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DIGITAL TRANSFORMATION IN HIGHER EDUCATION INSTITUTIONS: A SYSTEMATIC LITERATURE REVIEW FROM 2020 TO 2025

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Abstract

Digital transformation (DT) has become a pivotal force reshaping higher education institutions (HEIs), especially after the COVID-19 pandemic, significantly influencing teaching, learning, and governance. Despite widespread technological adoption, the conceptual and operational understanding of DT remains fragmented due to its complex, multidimensional nature. This paper systematically reviews recent literature (2020–2025) to clarify how DT in HEIs is defined, why it is implemented, and which key components shape its success. The review follows Kitchenham's protocol and PRISMA guidelines, analyzing 90 peer-reviewed journal articles from Web of Science and Scopus, selected based on rigorous inclusion and exclusion criteria. Research questions were framed using the Population, Intervention, Comparison and Outcomes (PICO) model. The PICO model is often used to develop the search strategy for a systematic literature review. Findings reveal that DT in HEIs is driven by technological, organizational, business, and social factors. Core elements include the adoption of digital strategies, use of conceptual models and frameworks, development of digital skills and competencies, cultural and leadership support, digital readiness and maturity, and transformation in teaching and learning. This review is limited to English-language, indexed journal publications, potentially omitting relevant regional or gray literature. Future research should broaden the scope to include diverse contexts and assess digital maturity at institutional and national levels, particularly in underrepresented regions, to enable more inclusive and sustainable digital transformation in higher education.

Keywords: digitalization, digital transformation, higher education institutions, systematic literature review, university

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1. INTRODUCTION

In the past five years, particularly following the outbreak of the COVID-19 pandemic, digital transformation has significantly accelerated and has been increasingly recognized as a continuous, evolutionary process that affects all dimensions of life, including individuals and organizations. The pandemic served as a major turning point, forcing institutions to rapidly adopt and integrate digital technologies in response to global disruptions. Higher education is changing due to digital transformation (Akour & Alenezi, 2022, p. 4). Digital transformation (DT) has emerged as a defining force reshaping higher education institutions (HEIs) worldwide. Triggered by technological advancements and accelerated by the COVID-19 pandemic, the integration of digital tools and processes into teaching, research, and administration has shifted from a strategic option to an institutional necessity. DT in HEIs is not merely about adopting new technologies but involves a fundamental reconfiguration of educational models, governance structures, and institutional cultures.

Furthermore, while numerous research efforts address specific aspects of digitalization, there is a lack of comprehensive and structured syntheses that capture how DT is defined, why it is implemented, and what elements are critical to its successful realization in HEIs.

In this context, the purpose of this paper is to conduct a systematic literature review of studies published between 2020 and 2025, with the aim of providing a cohesive understanding of DT in higher education. A systematic literature review represents a systematic and structured analysis of the results and conclusions published in scientific literature on a specific topic or research problem. According to Kitchenham (2004, p. 1), "A systematic review is a means of identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest". The studies that form the basis for the systematic review are termed primary studies, and the systematic review is itself a form of secondary study (Budgen & Brereton, 2006). There are many reasons for undertaking a systematic review. One of the most important reasons of a review article is to identify any gaps in current research in order to suggest areas for future research. The systematic review process includes three main phases: planning the review, conducting the review, and reporting the review.

The paper is structured as follows: in Section 1, we present the methodology, outlining the research questions, search strategy, study selection process, and quality assessment. Section 2 discusses the results and findings, beginning with definitions and motivations for implementing DT in HEIs, followed by an examination of its fundamental aspects. These aspects are explored through six key dimensions: digital strategy, models and frameworks, culture and leadership, readiness and maturity, skills and competencies, and teaching and learning.

2. METHODOLOGY

Despite the growing volume of research on DT in HEIs, existing studies often address isolated aspects, such as the adoption of specific technologies or changes in teaching practices, without offering a holistic view of

the phenomenon. Moreover, definitions, frameworks, and reported outcomes vary significantly across contexts, making it difficult to form a unified understanding of DT processes.

To bridge these gaps, this study employs a systematic literature review grounded in Kitchenham's protocol (2004) and guided by the PRISMA statement (Page et al., 2021). This methodology promotes methodological transparency, reproducibility, and thorough coverage of the relevant literature. The review process includes four key stages: (1) formulation of research questions using the PICO model, (2) design of a structured search strategy across the Web of Science and Scopus databases, (3) application of strict inclusion and exclusion criteria, and (4) a formal quality appraisal of eligible studies to ensure methodological rigor. Each phase is designed to minimize bias and enhance the validity of the findings. This approach enables the synthesis of validated findings, clarification of conceptual models, and identification of prevailing trends and challenges in the DT of HEIs.

2.1. Research questions

In order to systematically address the objectives of this study, the research questions were formulated using the PICO model, a widely recognized framework originally introduced by Richardson et al. (1995) for structuring systematic reviews and decomposing clinical questions into searchable components. PICO, which stands for Population, Intervention, Comparison, and Outcomes, provides a clear and rigorous approach for defining the scope of an investigation. In the context of this research, the *Population* refers to HEIs, the *Intervention* denotes the implementation of DT, while the *Comparison* component is not applicable. The *Outcomes* focus on examining the effects of DT on teaching quality, student experience, and overall institutional effectiveness.

Table 1. Summary of PICO

Population	Higher Education Institutions
Intervention	Digital Transformation
Comparison	N / A
Outcomes	Effects of DT implementation approaches on teaching quality, student experience, and institutional effectiveness in HEIs.

Source: Authors

Based on the PICO analysis in Table 1, the research questions in this systematic review are:

RQ1: What is the definition of DT in higher education, and why is its implementation considered necessary?

RQ 2: How should DT be implemented in HEIs?

2.2. Search strategy

A critical step in conducting a systematic literature review is the development of a transparent and structured search strategy to ensure the completeness and relevance of the collected studies. The search was carried out through the electronic databases Web of Science (WoS) and Scopus. According to Benavides et al., (2020, p. 3), "they are the most relevant scientific information platforms that access the scientific databases and the most significant publication of the different areas of knowledge" (p. 3).

The structured search used to realize the search of the article was "digital transformation*" AND

"higher education institution*" OR "universit*" and was conducted on 21 March 2025.

