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Прийняття: 22/08/2025
Рецензія: 30/08/2025
Публікація: 30/09/2025

DOI: <https://doi.org/10.53920/ES-2025-4-1>

DIGITAL AVATAR AS AN ECONOMIC ASSET OF THE UNIVERSITY

JEL Класифікатор:
E24, I20, I25, N3



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The article provides a theoretical and methodological substantiation of the conceptualization of a teacher's digital avatar as an intangible economic asset in the ecosystem of a digital university. The essence, structural components, and functional connections of the avatar with key university subsystems are defined, and its role in forming value propositions and transforming data and pedagogical expertise into economic results is demonstrated. It is argued that the combination of data, AI algorithms, and institutional management mechanisms ensures the transition from fragmented digitalization to controlled digital capital of the university.

The existing approaches to digital transformation of education and platformization are analyzed, and their limitations regarding economic identification and measurement of the effects of digital assets are outlined. A framework for evaluating a teacher's digital avatar is proposed, taking into account the identifiability of the asset, the manageability of the model lifecycle (design – training – validation – deployment – monitoring/audit – update), privacy-by-design requirements, explainability, and intellectual property. A generalized map of economic value is presented with metrics of causal attribution of impact on income, costs, quality of educational outcomes, and risks.

It has been demonstrated that a teacher's digital avatar as a virtual pedagogical agent based on AI provides personalization of learning, scalability of 1:N interaction, reduction of service

ISSN 2786-5339 (print)
ISSN 2786-5347 (online)

transaction costs, acceleration of course development, and strengthening of the university's brand due to the network effects of an integrated digital infrastructure. It has been proven that institutionalizing the avatar as an asset (legal regime, data policies, management accounting, KPIs, external quality audit) creates the foundation for sustainable monetization and long-term competitiveness.

The research results confirm the feasibility of transitioning to an ecosystem model of a digital university, in which a teacher's digital avatar is the core of value creation and intellectual capital reproduction. Practical recommendations have been formulated regarding the phased implementation (from pilots to scaling), integration with internal systems, and the establishment of evidence-informed management metrics.

Keywords: digital university, teacher's digital avatar, digitalization, intangible assets, artificial intelligence, valuation.

Наталія БОБРО

ЦИФРОВИЙ АВАТАР ЯК ЕКОНОМІЧНИЙ АКТИВ УНІВЕРСИТЕТУ

У статті здійснено теоретико-методологічне обґрунтування концептуалізації цифрового аватара викладача як нематеріального економічного активу в екосистемі цифрового університету. Визначено сутність, структурні компоненти та функціональні зв'язки аватара з ключовими підсистемами університету, подано його роль у формуванні ціннісної пропозиції та перетворенні даних і педагогічної експертизи на економічні результати. Аргументовано, що поєднання даних, алгоритмів ШІ та інституційних механізмів управління забезпечує перехід від фрагментарної цифровізації до керованого цифрового капіталу університету.

Проаналізовано наявні підходи щодо цифрової трансформації освіти та платформізації, окреслено їх обмеження щодо економічної ідентифікації й вимірювання ефектів цифрових активів. Запропоновано рамку оцінювання цифрового аватара викладача з урахуванням ідентифікованості активу, керованості життєвим циклом моделі (проектування – навчання – валідація – розгортання – моніторинг/аудит – оновлення), вимог privacy-by-design, тлумачення та інтелектуальної власності. Запропоновано узагальнену карту економічної цінності з метриками каузальної атрибуції впливу на доходи, витрати, якість освітніх результатів і ризики.

Показано, що цифровий аватар викладача як віртуальний педагогічний агент на основі ШІ забезпечує персоналізацію навчання, масштабування взаємодії 1:N, зниження транзакційних витрат сервісів, прискорення розроб-

лення курсів і підсилення бренда університету завдяки мережевим ефектам інтегрованої цифрової інфраструктури. Доведено, що інституціоналізація аватара як активу (правовий режим, політики даних, управлінський облік, KPI, зовнішній аудит якості) створює підґрунтя для стійкої монетизації та довгострокової конкурентоспроможності.

