to rethink the traditional model of providing educational services, transforming it into a more flexible, adaptive, and focused on the individual needs of students.

The research notes that digital platforms create new opportunities for the formation of innovative business models, the development of the educational technology industry, and the integration of various participants in the educational market into a single information space (Popelo et al., 2024). It means that the university can go beyond the traditional campus and classrooms by using online courses, massive open online courses (MOOCs), joint educational programs on global platforms, certificate programs for specialists, consulting and research services, etc. Each of these areas transforms the structure of the university's income and expenses, as well as its positioning in the educational market.

First, digitalization allows universities to diversify their sources of income. Whereas previously the main source was tuition fees for long-term full-time students, now there are opportunities to receive income from short-term online courses, professional development programs, and licensing of their educational content or technologies. For example, a university, having created a unique online course or e-textbook, can simultaneously train a much larger number of students around the world than is possible in a classroom format, thereby scaling its educational product without a proportional increase in costs. Moreover, such content can become a source of license payments in the case of partnerships with educational platforms or other institutions. The research by H. Lopushnyak, N. Chala, and O. Poplavska records cases where universities turn the created academic content into an asset that generates economic benefits for a long time (Lopushnyak et al., 2020).

Knowledge digitized in the format of video lectures, online courses, or e-learning materials acquires reusable properties, which allows for the stable generation of added value and potential income even in the absence of the content author in the university structure. This significantly changes the logic of the business model: educational content acquires the features of a digital asset capable of generating rental income, not just one-time benefits. However, this “capitalization” of knowledge also raises new questions about intellectual property rights and income distribution, but in economic terms, it undoubtedly expands the university's financial horizons.

Second, digital transformation contributes to the emergence of new formats of educational services that better meet the needs of modern “digital” consumers. Instead of rigidly structured educational programs, universities implement modular and personalized learning paths, on-demand courses, and lifelong learning. These formats, supported by technology (adaptive learning software, online testing platforms, progress tracking systems, etc.), enhance the value of the university's offer to different audience segments, from traditional applicants to working professionals and international students. As a result, universities are entering new markets and segments, increasing their presence and revenues.

Third, digitalization is forcing universities to reconsider the cost side of their business model, including the structure of staff, campus, and student support costs. The role of investments in technological infrastructure and cybersecurity is growing, while certain traditional costs may be

decreasing (e.g., the cost of physical libraries is decreasing due to access to electronic resources). In this context, universities face the challenge of increasing cost flexibility to quickly adjust their budgets to new models of operation. Overall, research findings show that digital transformation is changing the very paradigm of the university business model – from a model based on the extensive expansion of traditional education to one based on innovation, intellectual capital, and multichannel educational products. This transformation directly leads to the need to develop adaptive and sustainable business models for the digital age, capable of ensuring the effective functioning of universities in the context of intensive globalization of the educational space and dynamic technological development.

The digitalization of classical universities significantly changes the structure of their intangible resources, moving them into the knowledge-based economy. While traditionally, the main assets of a university were its staff (faculty), material base, and reputational capital, in the context of the digital transition, digital assets – educational content, data, software platforms, network interconnections – come to the fore. Knowledge and information are becoming capital that can be accumulated, transformed, and used to create value. Studies of intellectual capital indicate that digitalization is changing the ratio of its components in favor of the structural and innovative capital of universities (Sklyarenko et al., 2024). In other words, the share of knowledge contained in systems, databases, technologies, and organizational processes (structural capital), as well as the ability to generate new ideas, products, and solutions (innovative capital), are increasing under the influence of digitalization. The introduction of the “digital university” concept actually means building a new knowledge management system where digital technologies are integrated into all processes – from education and science to administrative management (Verina & Titko, 2019).

One of the most valuable digital assets of a modern university is data. In the course of its activity, the university generates big data sets – about students' academic achievements, research results, infrastructure, and interaction with external stakeholders. When properly processed, this data turns into an analytical resource for decision-making and strategic planning. For example, the use of Learning Analytics methods (learning data analysis) allows us to identify hidden patterns in student behavior, predict the risk of dropout, and individualize educational trajectories, which improves the quality of education and the university's performance. Data on research and development can serve as a basis for commercialization (patents, startups), which generates new sources of income.

Thus, universities that operate based on management principles focused on data analytics gain tangible strategic advantages in the context of the knowledge-based economy due to the ability to transform information resources at the organizational level into long-term assets. However, the commercial use of educational data requires not only technical capability but also a high level of regulatory and ethical responsibility. This implies strict adherence to the principles of personal information protection, academic integrity, and legal regulation of procedures for accessing, processing, and using data. In this regard, the problem of the so-called information rent, which is the economic appropriation of the value generated by access to educational data sets, and the determination of the legitimate limits of such benefits in the public sector, is of particular importance.