The search string adapted to the syntax

required by the WoS database was as follows: (((((TS=("digital transformation*")) AND TS=("higher education institution*" OR "universit*")) AND PY=(2020-2025)) AND DT=(Article)) AND LA=(English)) AND WC=(Business & Economics OR Management OR Education & Educational Research)

The search string adapted to the syntax required by the Scopus database was as follows: TITLE-ABS-KEY ("digital transformation*") AND TITLE-ABS ("higher education institution*" OR "universit*") AND DOCTYPE (ar) AND PUBYEAR > 2019 AND PUBYEAR < 2025 AND SUBJAREA (arts OR busi OR deci OR econ OR psyc OR soci) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE, "j")) AND (LIMIT-TO (SUBJAREA, "BUSI") OR LIMIT-TO (SUBJAREA , "ECON")).

The initial search retrieved 444 records (290 from WoS and 154 from Scopus). All references were imported into Zotero reference management software, where 52 duplicate entries and 2 retracted papers were removed. After deduplication and quality checks, 390 unique records were retained for the screening phase. This structured search approach ensured that the selected studies systematically address the research questions and maintain methodological rigor. This review focuses on English-language studies and on the subject categories of Business, Economics, and Education to maintain conceptual coherence and highlight the managerial and pedagogical aspects of digital transformation in HEIs. Other languages and fields, such as STEM and Social Sciences, were excluded to reduce disciplinary heterogeneity, which represents a potential limitation of the study.

2.3. Study selection

Study selection criteria determine criteria for including in, or excluding a study from, the systematic review. Once the potentially relevant primary studies have been obtained, they need to be assessed for their actual relevance. Study selection criteria are intended to identify those primary studies that provide direct evidence about the research questions. Also, inclusion and exclusion criteria should be based on the research question. They should be piloted to ensure that they can be reliably interpreted and that they classifies studies correctly (Kitchenham, 2004, p. 4). In terms of reference selection, the PRISMA guideline were followed, and the exclusion and inclusion criteria can be found in Table 2.

After obtaining the potentially relevant primary studies, their actual relevance was thoroughly assessed. From the total of 390 records screened, a significant portion those that did not address relevant outcomes were excluded, accounting for 170 entries. Full-text retrieval was attempted for 220 reports; however, 86 could not be accessed. The remaining 134 studies underwent an eligibility evaluation, during which 34 were excluded based on additional criteria: 28 were not listed in the Journal Citation Reports, and 16 were deemed insufficiently relevant. As a result, a final set of 90 studies was included in the systematic review. The flow of reference selection is illustrated in Figure 1. The selection process was conducted according to PRISMA guidelines to ensure transparency, reproducibility, and minimized selection bias.

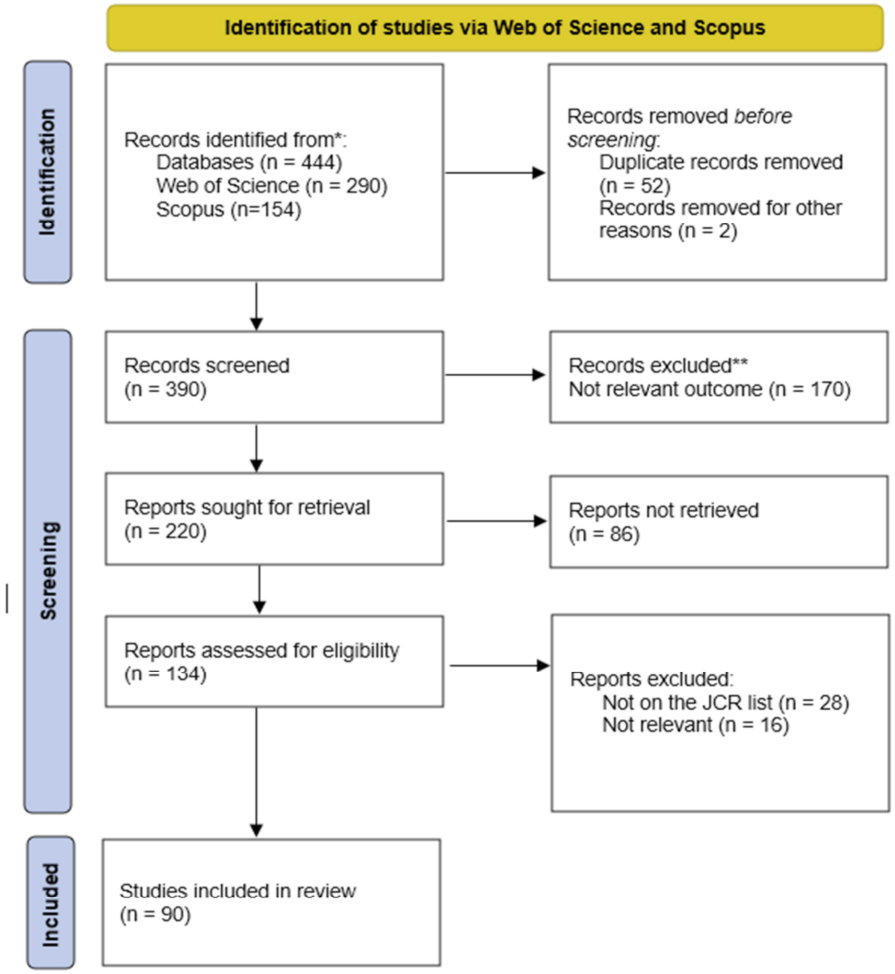
2.4. Quality Assessment

Kitchenham (2004) suggests that study

Table 2. Inclusion and exclusion criteria

Criteria	Inclusion	Exclusion
Study topic	Digital transformation in higher education	Digital transformation in fields other than higher education.
Publication Years	2020 or 2021 or 2022 or 2023 or 2024 or 2025	Studies published prior to 2020
Document Types	Journal article	Book Chapter; Retracted Publication; Proceeding Paper.
Language	English	Other languages, e.g. Spanish; German; Russian.
Web of Science Categories Scopus subject area	WoS (Business & Economics OR Management OR Education & Educational Research) Scopus (Business, Management and Accounting; Economics, Econometrics and Finance)	Others WoS categories; Others Scopus subject areas.

Source: Authors



Source: Authors

Figure 1. Search and selection strategies

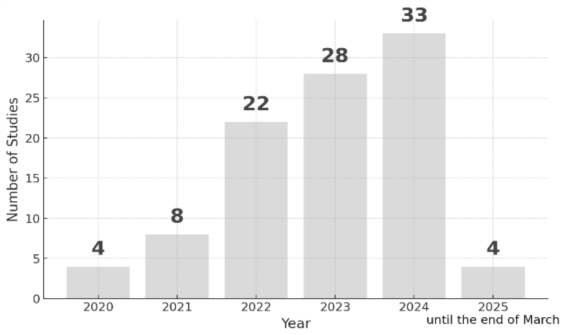
quality relates to the extent to which bias is minimized and internal and external validity are maximized. Assessing the quality of primary studies is crucial in a systematic review for several reasons: to refine inclusion and exclusion criteria, to explore whether quality differences explain variations in findings, to weigh the importance of individual studies during synthesis, to guide the interpretation of results, and to strengthen recommendations for future research (p. 10).