Результати дослідження засвідчують доцільність переходу до екосистемної моделі цифрового університету, у якій цифровий аватар викладача є ядром створення вартості та відтворення інтелектуального капіталу. Сформульовано практичні рекомендації щодо етапності впровадження (від пілотів до масштабування), інтеграції з внутрішніми системами та встановлення метрик evidence-informed управління.

Ключові слова: цифровий університет, цифровий аватар викладача, діджиталізація, нематеріальні активи, штучний інтелект, оцінювання вартості.

Problem statement. The digitalization of higher education is accompanied by profound transformations in both the content of education and the organization of educational and economic interaction between universities, the state, business, and society. In this context, the task of building a holistic educational and economic ecosystem of a digital university becomes relevant, capable not only of training specialists with competencies relevant to the digital economy but also of increasing intellectual capital as the basis for sustainable development. At the same time, scientific discourse lacks a comprehensive approach to analyzing a university as an open, adaptive, and economically oriented ecosystem in which data is a strategic resource and artificial intelligence (AI) is a key tool for personalization and efficiency improvement.

Most higher education institutions continue to replicate the “classical” university model, which focuses primarily on knowledge transfer and the fragmented implementation of digital solutions. This leads to inertia in responding to the challenges of global competition, incomplete integration of digital platforms, limited interaction with employers, and insufficient use of the potential of data analytics and artificial intelligence. In addition, the methodological and ethical limitations of data-centric approaches are intensifying, including data incompleteness and noise, the complexity of predicting rare events, high infrastructure costs, and requirements for privacy and algorithm explainability.

Against the backdrop of these challenges, the concept of a teacher’s digital avatar – a virtual pedagogical agent based on AI, capable of cognitive adaptation, providing feedback, and modeling pedagogical practices in interaction

with students - is being formed. Despite its proven pedagogical usefulness, no agreed framework allows identifying a digital avatar as an intangible economic asset of a university, measuring its contribution to value creation (revenue, cost savings, quality, risks), integrate it into the business model and process architecture, and ensure legal protection, model lifecycle management (versioning, audit, explainability, human-in-the-loop), and data compliance.

Therefore, the problem lies in the lack of a holistic, economically justified approach to the design, evaluation, and management of the teacher's digital avatar as a component of the educational and economic ecosystem of a digital university. Overcoming this gap requires: conceptualizing the avatar as an intangible asset; developing metrics and procedures for causal attribution of effects; integrating it into the business model and management accounting system; defining legal regimes and data governance policies. The focus should be on building a flexible, sustainable, and strategically oriented model that transforms data and pedagogical expertise into manageable digital capital of the university and ensures long-term competitiveness in the digital reality.

Analysis of recent research and publications. The theoretical basis for researching the digital university as an educational and economic ecosystem is based on interdisciplinary work covering both the general framework of digital transformation and the specifics of educational practices in the post-pandemic period. The conceptual foundations of the digital transformation of organizations are presented in works that outline the conceptual apparatus and logic of the transition to data-centric and platform models [1]. They also record the state and trends of the digitalization of education at the national level [2]. The impetus to rethink learning formats has been confirmed by studies analyzing distance education policies and practices under pandemic restrictions [3] and students' choices between full-time, hybrid, and online lectures, along with learning outcomes at technical universities after the pandemic [4].

An important contribution to understanding the organizational architecture of a digital university is provided by developments in platformization as a modern innovation in the management and coordination of interaction between participants in the education market [5]. There is also research on the impact of interactive technologies on the learning process and the development of higher education students, which empirically support the feasibility of intensive digitalization of educational practices. [6]. In terms of the economic and legal context, works on the innovation potential of European countries and the institutional conditions for its implementation [7] are relevant, as well as studies of

the socio-economic determinants of the sustainable development ecosystem, which emphasize the role of universities as elements of broader social systems [8]. Additional dimension is provided by works on inclusive approaches to development and reducing inequality in European countries [9], which set value benchmarks for the design of digital educational services, and research on the role of AI in forming future strategies (in particular, marketing strategies). This demonstrates the possibilities of algorithmic personalization, data analytics, and scalable interaction with stakeholders [10].

