



DOI: [10.71317/jgst.2.10.2026.740](https://doi.org/10.71317/jgst.2.10.2026.740)

Journal of Global Social Transformation

Journal homepage: <https://rjsaonline.org/index.php/JGST>



Digital Transformation and the Future of Higher Education: A Comprehensive Umbrella Review

Maksud Zaloidinov¹, Aafia Shahid², Muhammad Uzair Khan³, Sumaya Batool⁴, Mazhar Ali⁵, Dua Mobin⁶, Naji Ullah⁷

¹ Department of English Language and Literature, Gachon University, Seongnam-si, Seoul, South Korea.

Email: Zaloidinov90@gmail.com

² Department of Sciences, Engineering Management, Uskudar University, Istanbul, Turkey.

Email: shahidaafia8@gmail.com

³ Department of Psychology, International Islamic University Islamabad, Islamabad, Pakistan.

Email: muhammad.mscp458@iiu.edu.pk

⁴ Department of English Language and Literature, Balochistan University of Information Technology Engineering and Management Sciences, Quetta, Pakistan.

Email: sumayabatool41@gmail.com

⁵ Department of Psychology, University of Buner, Buner, Pakistan.

Email: Psymazhar@yahoo.com

⁶ Department of Business, Mphil from IBA Punjab university, Lahore, Punjab

Email: duamobin23@gmail.com

⁷ Department of Environmental Sciences, Abdul Wali Khan University Mardan, Mardan, Pakistan.

Email: khannajiullah79@gmail.com

ARTICLE INFO	ABSTRACT
Submission: August 23, 2026 Revised: September 04, 2026 Accepted: September 21, 2026 Available Online: October 01, 2026 Keywords: Digital transformation, higher education, Industry 4.0, emerging technologies, digital maturity, systematic literature review, teaching and learning, artificial intelligence, and umbrella review. Corresponding author: Maksud Zaloidinov Email: Zaloidinov90@gmail.com	Digital transformation (DT) is fundamentally changing the higher education institutions (HEIs) around the globe. The COVID-19 pandemic has drastically increased using digitally enabled approaches for teaching, learning, research, and administration, driven by the convergence of technologies encompassing the industry 4.0. Despite the various existing reviews that tackle digital transformation separately, some, such as those on the technology adoption or strategic planning, or pedagogical innovation, have limited scope and do not offer an overall, multi-dimensional synthesis. This rather comprehensive umbrella review combines dimensions, technologies, strategic processes and actors related to the implementation of DT in HEIs, based on the systematic and multivocal literature reviews, analyses via PRISMA, and thematic syntheses of articles, published from 2015 to 2024, in Scopus, Web of Science, IEEE Xplore, ScienceDirect, Springer Link and ACM Digital Library databases. A total of 47 studies in the analytical corpus, two of which were anchor reviews and 43 were complementary primary studies, were identified in an initial pool of 312 records. The findings showed that most digital transformation projects (DTIs) in the education sector are concentrated on competitive education (24%) and that the dominant enabling technologies are analytics (23%), cloud computing (20%), and artificial intelligence (16%). Most of all, just one-quarter of HEIs can speak with any degree of fluency about a digital strategy and only 56% of DTIs are part of a broader institutional agenda. The review concludes that, based on the importance of those topics in the curriculum, student demand satisfaction (12%) and digital culture (9%) fall short of expected levels of investment. The results are derived from the existing reviews and primary studies and thus share the limitations of the primary literature reviewed. The results highlight the need for university leaders to create digital strategies that are integrated, invest in faculty development and digital culture, and embrace a transformative approach instead of a technology-only approach to the implementation of digital transformation.

Introduction

Rationale and Context

It has been concluded that digital transformation is revolutionizing every sphere of the world [1, 2] and higher education institutions are under ever increasing pressure from Industry 4.0, a multifaceted globalized world, rapidly evolving job markets, and post COVID world. According to Akour and Alenezi [3] pandemic has had a dramatic impact on all aspects of education; leaving all higher education sectors in the world in a period of great uncertainty. Skill sets taught in schools are constantly evolving and rapidly changing within just a few years of acquisition as technology changes rapidly [4]. New professions and even new and emerging work areas are expected to emerge in the next decades, exacerbating the need for changeable education models.