In this review, the quality assessment was conducted during the eligibility evaluation phase. Studies were included only if they were published in journals indexed in the Journal Citation Reports 2024, which ensures that all sources meet rigorous international standards of academic quality. Additionally, articles were required to address core issues related to DT in HEIs. This approach guaranteed that only recent, peer-reviewed, high-impact studies contributed to the synthesis of findings. By applying these criteria, the review maintained a high level of methodological rigor, minimized bias, and enhanced the credibility and reliability of the results.

3. RESULTS AND DISCUSSION

The results of this systematic literature review are organized in alignment with the key research questions framed by the PICO model. Following the application of predefined inclusion and exclusion criteria, quality appraisal, and data extraction procedures, a total of 90 peer-reviewed studies were selected for synthesis. The findings offer a comprehensive overview of how DT is conceptualized within HEIs, highlighting the main drivers of its adoption and the core elements that underpin successful initiatives.

Figure 2 illustrates the distribution of selected studies by publication year, revealing a consistent upward trend in research interest related to DT in higher education. This progression indicates that the topic has gained increasing academic attention, particularly in recent years, likely influenced by external factors such as the COVID-19 pandemic (Rasli et al., 2022; Erdmann et al., 2024). It is important to note that data for the year 2025 includes only publications available until the end of March. The sharp rise in publications over time underscores the growing relevance of this field and the urgency for institutions to adapt to digital advancements.



Source: Authors

Figure 2. Number of studies on digital transformation in higher education by year (2020–2025).

3.1. Definitions and reasons for implementing DT in HEIs

The analysis of the selected studies reveals that DT in HEIs is broadly conceptualized as a profound and holistic process of integrating digital technologies across all institutional activities. Rather than focusing solely on the adoption of isolated technologies, DT is understood as a strategic

reconfiguration of teaching, learning, research, administration, and management practices to leverage digital innovations in achieving institutional goals (Teixeira et al., 2021; Akour & Alenezi, 2022; Fleaca et al. (2022).

Several studies emphasize that DT is not limited to digitization (the conversion of analog to digital data) or digitalization (the optimization of processes through digital means), but rather represents a deeper, organizational-level change that impacts institutional culture, leadership engagement, and strategic positioning (Alenezi, 2021; Carayannis & Morawska-Jancelewicz, 2022; Graham et al., 2023a). It is viewed as an evolutionary and continuous process that enables HEIs to enhance operational efficiency, educational accessibility, societal relevance, and competitiveness in both domestic and international arenas. Furthermore, some authors highlight that DT in HEIs must align with broader global trends, such as the knowledge economy and the demands of digitally native generations (Goulart et al., 2022; Fedajev et al., 2024). This comprehensive understanding positions DT as a key enabler of institutional sustainability and innovation in the 21st century educational landscape.

In the systematic literature review for this study, a lot of papers offers the definition of DT. Table 3 presents few dimensions that are the most relevant within the context of HEIs.

The reviewed literature identifies a range of social, business, organizational and technological drivers that motivate HEIs to engage in DT. The COVID-19 pandemic in 2020 drastically reshaped societal norms and accelerated digital transformation (Garcez et

Table 3. Definition of DT in the context of HEIs

Author(s)	Definition
Alenezi, 2021, p. 1	DT in the HEIs is about the development of new more advanced and effective methods and practices in pursuit of the higher education's mission.
Gkrimpizi et al., 2024, p. 13	DT in HEIs is an evolutionary process for a series of deep and coordinated changes characterized by the strategic adoption and integration of emerging technologies to significantly improve educational activities and operational efficacy, transforming the educational model, strategic directions and value proposition of higher education institutions.
Griffin et al., 2022, p. 1	Many definitions of DT contain elements of technological, organizational, or social perspectives, which aim to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies.
Jakoet-Salie & Ramalobe, 2023, pp. 61-62	DT includes the creation of new infrastructures as well as the increased use of digital media and technologies for teaching and learning, research, support services, administration, and communication, as well as the need for students and faculty to acquire new (digital) skills for their current and future workplaces.
Rasli et al., 2022, p. 2	DT is defined as the organizational change in processes or business models by using technological innovations or disruptive digital concepts for key improvements with the aim of meeting the current needs of stakeholders and enhancing all aspects of their life
Mohamed Hashim et al., 2022, p. 8965	Transformation is defined as deploying/implementing new technological base mechanisms to influence the delivery of digital education.
Mhlanga et al., 2022, p. 2	DT would be depicted as the process of deploying digital technologies in the higher education sector to transform traditional teaching and learning.
Portuguez-Castro et al., 2022, p. 3	In universities, this transformation involves the integration of new technologies and changes in organizational culture to enable the implementation and management of the digital university.
Zhang & Wu, 2025, p. 1	At the center of the DT of higher education, the role of the university teacher has undergone a major redefinition, moving from its traditional status as a lecturer to that of a guide in the process of knowledge dissemination, skilled in the use of a wide range of digital pedagogical tools for the enrichment of the educational experience.

Source: Edited by authors based on reviewed literature (2020–2025)

al., 2022). In higher education, DT promotes social inclusion by expanding access for underrepresented groups and fostering equity (Akour & Alenezi, 2022; Bautista Garcia-Vera et al., 2023; Graham et al., 2023b; Farrell et al., 2024; Lundberg & Stigmar, 2024). Digital platforms enable remote learners to access education without relocating (Graham et al., 2023a; Lundberg & Stigmar, 2024), while aligning with the expectations of digital-native students (Alenezi, 2021; Graham et al., 2023b; Lundberg & Stigmar, 2024; Malieiev et al., 2024). During crises, online platforms ensure continuity in teaching and learning (Aljanazrah et al., 2022; Mhlanga et al., 2022; Mospan, 2022; Budiyanto et al., 2024; Gerchen, 2024). Carayannis and Morawska-Jancelewicz (2022) further advocate for socially and digitally engaged universities that co-create innovation with stakeholders and promote sustainable development.