Despite this, contemporary research still lacks a holistic economic understanding of the digital university as an open ecosystem, as well as methodologically verified approaches to identifying and evaluating digital assets (in particular, the teacher's digital avatar) and their integration into the institution's business model and data governance system.

The aim of the article is to substantiate data as a strategic resource and clarify the meaning of the category «university digital asset», in particular the concept of a teacher's digital avatar as its component, based on an analysis of the digitalization of higher education and the evolution of university business models; to develop and present a map of the economic value of the avatar with relevant metrics for measuring its impact on revenues, costs, quality of educational outcomes, and risks, as well as to outline the institutional conditions for integrating this asset into the university's business model and management processes.

Presentation of the main research material. In the digital economy, data presented in electronic form is a key resource for the development of any organization. It determines management efficiency, contributes to increasing labor productivity, creation new jobs, and maintaining a high level of technological development. The universality and multifunctionality of digital data make it a fundamental factor in modern economic and social processes. This is particularly important for educational institutions, as data ensures the growth of productivity in educational and scientific activities and contributes to the formation of new educational services and models of interaction. Under such conditions, there is a continuous increase in the complexity of ready-to-use educational products and services, as well as management and organizational processes. The rapid pace of change in various fields means that educational technologies, methodologies, and even institutional practices are quickly becoming obsolete.

In turn, the globalization of educational markets, the growth of innovative educational products, and global competition are forcing universities to acceler-

ate the development of educational technologies, shorten the cycles of creating new programs, and ensure high-quality educational services [7, P. 263]. In this context, the university's business model becomes particularly important. A business model in higher education is a generalized conceptual construct designed to describe and analyze the activities of an institution, its educational and management processes, and their interrelationships. It is cyclical in nature: certain models of functioning become obsolete over time and are replaced by new ones. At the same time, mistakes in implementing new models can lead to significant financial losses, a decline in reputation, or even a crisis in university management. Therefore, it is extremely important to be able to correctly design and evaluate various scenarios within educational models. The benchmarks for this are students and their educational needs, as well as the targeting of innovative educational solutions [2, P. 41].

Digitalization has significantly affected key components of university business models. It has changed the ways in which educational activities and management are organized (from business model structure to marketing tools), transformed the resources needed for functioning, influenced educational costs and transactional processes, and actualized the effects of scale and network interaction. The widespread dissemination of educational business models occurred with the development of personal computers, which made it possible to design various elements of educational activities. Today, educational models are being consciously created, rather than randomly adapted to circumstances, as was the case in the past. Each university business model includes the following components: the development and implementation of educational programs and scientific products; student recruitment and services (from finding the target audience to promoting educational services); financial mechanisms that determine how students pay for their education and how universities generate profits and resources for development [3, P. 113].

Relations between universities and students are reaching new heights due to digital technologies and the application of artificial intelligence. New rules of interaction are being formed, where the needs, requests, and expectations of students become the priority and the main source of value creation. Educational institutions are increasingly focusing on an individual approach to working with each student, on the quality and uniqueness of their educational experience, both in the traditional format and in a remote environment. The use of modern digital technologies accelerates not only production and administrative operations at universities, but also the educational process itself. This leads to a reduction in the average «life cycle» of both individual educational products and university business models in general.

Technological development is also facilitated by the extremely rapid growth in the volume of data that universities can use as an asset – it is information about students, graduates, scientific publications, research results, and statistics on educational processes. As a result, new ways of interaction between the university and students are emerging, based on the analysis of educational data. The popularization of science and the use of modern gadgets and digital tools are creating a new educational environment, without which it is difficult to imagine a university today. Artificial intelligence is already capable of predicting students' educational needs, offering adaptive courses or educational trajectories, and providing personalization of learning [7, 9]. This is achieved through algorithms that identify patterns in user behavior – so-called information «traces». Every student leaves such traces when searching for educational materials, using electronic libraries, or social educational platforms. Thus, the accumulation and intellectual processing of educational data becomes not only a tool for personalizing learning but also the basis for the formation of new economic models of universities. This opens up prospects for the emergence of additional sources of income and strengthening competitiveness.