For higher education, digital transformation can be defined as the process in creating a new strategic business model of the organization, using the latest digital technologies, and adding high value for all stakeholders [5]. This definition is a critical differentiation between DT, the process of digitizing analog materials, and a more nuanced term digitalization, which is the aim of optimizing the existing process by means of technology [6]. Bloomberg (2018) as cited by Fernández et al. (5) stated that 'digitalization is a technology and the digital transformation is a customer. HEIs are very complex entities that have several stakeholders (students, faculty, the government, and the industry), multiple dimensions (teaching, research, administration, and extension), and governance under public policy and the accreditation system [7].

Higher education used to be the realm of elite students, but now it is significantly regarded as a necessity in their journey of career promotions, civic involvement and tackling global issues [8]. While traditional education is still relevant, so is the need for the development of lifelong education that can be accessed by individuals at any age, through skills. The teaching and universities have consequently to transform themselves dramatically and become fully digital to meet the requirements of today's generation and the fully digital world they will inhabit [3].

Research Gap

There have been previously conducted digital transformation reviews from one perspective. Castro Benavides et al. [7] said that there is not a holistic DT proposal in HEIs, where they made a systematic review of 19 papers. From the perspective of the multivocal literature review, Fernández et al. [5] showed that merely a quarter of the universities have a digital strategy, and half of the and a half of DTIs are isolated initiatives. Various technology trends were explored in a study by Truong and Diep [9] that concludes that technology trends and digital transformation in education are not yet closely linked. Akour and Alenezi [3] recognized several under-researched digital gaps during the COVID-19 pandemic. Although the works mentioned above are valuable, there is no study that brings together the strategic, technological, pedagogical, and organizational part together in a forward-looking perspective for HEIs.

Objectives

This review aims to: (1) Summarize the dimensions, characteristics and actors dealing with DyTI in HEIs; (2) Determine the emerging technologies most used in DyTIs and relate them to the main university processes; (3) Evaluate the maturity with regard to digital; and (4) Summarizes some implications for practice and possible research directions for university leaders.

Research Questions

The review is structured by the following research questions: RQ1: What are the key dimensions of DT implementation in HEIs? RQ2. What are the key characteristics of DT implementation in HEIs? RQ2 To what extent do DTIs fit in the universities' digital strategy or stand alone? RQ3: What are emerging technologies, what strategic processes is DT currently being used in by HEs and what are the technologies used? RQ4: What changed in the HEIs' trajectory in the process of digital transformation in the landscape of COVID-19? RQ5: What are some challenges and future research trends?

Paper Structure

The rest of this paper presents the remaining details as follows. Through literature review, the concepts, and theories pertinent to digitalization in higher education are presented in section 2. Described in section 3 is the umbrella review protocol and selection of the studies carried out in accordance with the guidelines set out by PRISMA and the method of critical appraisal used. Results are provided for each of the research questions in Section 4. The findings, cross-cutting themes, and implications are discussed in section 5. The next section of the book summarizes the limitations and future directions.

Literature Review

Defining Digital Transformation in Higher Education

Transforming education through digitalization takes on a new meaning from a business perspective. DT was conceptualized by Hess et al. [10] as changes within an organisation's business model arising from the introduction of new digital technologies that lead to changes in organisational structure, its businesses products, or its services. For the purposes of education, Vial [11] used the term digital transformation as the process of changing an entity in order to improve it when significant changes in its characteristics are realised through the combination of information and information aspect aspects (information as data, information as knowledge, information as communication, and information as connectivity). Others expressed it as the use of technology to radically improve the performance or the reach of enterprises [12] or the use of new digital technologies to enable major improvements in enterprise operations and markets, such as an enhanced customer experience, streamlines operations or the development of an entirely new enterprise business model [13].

There is a need to strike a balance between digitization, digitalization, and digital transformation. When information in analog form is converted to a digital representation, it is called-digitized information. Writing Digitalization means improving the existing business process by digitalization technologies focused on process improvement for faster and more efficient processes [5, 6]. Finally, digital transformation is a strategic, organization-wide transformation that involves developing new business models, processes, and value propositions. While digitalisation work, such as automation of process and computer training of operators, can make processes faster and more efficient, according to Kane et al. [14] strategic digital organisational change is a different thing. In this review, we accept the term digital transformation as proposed by Schallmo and Williams [15] as the change of the new strategic business model of the organization with the latest digital technologies, plus high added value to all the involved stakeholders.

Dimensions of DT in HEIs

According to the literature, there are eleven dimensions that DT filters through HEI (higher education institutions): Teaching, Infrastructure, Curriculum, Administration, Research, Business Process, Human Resources, Extension, DT Governance, Information & Marketing [7]. Among these, the dimension of teaching is the most often cited one, which is core to the work of universities, as well as marketing is the least explored one. To map those dimensions Castro Benavides et al. [7] systematically reviewed 19 papers, covering the period between 1980 and 2019, which showed that HEIs' digital transformation environment is not integrated across all dimensions.