From a business perspective, DT enables HEIs to stay competitive in both local and global education markets by fostering innovation and responsiveness (Teixeira et al., 2021; Carayannis & Morawska-Jancelewicz, 2022; Hashim et al., 2022b). The integration of AI and digital tools is increasingly viewed as a competitive advantage (George & Wooden, 2023; Lara, 2023). Institutions can diversify revenue streams through online courses, micro-credentials, and certifications (Secundo et al., 2020; Portuguez-Castro et al., 2022; Farias-Gaytan et al., 2023; Salama & Hinton, 2023) DT also enhances graduate employability by aligning curricula with labor market demands and embedding digital skills (Goulart et al., 2022; Kaminsky et al., 2024), reinforcing the economic relevance of higher education.

From an organizational perspective, DT enhances institutional efficiency by automating administrative workflows and optimizing resource management (Akour & Alenezi, 2022; Tsupari et al., 2024). Data-driven decision-making supports informed leadership and strategic planning (Teixeira et al., 2021; Graham et al., 2023b). Digitalization encourages interdisciplinary collaboration and breaks down silos (Griffin et al., 2022; Graham et al., 2023a), while knowledge management systems help preserve institutional memory and foster innovation (Carayannis & Morawska-Jancelewicz, 2022). A strong digital culture increases adaptability, sustainability, and alignment with societal and market expectations (Teixeira et al., 2021; Goulart et al., 2022; Hashim et al., 2022a).

Technological advances are central to modernizing teaching and administration in HEIs. DT involves integrating tools like LMSs, video conferencing, and interactive media to enhance digital learning environments (Grosseck, 2020; Alenezi, 2021; Akour & Alenezi, 2022; Kaqinari et al., 2022; Mospan et al., 2022; Alenezi, 2023; Bran & Hudrea et al., 2023; Graham et al., 2023a; Alkandari et al., 2024; Alkursheh, 2024). Emerging technologies such as AI, data analytics, and VR/AR are increasingly used to personalize learning and improve outcomes (Spivakovsky et al., 2023; Gaievska et al., 2024; Rahiman & Kodikal, 2024; Kandil et al., 2025). Simultaneously, robust cybersecurity and digital infrastructure ensure long-term institutional resilience and innovation (Teixeira et al., 2021; García-Peñalvo, 2021).

3.2. Fundamental aspects of the DT process in HEIs

DT in HEIs can be understood as a

structured process composed of several interrelated activities. The process typically begins with the development of a coherent digital strategy, which articulates the institution's long-term vision, priorities, and goals for transformation. This is followed by the selection or design of suitable models and frameworks that operationalize strategic intentions and provide a roadmap for execution. Effective transformation also requires a supportive organizational culture and committed leadership to drive change and foster engagement across all institutional levels. Assessing digital readiness and maturity is a critical step to ensure alignment between institutional capacities and strategic objectives. Building on this foundation, the development of digital skills and competencies among academic and administrative stakeholders becomes essential to enable adoption. Ultimately, these elements converge in the transformation of teaching and learning, where innovative digital tools and pedagogical practices are integrated into educational processes.

3.2.1. Digital strategy

DT in higher education requires more than the deployment of technology – it calls for a strategic vision that aligns digital initiatives with institutional mission and long-term goals (Ovrelid, 2022; Panos-Castro et al., 2024). As Hess (as cited in Alenezi, 2023) notes, DT may reshape institutional strategy by enabling new products, transforming culture, or automating operations. In the same work, Gobble further defines it as the rapid advancement of operations, processes, and capabilities aimed at leveraging technology for societal and organizational impact through prioritized corporate strategy.

Digital strategy provides the structural backbone for such transformation. It ensures coherence across initiatives and aligns technological adoption with pedagogical effectiveness and administrative efficiency (Hashim et al., 2022b). A holistic approach is needed, encompassing not just education but also research, governance, and student services (Garcia-Penalvo, 2021).

The need for strategic planning is growing, influenced by global policies, technological shifts, reduced public funding, and changing student expectations (Aytar & Arslan, 2024, p. 72). Institutions with integrated digital strategies showed greater resilience during disruptions such as the COVID-19 pandemic (Hashim et al., 2022a). HEIs adopt diverse strategic approaches to DT, including top-down or bottom-up. In a top-down approach, the initiative comes from senior leadership – such as university presidents, vice-chancellors, or central IT departments. These actors define the vision, allocate resources, and establish strategic goals for DT. Key features of top-down approach are: centralized decision-making, trategic alignment with institutional goals, faster implementation due to authority and control and risk of limited faculty engagement if not well-communicated. A bottom-up approach is driven by grassroots efforts – typically faculty members, researchers, or departments – who experiment with digital tools and pedagogical innovations and gradually scale successful practices. Key features of this approaches are: decentralized innovation, strong faculty and staff ownership, often more flexible and context-sensitive and slower to scale without institutional support. For example, George and Wooden (2023) illustrate this dynamic through a case study

of a university where DT began as a decentralized, bottom-up approach and later evolved into a formalized, centrally coordinated strategy after early pilots demonstrated success. This aligns with findings by Straatmann et al. (2024), who emphasize that in pluralistic and decentralized academic environments, top-down digital initiatives are unlikely to succeed without the cognitive and behavioral support of professors. Their multilevel analysis underscores the importance of strategic vision communication, participatory processes, and localized support –particularly when combined with adequate department-level IT resources – as key enablers of sustained digital change. Hybrid approaches are increasingly recommended, where strategic oversight is combined with autonomy and innovation at the department level.

In higher education, recent digital strategies increasingly incorporate sustainability and green IT practices, AI and data ethics, and resilience planning through hybrid teaching models. Institutions are also shifting toward first and second party data strategies, leveraging generative AI for service personalization and process automation, and adopting immersive technologies such as AR/VR to enhance learning experiences and foster community engagement. These trends reflect a broader move toward responsible, resilient, and user-centered approaches to DT.

3.2.2. Model and framework

Models and frameworks of DT in higher education refer to structured conceptual tools that guide the systematic planning, implementation, evaluation, and scaling of digital initiatives across teaching, research, administration, and student services. These tools provide theoretical and practical foundations for understanding how HEIs adopt digital technologies, reorganize institutional processes, and transform organizational culture to enhance performance, agility, and educational outcomes. Bygstad et al. (2022) emphasize models as tools for analyzing the interplay between technology, organizational routines, and infrastructure in institutional change processes. García-Penalvo (2021) describes frameworks as "essential blueprints" that allow HEIs to coordinate DT across multiple dimensions, ensuring long-term sustainability and stakeholder engagement.