In the absence of proper data governance, the university risks losing some of its potential value to external platforms or corporations that exploit educational data. Therefore, the formation of a digital asset management policy is another important result of digitalization that is recorded in research. Another aspect – academic content as a digital asset – was mentioned earlier in the article. The peculiarity is that knowledge, once digitized, can be replicated many times with virtually no additional costs. This makes a new type of economic relationship possible: the university invests in the creation of high-quality digital content (course, textbook, simulation, etc.) and then receives a long-term return on it. The source of value here is intellectual property in digital form. In fact, a market for educational content is being formed, where universities can act as both suppliers and consumers of content resources.

According to the Global Challenges, universities are increasingly viewing educational materials and online courses as assets that bring economic benefits for a long time (*Global Challenges – Data Assets and the Future Governance of Higher Education*, 2023). This indicates a change in mentality: knowledge is no longer a purely informal “teacher's skill” and is becoming an alienated product that can be transferred, licensed, and sold. This approach fits into the concept of the knowledge-based economy, where the main values are intellectual, intangible resources. Accordingly, the university's digital strategy largely focuses on accumulating, protecting, and enhancing its digital assets – content, data, and technology. This becomes part of the economic model: the university invests in the creation of digital assets (through supporting teachers in developing online courses, building institutional repositories, platforms for collaborative research, etc.) with the expectation that these assets will strengthen its position in the long run.

The research results confirm the validity of this approach: digital assets are key elements of the knowledge-based economy, and universities that successfully create and use them gain competitive advantages and new growth opportunities.

At the same time, it is important to combine innovation with appropriate management – issues of content licensing, teachers' rights, and maintaining ethics in the use of data should be addressed in parallel with the economic exploitation of digital assets. To summarize, digitalization is moving universities into the knowledge-based economy, where the main success factors are the ability to generate, accumulate, and commercialize knowledge using digital technologies. The formation of powerful intellectual capital on a digital basis is the result that ensures the sustainability and development of universities in the twenty-first century.

In the context of the above facts, we can state that digital transformation is a powerful tool for strengthening the financial sustainability of classical universities. By financial sustainability, we mean the ability of a higher education institution to consistently ensure a balanced budget, adapt to external shocks, and invest in its development. Digitalization contributes to this in several ways (Figure 1).

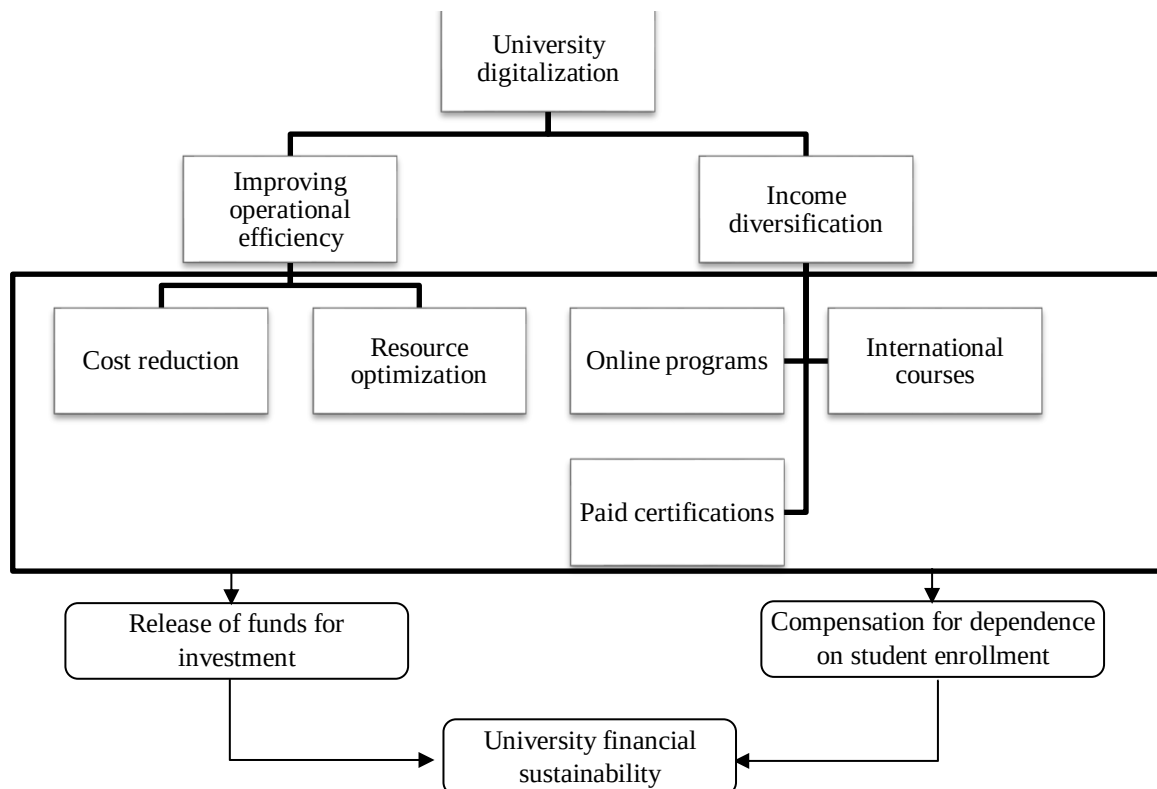


Fig. 1. The impact of digitalization on the university's financial sustainability
Source: compiled by the author