New sources of profit and factors of competitiveness play a special role in the modern educational space. A characteristic feature of the digital economy is the improvement of products and services through data [9, 10]. Today, educational data is the main resource that determines the quality of educational programs, management efficiency, and the value of educational products. The use of machine learning technologies makes it possible to predict the life cycle of educational programs and services, monitor their quality in real time, and optimize management processes. Remote software updates or remote access to educational resources increase the value of existing systems instead of their rapid depreciation. The use of business analytics allows the «life cycle» of educational platforms and technologies to be extended. Based on such forecasting, completely new models of university functioning are being formed, relying on digital capital as a strategic resource. Digital capital is becoming a fundamentally new source of income and a factor in the competitiveness of educational institutions. In modern scientific research, its growth is considered a key indicator of the development of universities in the digital economy [10, P. 44].

A characteristic feature of the digital economy that directly affects universities is the high proportion of innovation, knowledge, and the dominance of educational and scientific services over other types of activities. The digital technologies of universities depend on the knowledge and competencies of their employees, access to modern Internet solutions, electronic services, and digital financial mechanisms. In this context, the concept of a «digital asset» is formed. It does not yet have an established definition, which complicates its interpretation and applica-

tion in the field of education. Incomplete interpretation leads to ambiguity in the use of the term, distorts understanding of processes, and limits the ability to correctly evaluate the university's digital assets. That is why it is important to clarify the essence of the concept of «digital asset». In this research, a digital asset is defined as a specific resource based on a value component and used as a unique information identifier. It can be considered in connection with several components – economic, legal, informational, and value – that form the comprehensive basis of the modern educational model. This interconnection is shown in Figure 1.

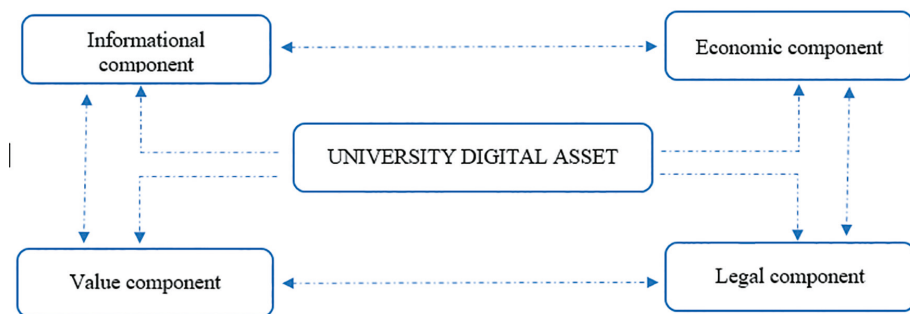


Figure 1. The concept of «university digital asset» in economic and legal terms

Source: compiled by the author independently

Digital components enable universities to develop competitive advantages in the global market, increase the productivity of educational activities, reduce the time needed to create new programs, and ensure their quality. One of the key innovations in this context is the teacher's digital avatar – a virtual teaching agent based on artificial intelligence that reproduces the image of a teacher in a digital environment. Within the digital university ecosystem, such an avatar functions as an autonomous participant in the educational process, capable of cognitive adaptation, providing feedback, and modeling pedagogical practices in interaction with students [1, 7]. This makes it possible to «intelligently» predict educational needs, individualize educational trajectories, optimize the organization of classes, and improve the efficiency of the educational process management. Modern educational platforms that integrate teachers' digital avatars support real-time analytics, which not only improve the quality of educational services but also enable rapid program adaptation, extend the «life cycle» of educational products, and create new forms of pedagogical interaction.

Digital avatars of universities differ in terms of scalability, ease of integration, cloud deployment options (public or private), and data protection levels. They are gradually becoming important elements of educational infrastructure, ensuring the management of large amounts of information and the optimization of the functioning of the entire educational system. Within the digital university ecosystem, the teacher's digital avatar, as a virtual teaching agent based on artificial intelligence, complements digital platforms and interacts with them as an autonomous actor. Such an avatar performs specific tasks within the educational process – from providing feedback to cognitive adaptation to the individual needs of students, while the educational platform ensures the structure and connectivity of all components of the educational ecosystem.