Based on a systematic review of 90 peer-reviewed studies published between 2020 and 2025, nine of the most significant and recurrent models and frameworks for digital transformation in higher education were identified. These include: the JISC Digital Capability Framework (JISC, 2019), the European Commission's DigComp and DigCompEdu (European Commission, 2019), the EDUCAUSE Dx Framework (EDUCAUSE, 2020), the Technology Acceptance Model – TAM, (Davis,1989), the Online Teaching Competence Framework for University Lecturers (Oanh et al., 2023), the Digital Learning Space framework (Bygstad et al., 2022), KPMG's Blueprint for Digital Transformation in Universities (KPMG, 2020), Microsoft's Education Transformation Framework (Microsoft, 2021) and Google's Framework (Google, 2020).

JISC Digital Capability Framework is developed by the UK-based JISC organization. This framework aims to build digital capabilities among students and staff across HEIs. Its primary focus lies in developing a wide range of digital skills,

structured into dimensions such as: digital proficiency and productivity; digital creation, problem-solving and innovation; digital learning and development; digital identity and wellbeing; information, data, and media literacies; digital communication, collaboration and participation (JISC, 2019).

DigComp and DigCompEdu are established by the European Commission. DigComp addresses the digital competence of all citizens, while DigCompEdu targets educators specifically. In DigComp, digital competence involves the "confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It is defined as a combination of knowledge, skills and attitudes" (European Commission, 2019). The DigComp framework identifies the key components of digital competence in 5 areas: information and data literacy, communication and collaboration, digital content creation, safety, problem solving. DigCompEdu is a scientifically sound framework describing what it means for educators to be digitally competent. It provides a general reference frame to support the development of educator-specific digital competences in Europe. The six DigCompEdu areas focus on different aspects of educators' professional activities: professional engagement, digital resources, teaching and learning, assessment, empowering learners, facilitating learners' digital competence (Redecker & Punie, 2017).

The EDUCAUSE Digital Transformation (Dx) Framework, developed in the United States, offers a comprehensive structure to support HEIs in managing institution-wide digital change (EDUCAUSE, 2020). Organized into three progressive phases – Learn, Plan, and Do – this framework guides institutions through a ten-step journey toward sustainable DT. The Learn phase encourages institutions to understand the foundational concepts of DT and its implications for institutional culture (Step 1: Defining Dx, Step 2: Dx and Culture), workforce development (Step 3: Dx and Workforce), and technological alignment (Step 4: Dx and Technology). In the Plan phase, institutions assess their internal readiness (Step 5: Assessing Readiness), foster campus-wide engagement (Step 6: Leading a Campus Conversation), and formulate strategic plans (Step 7: Developing a Dx Strategy). Finally, the Do phase emphasizes implementation and iteration through monitoring progress (Step 8: Assessing Dx Progress), refining strategies (Step 9: Planning the Next Steps), and drawing lessons from peer institutions (Step 10: Learning from Others) (EDUCAUSE, 2020).

Technology Acceptance Model (TAM) is originally proposed by Davis (1989) and later adapted to higher education (Le et al., 2023; van der Walt et al., 2024). This model explains how users come to accept and use technology. Its primary focus is on perceived usefulness and ease of use, which influence behavioral intentions and actual system usage – key factors in understanding technology adoption in educational settings. Aldosemani (2023) utilizes TAM to examine teachers' acceptance of distance education through Madrasati learning management system (LMS). The study found that teachers had generally positive perceptions of this system during emergency remote teaching caused by the COVID-19 pandemic. Teachers rated system learnability, content quality, and visual design the highest among external usability variables, indicating that the platform was easy to learn, well-

designed, and contained useful educational content. In terms of the Technology Acceptance Model (TAM) constructs, teachers agreed that Madrasati was easy to use and useful for their teaching. They also expressed strong behavioral intention to continue using the platform in the future and reported frequent and regular actual use of the system.

Oanh et al. (2023) developed the Online Teaching Competence Framework for University Lecturers (OTCFUL) to define essential competencies for effective online teaching in higher education. The framework comprises 25 items grouped into five key areas including: "understanding student learning" (5 items), "online session administration" (4 items), "digital content development and learning facilitation" (7 items), "technology" (5 items), and "online learning outcomes assessment" (5 items).: technology use, digital content development, session administration, understanding student learning, and assessment of online outcomes. OTCFUL serves as a foundation for designing targeted training programs to enhance lecturers' online teaching capabilities.

The Digital Learning Space Framework developed by Bygstad et al. (2022) is a conceptual model that explains how higher education can undergo DT by aligning technical, pedagogical, and organizational elements. It evolves from the notion of "dual digitalization," referring to the previously separate developments of digital teaching and digital content. A digital learning space emerges when these two paths converge: technically through infrastructure and tools, pedagogically through redefined roles of teachers and students, and organizationally through greater openness to society. This framework supports deep, personalized, and collaborative learning, enabling extended interaction with external stakeholders such as companies and institutions, thus transcending traditional physical and institutional boundaries.

On the other side, several major technology companies have developed frameworks to guide the DT of HEIs. KPMG's "blueprint for digital transformation in universities" focuses on delivering a consumer-centric experience by aligning six elements: customers, channels, enterprise strategy, core business practices, advanced data and analytics, and enabling business practices. Microsoft's framework provides practical guidance across four dimensions: student achievement, teaching and learning, academic research, and a secure, connected campus. Google's Education Transformation Framework identifies seven key elements: vision, learning, culture, technology, professional development, funding and sustainability, and community engagement. These frameworks offer structured approaches to support institutions in their digital transformation efforts (Alenezi, 2021, pp. 7–8).

Table 4 provides a comparative summary of the nine most significant digital transformation (DT) models and frameworks identified in this review, highlighting their main focus, core dimensions or components, applications and relevance for higher education institutions (HEIs), and key references.