As we can see from Figure 1, first of all, increased operational efficiency directly strengthens the financial base: the university spends fewer resources per unit of educational result, thereby releasing funds for reserves or new investments. Digital solutions have been shown to reduce or optimize a number of cost items (administration, infrastructure maintenance), which increases budget sustainability to possible funding cuts or revenue fluctuations. Second, the diversification and growth of income through digital educational products reduce the university's dependence on mono sources of funding. Traditionally, the university budget is very sensitive to fluctuations in enrollment in major programs – a decline in enrollment immediately creates a shortage of funds. However, the introduction of online programs, international courses, and paid certifications for a wider audience allows for compensating for a possible decrease in the local contingent at the expense of the global audience. According to forecasts, the share of the online segment in the global higher education market is growing steadily and will reach tens of billions of dollars by the mid-2030s (*Boston Consulting Group*, 2021). This confirms that universities that successfully enter this segment will be able to count on a significant income inflow by attracting foreign students.

There are already examples of innovative universities using digitalization to create financially sustainable models that are less dependent on local circumstances: reviews of the most successful institutions have shown that they have all relied on technological innovation and digital development strategies (EdTech). In other words, investments in digitalization directly correlate with the financial dynamics of universities, which is manifested in the outpacing growth of their indicators compared to traditional competitors.

Third, digitalization increases adaptability and resilience to crisis situations, which has become particularly evident in recent years. Universities that had a developed online infrastructure before the digital transition have survived the instability of the external environment much better, maintaining the continuity of the educational process and sources of income. In turn, higher education institutions that did not have established digital learning channels experienced a rapid decline in income and had to urgently implement anti-crisis management strategies. This experience has significantly transformed management approaches: the digital ecosystem is increasingly being positioned as a tool to ensure the financial security of the university. In particular, the ability to quickly transform the educational process into a distance format and maintain access to online resources is now seen as a factor of stability in a crisis.

According to research by various scholars, universities with a high level of digital maturity demonstrate better results in many key indicators, from income growth to customer satisfaction (Verina & Titko, 2019; Williamson et al., 2020). In particular, according to research by the Boston Consulting Group, digitally advanced organizations outperform their peers in terms of income growth, profitability, and cost efficiency (*Boston Consulting Group*, 2021). For higher education, this translates into specific measurable benefits: higher student enrollment and retention rates, higher graduate employment rates (which increases the attractiveness of education), better operational efficiency, and greater innovation in research.

All of these factors have a financial impact, as higher enrollment and better academic performance mean higher income, and efficient processes mean lower costs. Thus, digitalization creates a comprehensive positive financial effect. It is important to emphasize that the potential of digitalization for financial sustainability is not automatic – its realization requires careful management. For example, the maximum economic effect is achieved when there is a holistic digital strategy that combines all the aspects considered: efficiency, thoughtful investment policy, new business models, and digital asset management. Only in combination can these elements bring a university to a new level of financial self-sufficiency. If the university simply invests in technology without reorganizing processes or developing new products, the desired result may not be achieved.

The results of modern research confirm that universities that consciously realize their digital potential and implement appropriate strategies are transforming into operationally efficient organizations, which is a prerequisite for their long-term business sustainability. In other words,

digital maturity is increasingly being equated with financial reliability and institutional capacity. Summarizing the analytical results, it can be argued that the digitalization of classical universities in the context of the digital transition has clear investment and economic benefits. It helps to increase economic efficiency by optimizing costs and scaling operations, initiates a new investment logic focused on strategic feasibility and profitability assessment, transforms traditional business models towards innovation and customer focus, and ensures the formation of digital assets as a factor of competitiveness in the modern knowledge-based economy. The combined effect of these factors significantly strengthens the financial sustainability of universities, creating conditions for their stable functioning even in the face of external turbulence. At the same time, digital transformation is accompanied by new management challenges, such as updating accounting structures, forming digital competencies of staff, and ensuring information security. Therefore, in the context of the digital transition, classical universities have a significant economic incentive to continue and deepen digital transformation, as its results contribute to the long-term success and sustainable development of these institutions on a knowledge and information basis.

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