By using the seven strategic challenges that emerged in the md4u (Digital Maturity for Universities) framework [16] for these dimensions, it is possible to enrich the analysis. The challenges are digital skills and culture, information security, quality of services, competitive education, students' demands, decision making and university vision. Changes in DTIs in response to these challenges are discussed in Section 4.5.

This lesson covers how technology comes into play when learning is digital.

The advent of new and Internet-based technologies has transformed the landscape of the academic environment and is helping colleges and universities move into the digital age. These technologies have been found to be especially effective in enhancing student-teacher interaction in the education sector of higher studies [17]. Historically, technology mediated learning was formulated in the classroom, but it is evident that it can take place in anywhere, anytime [18] and promote the resurgence of digital transformation in modern culture, benefitting both learners and teachers.

Students' use of mobile devices has been growing over time, with a focus on updating their learning and improving their efficiency in the daily execution of their jobs. Knowledge that can be found more easily has led students to become more independent in their learning and teachers have adapted their teaching strategies by exploiting the hints of greater access to knowledge on-line [3]. But this transformation is also bringing forth challenges, such as the demand for the teacher to be available at any time of the day and communicate with students [19]. Therefore, Universities will need to develop and implement infrastructures for technology communication that have sufficient channels for teaching and learning activities and must supply adequate resources for fulfilling teaching and learning goals; this will require educating and encouraging students and teachers to use them [20].

The SMAC framework stands for social media, Mobile platforms, Analytics, and Cloud computing four technical platforms and technologies that make up the digital environment that empowers transformation in organizations and educational institutions [9].

It enables the application of SMAC within the context of tertiary education to transform operations and management, gain competitive edge and introduce new opportunity for innovation.

Old and New Technologies for DT

There are a number of new technologies entering the higher education 21st century that have unique capabilities for institutional renewal.

AI (Artificial Intelligence) is one of the most revolutionary technologies in the world of education. The functions of AI in HEIs include student outcome predictions, intelligent tutoring systems, automated evaluation systems, and adaptive and personalized teaching [9, 21]. AI models also have been applied to predictive systems, including early warning mechanisms to identify learners at risk of dropping out of school, and machine learning models to analyze learner behavioural data in online learning to forecast engagement in online learning [9]. One of the most promising applications is the development of intelligent tutors, capable of teaching particular subjects, analysing errors made by students and giving them individualized feedback.

Push the development of the smart campus thanks to the Internet of Things (IoT) with temperature sensors, energy consumption, real-time foot traffic and security systems. In a smart classroom with the Internet of Things (IoT), the lesson can adjust learning based on the emotions and thinking of each student using the data collected from the behaviour such as facial expressions and engagement time [9, 22]. Another advantage of IoT is the ability for personalized and adaptive learning, with the use of data to track students' learning styles and preferences and allowing teachers to tailor their curricula accordingly.

The third potential arena for blockchain to be used in tertiary education is by providing credential verification, which would guarantee the authenticity of a certificate of competency or a transcript. Smart contracts can also be used to facilitate the enforcement of the training rules, and blockchain-based copyright management systems can ensure the protection of intellectual property rights. The technology also allows for the simpler transfer of credits from institutions, doing away with much administrative paperwork and thus with hurdles to moving students after they accepted at college. [9, 23]

Some other technologies related to DT in HEIs are virtual reality and augmented reality (VR/AR) for creating an immersive learning environment, robotic process automation (RPA) for automating administrative procedures, 3D printing for hands-on engineering, and design learning environments, MOOCs, chatbots, and virtual assistants for delivering an online, scalable learning environment [5, 9]. The distribution of these technologies by DTIs can be seen in Section 4.6.

Digital Maturity and Strategic Readiness

Digital maturity in HEIs can be considered from the perspective of the framework proposed by Molina-Carmona et al. [16] which considers digital maturity under the four quadrants Digital Management, Digital Innovation, Digital Governance, and Digital Transformation. The authors have assumed that digital maturity can be achieved step-by-step with the implementation of digitalization initiatives, IT governance best practices, and digital transformation initiatives [5].