At the same time, the dissemination of solutions based on Big Data technologies shapes the understanding of the universality of an approach focused on mass data collection and accumulation. However, the use of big data in education has a number of limitations: incomplete information, difficulties in predicting unique or rare events, high costs of installing and maintaining data collection infrastructure, and risks of errors and system failures. An excessive amount of information can complicate the management decision-making process. In addition, without a clear understanding of educational process models, it is difficult to determine which data is relevant for analysis [4, P. 94].

Within the educational system, data is constantly being accumulated, forming so-called «digital shadows». These allow for highly accurate descriptions of the behavior of students, teachers, and even educational platforms, as well as predictions development of educational processes. For example, it is possible to assess the «residual resource» of an educational program, determine the effectiveness of the methods used, or predict possible risks of deterioration in the quality of education. The additional information obtained «trains» the teacher's digital avatar, enabling it to adapt, make more accurate predictions, and maintain the flexibility of the educational process.

The essence of the concept of a «teacher's digital avatar» in education is that it is a virtual information copy of a teacher that exists in a digital environment and serves as an intermediary between the educational process and its participants. The universality of a teacher's digital avatar lies in its ability to combine physical educational activities in real space with their virtual representation in the digital ecosystem. The data collection and processing technologies underlying the creation of a teacher's digital avatar involve scaling, standardization, and further use of information for students and teachers, as well as for univer-

sity management and analytical systems. As a result, a new class of educational platforms is emerging that not only provides access to educational resources but also integrates teachers' digital avatars to perform analytical functions, adapt the learning process, and improve its effectiveness.

When considering a teacher's digital avatar through the prism of economic value, it is appropriate to interpret it as an intellectual intangible resource that combines identifiability (model, data, interaction scenarios), controllability (legal basis, technical control, access policies), and the ability to generate future economic benefits for the university. Unlike a purely technological tool, such an avatar forms the digital capital of an institution – a set of data, algorithms, training scenarios, and reputational trust that is converted into financial and non-financial results. The effects are realized both on the revenue side (increased applicant conversion, personalized pricing policy, new digital products for the postgraduate education and corporate training market) and on the cost side (1:N scalability in providing consultations and feedback, reduction in course development time, optimization of the workload of teachers and service departments). At the same time, the quality of academic services is improving, transaction costs are decreasing (faster student onboarding, automated responses, 24/7 support), brand awareness and stakeholder loyalty are increasing, which is reflected in reduced outflow risks and stable cash flows.

The value of a teacher's digital avatar is also evident in the multiplicative platform effects: combining them with LMS/LCMS, applicant CRM, SIS, scientific repositories, and data lakes creates network externalities – the greater the interaction and reuse of content and scenarios, the lower the marginal cost of personalization for each additional student. Added to this are real development options: expansion into adjacent segments (microcredentials, short programs, corporate upskilling tracks), the launch of «avatar-as-a-service» B2B products for partners, and the licensing of training scenarios and templates. It is important that economic benefits coexist with regulatory restrictions: to transform a digital avatar into a full-fledged asset, clear IP rights regimes, privacy policies, and model lifecycle management (versioning, audit, explainability, human-in-the-loop) are required.

It should be noted that, in our opinion, economic assessment should be carried out in two areas. First, management accounting records the increase in cash flows and cost savings attributed specifically to the use of the avatar (uplift LTV, reduction in CAC/CAC analogue for educational programs, increase in retention, reduction in TTM for courses, reduction in support FTE hours). Second,

the portfolio perspective considers strategic optionality (the right, but not the obligation, to launch new products, enter new markets, or scale up in partner networks), which enhances the value of university digital capital in the medium and long term. Below is a generalized map of value creation that integrates revenue/cost-saving mechanisms, evaluation indicators, time horizons for effects, and necessary risk controls (Table 1).