Building on the DigCompEdu framework, a methodological course could be designed to operationalize DT in higher education through structured professional development. Such a course would aim to enhance educators' digital competences across the six DigCompEdu areas: professional engagement, digital resources,

Table 4. Comparative Summary of Digital Transformation (DT) Models and Frameworks in Higher Education Institutions (HEIs)

Model / Framework	Main Focus	Core Dimensions / Components	Application / Relevance for HEIs	Reference
JISC Digital Capability Framework	Development of digital skills and literacies for staff and students	Digital proficiency, creation, communication, collaboration, identity, well-being	Provides a structured approach for building digital capabilities across HEIs	JISC, 2019
DigComp / DigCompEdu	Digital competence of citizens and educators	Information literacy, communication, content creation, safety, problem-solving	Used as a European reference model for assessing and improving digital competences	European Commission, 2019; Redecker & Punie, 2017
EDUCAUSE Dx Framework	Institutional digital transformation process	Learn–Plan–Do phases, culture, workforce, technology alignment	Guides HEIs through stages of planning and implementing DT strategies	EDUCAUSE, 2020
Technology Acceptance Model (TAM)	User acceptance and behavioral intention toward technology	Perceived usefulness, perceived ease of use	Helps explain technology adoption among teachers and students	Davis, 1989; Le et al., 2023
Online Teaching Competence Framework (OTCFUL)	Faculty competencies for online teaching	Learning understanding, administration, content creation, technology, assessment	Defines competencies and supports teacher training in DT contexts	Oanh et al., 2023
Digital Learning Space Framework	Integration of technical, pedagogical, and organizational elements	Dual digitalization, collaboration, openness	Explains how HEIs integrate learning spaces and digital infrastructure	Bygstad et al., 2022
KPMG Blueprint for DT in Universities	Consumer-centric institutional transformation	Strategy, customers, channels, data analytics, business practices	Consultancy model for aligning DT strategy with user experience	KPMG, 2020
Microsoft Education Transformation Framework	Strategic and operational guidance for DT	Student achievement, teaching, research, secure campus	Practical tool for implementing institutional DT strategies	Microsoft, 2021
Google Education Transformation Framework	Institutional digital leadership and culture	Vision, learning, culture, technology, community	Promotes leadership, sustainability, and innovation in education	Google, 2020

teaching and learning, assessment, empowering learners, and facilitating learners' digital competence. The proposed course could follow a modular format, starting with a diagnostic assessment of current digital competence levels, followed by guided workshops, peer collaboration, and reflective practice tasks. Each module would combine theoretical input with practical assignments tailored to specific institutional contexts. Implementing such a methodological course would not only support the digital upskilling of academic staff but also provide a replicable and evidence-based pathway for universities seeking to advance their digital maturity.

3.2.3. Culture and leadership

Organizational culture and leadership play a pivotal role in enabling or hindering the success of DT initiatives within HEIs. Numerous studies emphasize that the mere availability of digital technologies is insufficient – effective and sustainable transformation requires cultural readiness, vision-driven leadership, and institutional support mechanisms (Hervas-Gomez et al., 2021).

Studies such as Alhubaishy and Aljuhani (2021) highlight that DT requires not only technical adaptation but also cultural shifts in mindset among faculty, staff, and students. Cultural readiness includes openness to innovation, willingness to collaborate across disciplines, and acceptance of new pedagogical paradigms such as blended and online learning. In their study, they proposed the "Model of Human Attitude Factors Affecting the Adoption of Digital Transformation in HEIs" and employed the Analytic Network Process (ANP) to prioritize attitudinal challenges. Their findings emphasize that learning performance, lack of access to resources, and fear of change are the primary barriers for students, while resistance to change, lack of experience, and privacy concerns are the most significant challenges for instructors.

Also, Castro-Benavides et al. (2022) identify several key challenges that hinder DT in HEIs. These include a lack of digital culture, underdeveloped digital leadership, insufficient digital skills among staff, poor change management strategies, and inadequate training. The authors emphasize that DT is not merely technological but also deeply organizational and cultural. Addressing these barriers requires a comprehensive and institution-wide strategic approach. Ghazali-Mohammed et al. (2024) show that educational leaders played a key role in managing the shift to hybrid teaching, taking on expanded responsibilities and supporting staff through uncertainty. Their study emphasizes that effective DT relies on distributed leadership, trust, and ongoing professional development.

Leadership commitment is frequently cited as a critical enabler of DT. According to Hashim et al. (2022a), effective leadership in HEIs must go beyond administrative oversight and embrace a proactive role in strategy formulation, resource allocation, and capacity building. Leaders who champion digital initiatives create a vision for change and align organizational values and goals accordingly.

In Langseth et al. (2023), the authors document how support units and top-down leadership structures influence the scalability of digital initiatives. These findings suggest that leaders must cultivate digital innovation through both strategic direction and support for bottom-up experimentation. Loglo (2024) further underscores that while top-

down leadership can catalyze in HEIs, sustainable change requires broader institutional engagement, coherent policies, and cross-cutting digital leadership structures. Furthermore, DT requires not only technological integration but also fundamental changes in leadership, mindset, innovation processes, business models, and the pervasive incorporation of digitization across all organizational dimensions (Mondragon-Estrada et al., 2023).

A distinction is often made between transformational leadership, which focuses on inspiring and guiding change, and transactional leadership, which focuses on routine management tasks. George and Wooden (2023) argue that transformational leadership is more effective in contexts where DT involves high degrees of uncertainty and organizational disruption. Leaders with transformational qualities can foster a culture of continuous learning and digital agility.

Shaya et al. (2025) highlight leadership as a critical enabler of sustainable and inclusive blended learning in higher education. Their study, conducted across three universities in the UAE, reveals that effective leadership fosters a supportive institutional culture by ensuring alignment between pedagogical goals, technological infrastructure, and faculty development. Leaders play a key role in shaping communication channels, promoting staff engagement, and sustaining organizational adaptability. The findings indicate that visionary and adaptive leadership is key to developing blended learning that is pedagogically effective, institutionally resilient, and aligned with the university's strategic goals.

Timokhova et al. (2022) emphasize that DT in HEIs must go beyond technology implementation to foster a digital culture, support personalized learning, and build an integrated ecosystem that enhances creativity, efficiency, and student engagement.

The reviewed literature underscores that successful DT depends not only on technological infrastructure but on the cultural and human dynamics within HEIs. Leadership must act as a catalyst, articulating a digital vision, empowering academic staff, and embedding change into institutional DNA. Future studies should explore how leadership development programs and cultural diagnostics can better support HEIs in their DT journeys.

3.2.4. Readiness and maturity

Digital readiness refers to an institution's capacity to adopt, implement, and integrate digital tools and processes across various domains of its operation. It encompasses not only the availability of technical infrastructure but also includes organizational structures, staff competencies, digital literacy, and institutional policies that enable meaningful technology use (Chounta et al., 2024). Akour and Alenezi (2022) conceptualize digital readiness as a multidimensional construct, incorporating hardware availability, platform reliability, and user confidence. Their study, along with findings from Gerchen (2024), emphasizes that institutions with well-developed support systems and prior exposure to online learning were better positioned to adapt during crisis-driven shifts, such as those induced by the COVID-19 pandemic. Budiyanto et al. (2024) further identify key readiness indicators such as leadership commitment, stakeholder engagement, and sustained investment in IT infrastructure, particularly highlighting the critical gaps in

developing countries.