Research from the past has clearly shown a disconnect between the importance of a HEIs digital strategy and its implementation. The quantitative results of the extent of digital strategy are included in Section 4.3. Digital maturity, as stated by Kane [14] is the capability to respond to the evolving digital competitive environment in an appropriate manner and the response is typically learned and not automatic. Brown [24] also explained that Digital maturity is neither a collection of answers to everything digital, but it's an ensemble of the skill sets and tools to find the answers rapidly.

Underpinning Theories

This review is guided and shaped by two theoretical streams which help inform the lens for the analysis and interpretation of the findings.

The first is the general theory of Learning and Teaching (L&T) in Higher Education which focuses on competency-oriented models and outlines six learning phases for competency building [25]. These are the steps involved: (1) identifying the problem and identifying what are the cognitive and affective learning needs; (2) generating ideas related to the problem; (3) bringing the ideas into the conversation; (4) refining/ redrafting learning materials and produce learning products; (5) comparing learning gain with previously designed ideas; (6) networking abilities and application in different situations. Effective L&T is further characterised by six research-based principles: goal-directed practice with focused feedback; the importance of prior knowledge; organizing prior knowledge; motivations for learning; learning environment climate; development of autonomous learning strategies [26]. This

theoretical approach is directly relevant to the present review in that it offers a way of judging the didactic aspect of the digital transformation; either by seeing if DTI contributes to the development of competences, and/or by checking whether it is based on the principles of evidence-based learning, or simply on a process that reproduces the same pedagogy in the digital space.

The second theory tradition noted is the digitalization of social theory itself. To accept digital transformation as an emulation of the digital era, then the previous social theories must be transformed in a digital way, too, as Roth [27] suggested. Theoretically, systems theory of Parsons and Luhmann [28] offers a framework from which to relate and scrutinize the properties of these distinctions in social theory as established above, and if needed, transform false distinctions into true ones. This tradition contributes to the organizational and cultural aspects of DT addressed by this review, as it sees transformation as more than a technological event, it is a process that transforms institutional identity, governance, and social relations in the University. When applied in combination, these two theoretical viewpoints enable the synthesis to explore DT in terms of pedagogical effectiveness and sociotechnical complexity and in terms of technology adoption as an end, rather than a means.

A moment of turning point in relation to COVID-19 pandemic.

COVID-19 became an unprecedented accelerator of digital transformation in the realm of higher education organizations around the globe. COVID-19 has been an unprecedented catalyst for change in the digital world of higher education institutions globally. In the pre-COVID era, higher education had not experienced any major reforms for decades [3]. When COVID-19 hit, HEIs and educational systems had to suddenly and unexpectedly shift to remote and online learning, drastically changing the dynamics of physical and virtual learning environments.

But this swift change also shed light on and reinforced key digital divides. Access to technology and Internet connectivity was identified as a major problem, as were digital skills gaps among students and faculty and building/facility-related gaps [3, 29]. These were disproportionately affected with students from lower income areas and in developing regions lacking in devices, bandwidth, and digital literacy to successfully engage with online education. The long-term question remains of whether the pandemic-induced changes will stick as institutional change or fade as the crisis subsides and institutions become more inclined to home in on their previous roles and methods of operation [30].

Methodology

Research Design

This study follows an umbrella review or review of reviews/meta-review approach that systematically searches, appraises, and combines the results of both systematic reviews and complementary primary studies to create a higher order review of a research field [31]. An umbrella review is not a traditional summary of primary studies but instead aims to first examine previously published systematic review(s) as it is primary analytical unit, then add other primary studies to that data to provide thematic context and address important gaps. This is fitting of the field of digital transformation in higher education, since after all, there are many independent and systematic reviews that address digital transformation from a particular lens; the key contribution of the present study is the integration of these lenses.

The protocol and processes used were based on rigorous criteria described by Kitchenham [31] for systematic review rigor, transparent reporting as per PRISMA guidelines (Shamseer et al. [32]) and thematic coding of qualitative data/browser as prescribed by Braun and Clarke [33] for the qualitative findings. Through the umbrella review methodology, the synthesis could cover both the scope of the data (the combined collection of corpora from the source reviews) and the focus of the data (the thematic analysis from additional primary sources that deepened the analysis of the digital transformation in HE).