Table 1. Map of the economic value of a teacher's digital avatar as a university asset

Dimension	How it creates value	Key performance indicators (KPIs)	Key risks/controls
Engagement and conversion	Personalized communication 24/7, quick responses	Lead→app→enroll conversion; response time; NPS	Brand tone, dialogue audit, scripts
Retention and success	Early detection of outflow risk, micro-recommendations	Retention; credit progress; share of "risky"	Explainability, escalation to curator
Operational efficiency	Scaling 1:N consultations, FAQ automation, faster TTM of courses	FTE hours; course TTM; share of automated inquiries	SLA, logging, model versioning
Quality and personalization	Formative feedback, modeling of pedagogical practices	Assessment results; completion; engagement	Academic integrity, anti-hallucination tests
Commercialization of knowledge	Licensing of scenarios, «avatar-as-a-service», B2B products	Revenue from contracts; repeat sales; margin	IP rights, data agreements, KYC partners
Data, brand, compliance	Anonymized insights; multilingualism; traceability of decisions	Data quality; share of foreign students; audit results	Privacy-by-design, audit, MLOps

Source: compiled by the author independently

The economic potential of this asset should be assessed through causal attribution to the university's business processes: revenue gains and cost savings should be compared to the baseline (before the avatar was implemented) on equivalent cohorts. A metric framework is used to manage the value portfolio: student LTV uplift, reduction in conditional CAC for programs, time-to-competency, course completion, NPS/CSAT, proportion of requests processed without human intervention, average response time, frequency and quality of avatar interventions, and academic integrity indicators. A financially justified assessment can be based on discounted cash flows, to which the value of real expan-

sion options (launching new programs/markets) and risk adjustments (model drift, privacy, brand risks, supplier dependence) are added.

The legal and ethical contours of the asset remain critically important: securing intellectual property rights to the avatar's «persona» and content; licensing and co-authorship with a real teacher; transparency and informed consent policies; restrictions on the use of personal data; mechanisms for explaining decisions; regular audits of bias and quality. It is these conditions that ensure the controllability of the asset and the conversion of its educational usefulness into sustainable economic value.

From the perspective of the asset management lifecycle, it is advisable to identify the stages of «design – training – validation – deployment – monitoring and audit – updating», with a clear distinction between CAPEX (creation of a base model, data preparation, integration) and OPEX (operation, support, MLOps, localization). Combined with data governance and a mature integration architecture, this creates cost control and predictability of economic effect.

In conclusion, it is worth noting that a teacher's digital avatar in the digital university ecosystem is more than just a set of algorithms and interaction scenarios. It is a managed intangible economic asset that transforms data and pedagogical skills into stable value streams, reduces transaction costs, strengthens the brand, and opens up options for future growth. It is through the institutionalization of rights, processes, and measurements that this asset gains the ability to systematically support the financial sustainability and competitiveness of the university in the context of accelerated digital transformation.

Conclusions and proposals. Within the scope of this work, a digital university is interpreted as a multi-loop educational and economic system that combines socio-technical, organizational, and market mechanisms for creating value and developing human capital in the digital economy. In this context, the teacher's digital avatar is not just a technological solution, but a managed intangible asset capable of scaling pedagogical practices, improving the quality of interaction with students. It also contributes to the sustainability of the university's business model through network effects and the expansion of value propositions.

The economic capacity of such an asset is revealed under conditions of its institutionalization: clear identification of the composition and intellectual property rights, integrated data and model lifecycle management, as well as

transparent rules of responsibility and quality control. At the same time, the ecosystem approach requires the coordination of internal subsystems (LMS/LCMS, SIS, CRM, repositories) with external stakeholders – the state, employers, partners – which ensures interoperability, reduces transaction costs, and provides resilience to the risks of digital transformation.

In the long term, a phased deployment of the teacher's digital avatar seems appropriate: from limited pilot experiments to institutional scaling with synchronized methodological support (standardized pedagogical scenarios, feedback protocols, personalization mechanisms) and regulatory and ethical support (privacy-by-design, requirements for explainability of decisions, codes of ethical use of AI). A key prerequisite is the implementation of a validation system for performance assessment with causal attribution of effects: KPI metric loop, experimental and quasi-experimental designs, regular bias and quality audits, ensuring evidence-informed management decisions, and reliable linking of educational and economic outcomes to avatar functioning.

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ЛІТЕРАТУРА

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