Digital maturity, on the other hand, extends beyond readiness by evaluating how systematically and strategically digital capabilities are embedded within the institution. Maturity models typically present DT as a staged progression – from ad hoc or experimental use of digital tools to a fully integrated, transformative approach where digital processes are aligned with institutional mission and values. These stages are commonly categorized as: (1) Initial, (2) Emerging, (3) Integrated, and (4) Transformative. Digital maturity thus reflects not only technical proficiency but also strategic coherence and institutional learning capacity.

Several concrete models have been proposed to assess both digital readiness and maturity in HEIs. Alenezi (2021) provides a synthesis of widely used models developed by leading consulting firms such as Deloitte, McKinsey, PwC, EY, and others. These models, although originally designed for industry, offer structured and multidimensional approaches that are increasingly relevant to the higher education sector. For example, Deloitte's Digital Maturity Model assesses dimensions such as strategy, technology, operations, and culture, while McKinsey's framework prioritizes data-driven insights, customer experience, and digital enablers. EY's Digital Readiness Assessment includes components such as innovation management, risk and cybersecurity, and organizational agility.

These models serve a dual role – as diagnostic tools and as strategic guides – helping institutions to benchmark their digital capabilities, identify developmental gaps, and plan targeted improvements. However, their application in the context of higher education remains limited, and contextual adaptation is often necessary. The literature identifies persistent challenges such as fragmented infrastructure, uneven digital literacy among faculty, and resistance to standardized evaluation. Moreover, there is a noticeable lack of longitudinal data that would allow for tracking institutional digital maturity over time, raising concerns about the long-term sustainability of many digital initiatives.

In conclusion, digital readiness and maturity form the foundational pillars of successful DT in higher education. While many institutions exhibit isolated innovations, what is often missing is a cohesive, institution-wide approach to building capacity, aligning strategy, and embedding digital change within organizational culture. Maturity models, when thoughtfully applied, can support this process and provide valuable insights into institutional performance. Based on the reviewed models, HEIs can progress toward digital maturity through a staged approach: (1) assessing digital readiness, (2) defining a comprehensive and institution-wide digital strategy, (3) implementing integrated frameworks such as DigCompEdu or the EDUCAUSE Dx Framework, and (4) monitoring progress through appropriate digital maturity models. This roadmap provides a practical guide for higher education institutions seeking to enhance their digital capabilities and achieve sustained, institution-wide digital transformation. Future research should aim to validate and localize these models, linking maturity outcomes to student success, pedagogical quality, and institutional resilience.

3.2.5. Skills and competencies

The successful implementation of DT in HEIs relies heavily on the digital skills and

competencies of both faculty and students (van den Berg & Bozalek, 2024). These skills extend beyond technical proficiency to include agility, creative thinking, problem-solving, critical thinking, and cross-cultural competencies (Alenezi, 2021). While infrastructure and strategy are essential, it is the human element – the ability to adapt, innovate, and effectively use digital tools – that ultimately determines the success and sustainability of digital initiatives.

Digital competence is broadly defined as the confident, critical, and creative use of ICT for learning, work, and participation in society (Burns et al., 2020, p. 7). Faculty are central to this process, yet a widespread digital skills gap persists, particularly in traditional institutions (Alkursheh, 2024). Garcia-Penalvo (2021) emphasizes that professional development should go beyond basic training to include pedagogical design, ethical digital use, and data-informed decision-making. This includes competencies such as data literacy, online collaboration, digital content creation, and cybersecurity awareness (Rzonca, 2024). To address these needs, many HEIs have established Teaching and Learning Centers to support continuous staff development.

Burns et al. (2020) analyzed the digital competencies of VET teachers in Serbia and Russia, proposing a two-component model aligned with the DigComp and DigCompEdu frameworks to guide professional development. Similarly, McPhillips and Licznerska (2021) stress the importance of open innovation (OI) competencies – entrepreneurship, creativity, and collaboration –among students to meet the evolving demands of the digital economy (Garcez et al., 2023). Monteiro and Leite (2021) add that digital literacy must also include digital ethics and content curation skills.

Although students are often perceived as digital natives, research shows that their competencies are uneven. Many are comfortable with social media but struggle with navigating institutional platforms, using digital libraries, understanding data privacy, or collaborating in formal contexts (Allam et al., 2024). Szabo et al. (2023) confirm that the pandemic improved basic digital skills (e.g., video conferencing), but higher-order skills remained underdeveloped.

HEIs have introduced initiatives to address these gaps, including: workshops and seminars for faculty; digital badges and micro-credentials for students and mandatory onboarding for digital tools (Sansone et al., 2024).

Burns et al. (2020) link embedded digital skills in curricula to improved student outcomes and engagement. In a unique context, Scott et al. (2024) demonstrate how DT can also foster agency and resilience under conditions of occupation and infrastructural instability, highlighting its cultural and emancipatory dimensions.

Digital skills and competencies form the human foundation of DT. HEIs must strategically invest in inclusive capacity-building for all stakeholders, using validated frameworks and personalized learning approaches. Future research should focus on the long-term impact of such training and explore adaptive pathways that respond to learners' diverse needs.

These findings reinforce that DT in HEIs is a dynamic, multi-dimensional process that demands more than technological upgrades. Consistent with Teixeira et al. (2021), Goulart et al. (2022), and Farrell et al. (2024), transformation depends on cultural change.

3.2.6. Teaching and learning

DT in HEIs is not merely about adopting new technologies – it reshapes how teaching and learning are conceived, delivered, and experienced. The literature consistently highlights a paradigmatic shift from teacher-centered instruction toward student-centered, flexible, and technology-enhanced learning environments.

Studies such as Forid et al. (2022) show that reliable digital services enhance instructional experiences and student satisfaction, while Farias-Gaytan et al. (2023), and Scholkmann et al. (2024) report widespread transitions to hybrid and online models, accelerated by the COVID-19 pandemic. Benavides et al. (2020) demonstrate how flipped classrooms, asynchronous learning, and adaptive content delivery foster personalized and active learning. Burns et al. (2020) emphasize that digitally competent educators use constructivist and experiential methods that promote collaboration and critical thinking.

Digital platforms such as LMSs (Moodle, Blackboard, Canvas) and conferencing tools (Zoom, Teams) have become foundational (Alkursheh, 2024; Moldovan et al., 2024), yet many institutions fail to fully exploit their interactive potential (Misiejuk et al., 2023). Spirina et al. (2024) advocate for pedagogically grounded uses of MOOCs and problem-based learning, while Langseth et al. (2023) highlight the importance of institutional support and "pockets of innovation" in sustaining blended learning initiatives.

DT has also reshaped assessment, incorporating online quizzes, e-portfolios, peer feedback, and learning analytics for formative evaluation. Jost et al. (2021) link student success in blended learning to behavioral factors like consistent study habits, which can be supported through analytics. In this context, faculty roles shift from content delivery to facilitation, while students assume more responsibility for self-regulated, collaborative learning.

Multiple studies explore satisfaction in online environments. Bacci et al. (2023) use a multilevel IRT model to show that institutional factors and socio-demographic variables influence student satisfaction, while Fedajev et al. (2024) find that pedagogical quality – not platform features – drives perceived usefulness in distance learning. Bygstad et al. (2022) conceptualize the digital learning space as a fusion of technical, pedagogical, and organizational dimensions, driven by integration, role redefinition, and institutional boundary transcendence.

Jakoet-Salie and Ramalobe (2023) argue that DT empowers students as co-creators of knowledge but also demands new literacies and shared accountability. Hristov et al. (2023) expand this view by positioning HEIs as accelerators of societal DT through teacher training and STEM integration in schools.

Despite these advances, significant challenges remain. These include limited pedagogical training, over-reliance on passive tools, digital fatigue, privacy concerns, and uneven engagement (Rosak-Szyrocka, 2024). Pardo-Baldovi et al. (2023), analyzing the smart classroom model, caution that while digital innovation is often present, it may be more performative than transformative, framed by productivity and performance metrics.

Teaching and learning transformation is at the core of digitalization in higher education. While technologies provide infrastructure, pedagogical innovation and institutional

culture determine impact. HEIs must invest in pedagogical training, promote a culture of experimentation, and adopt inclusive, evidence-based digital strategies.

From a strategic perspective, institutions must align DT initiatives with their missions and values. This requires investments in digital upskilling, supportive organizational cultures, and robust governance (Hashim et al., 2022b; Carayannis & Morawska-Jancelewicz, 2022). The integration of technologies like AI, data analytics, and extended reality (Beloev et al., 2023) can further enhance personalization and agility – if guided by pedagogical intent.

4. CONCLUSION

This systematic literature review synthesizes recent research on DT in HEIs from 2020 to 2025, providing a comprehensive overview of its definitions, driving factors, and implementation strategies. The findings confirm that DT is a strategic and multi-dimensional process that demands technological integration, organizational change, leadership engagement, and the cultivation of a digital culture.

Successful DT initiatives are characterized by the presence of clearly articulated digital strategies, investment in digital competencies, and the strategic deployment of emerging technologies aligned with institutional missions. However, persistent barriers such as infrastructural gaps, resistance to change, and digital inequalities remain significant challenges. Vicente et al. (2020) reveal that successful DT in higher education is often hindered by material constraints, including limited infrastructure, insufficient funding, inadequate technological resources, conservative institutional culture, and a lack of technical support. These structural barriers create a gap between policy expectations and the actual capacity of institutions to innovate.

This review highlights the need for HEIs to adopt holistic, flexible, and context-sensitive approaches to DT to ensure resilience, competitiveness, and social relevance. Future research could focus on assessing digital readiness and maturity within higher education systems, particularly in underrepresented regions, to enable benchmarking against EU and non-EU best practices. There is also a need for deeper exploration of digital culture within institutions and the role of leadership in enabling its development and integration. Additional studies should aim to develop and evaluate practical models and strategic frameworks that support effective implementation of DT in education, research, and administrative domains.

The subject categories were limited to Business, Economics, and Education to maintain conceptual coherence and focus on managerial and pedagogical aspects of digital transformation in HEIs, while other fields such as STEM and Social Sciences were excluded to reduce disciplinary heterogeneity. Although this review included only studies published in English, which may introduce language bias, future research could leverage AI-based translation tools to incorporate non-English literature and enhance the comprehensiveness of systematic reviews.

ДИГИТАЛНА ТРАНСФОРМАЦИЈА У УСТАНОВАМА ВИСОКОГ ОБРАЗОВАЊА: СИСТЕМАТСКИ ПРЕГЛЕД ЛИТЕРАТУРЕ ЗА ПЕРИОД ОД 2020. ДО 2025. ГОДИНЕ

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Извод

Дигитална трансформација (ДТ) постала је један од кључних фактора преобликовања установа високог образовања, нарочито након пандемије COVID-19, при чему је значајно утицала на наставни процес, учење и управљање установама. Упркос широко распрострањеној примени дигиталних технологија, концептуално и оперативно разумевање дигиталне трансформације и даље је фрагментисано, што је последица њене сложене и вишедимензионалне природе. Овај рад представља систематски преглед новије научне литературе (2020–2025), са циљем да се прецизније одреде начини дефинисања дигиталне трансформације у установама високог образовања, разлози за њено спровођење, као и кључне компоненте које утичу на њену успешност. Систематски преглед литературе спроведен је применом протокола Kitchenham и смерница PRISMA, при чему је анализирано 90 рецензираних научних чланака објављених у научним часописима, а индексираних у базама података Web of Science и Scopus. Радови су одабрани на основу строго дефинисаних критеријума за укључивање и искључивање. Истраживачка питања формулисана су применом PICO модела (Population, Intervention, Comparison and Outcomes — популација, интервенција, поређење и исходи). PICO модел се често примењује за развој стратегије претраживања литературе у оквиру систематског прегледа научних истраживања. Резултати истраживања указују на то да су дигиталну трансформацију у установама високог образовања подстакли технолошки, организациони, пословни и друштвени фактори. Кључне компоненте дигиталне трансформације обухватају усвајање и примену дигиталних стратегија, коришћење концептуалних модела и оквира, развој дигиталних вештина и компетенција, подршку организационе културе и лидерства, дигиталну спремност и зрелост, као и трансформацију наставе и процеса учења.Овај систематски преглед ограничен је на публикације на енглеском језику које су објављене у индексираним научним часописима, чиме су потенцијално изостављени релевантни регионални извори и сива литература. Будућа истраживања требало би да прошире обухват анализе на различите контексте и да процене ниво дигиталне зрелости на институционалном и националном нивоу, нарочито у недовољно заступљеним регионима, како би се омогућила инклузивнија и одрживија дигитална трансформација у високом образовању.

Кључне речи: дигитализација, дигитална трансформација, установе високог образовања, систематски преглед литературе, универзитет

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