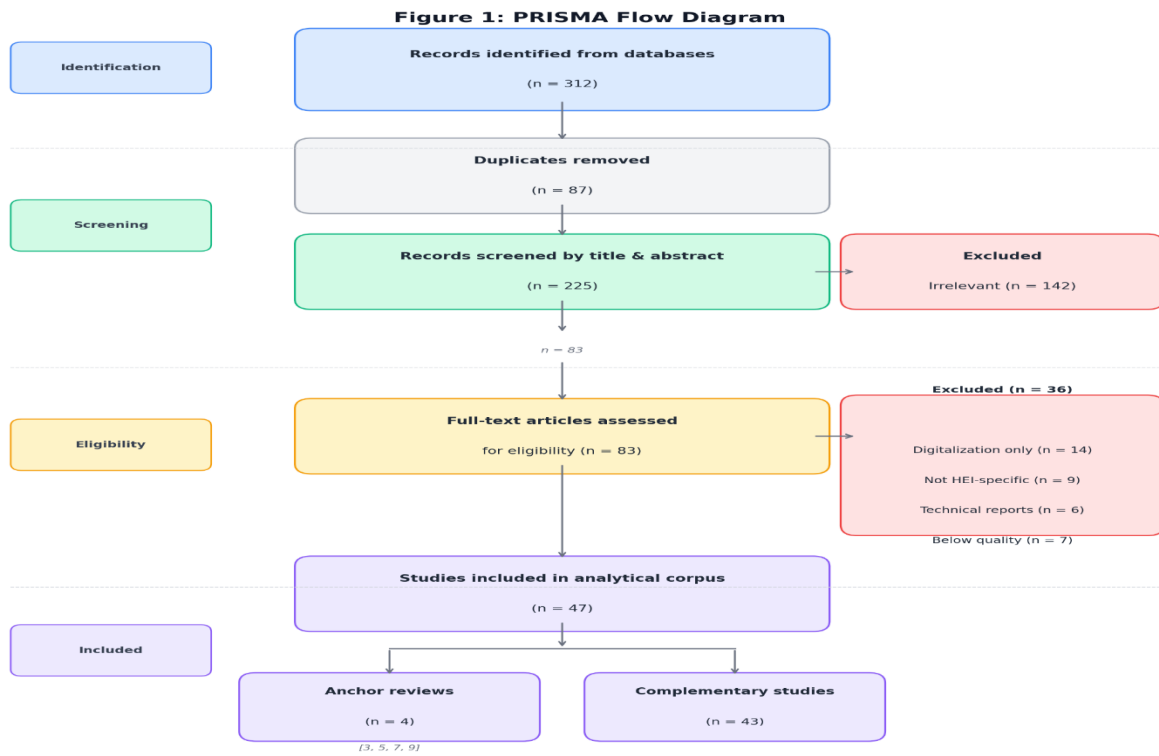
Data Sources and Search Strategy

The review is conducted from 6 major academic databases Scopus, Web of Science, IEEE Xplore, ScienceDirect, SpringerLink, ACM Digital library. Moreover, for the purpose of complementary searches, Google Scholar was used and after multivocal literature review methodology, EDUcause and Google were turned to for gray literature search. The search terms used were digital transformation, digital disruption or digital innovation AND higher education, university, or tertiary education. The time range is from 2015-2024, and English-language peer-reviewed articles and conference proceedings are eligible for use only.

Study Selection and PRISMA Flow

The selection process of the studies was done on the four-phase flow of the PRISMA. During Identification phase, all data bases were searched for 312 records. During the Screening phase, 87 duplicates were eliminated and 225 records were screened by title and abstract, of which 142 were deemed irrelevant, resulting in 83 records. During the Eligibility phase 83 articles underwent full text screening based on inclusion and exclusion criteria; 36 articles were excluded, as they were related to a digitalization process only (14 articles); they were not specifically addressed to HEIs (9 articles); they were technical reports or tutorials (6 articles); they did not meet the quality criteria (7 articles). There were 47 studies in the final Inclusion phase: 4 anchor reviews [3, 5, 7, 9] and 43 complementary primary studies.

To be included, the studies had to be published in the time window, include the search terms in the abstract, in the title or in keywords, describe DT initiatives, strategies, technologies or dimensions in HEIs, be published in English and fit all other criteria. If the review was of these kinds (for anchor reviews), the second criterion was that the focus of the study should be a systematic, multivocal or scoping review of DT in HEIs. The exclusion criteria narrowed the scope of study to exclude works that just talked about digitalization without transformation, one that was not specific to HEIs, an already published work and the low-scoring ones.



Quality Assessment

A six-question quality checklist adapted from Castro Benavides et al. [7] was employed, assessing both study design (whether research questions were answered, goals stated, and methods outlined) and system design (whether the DT applies to the whole HEI, dimensions and actors are defined, and model construction methods are described). Each question was scored as Yes (1), Partially (0.5), or No (0), with a threshold score greater than 4 required for inclusion [7].

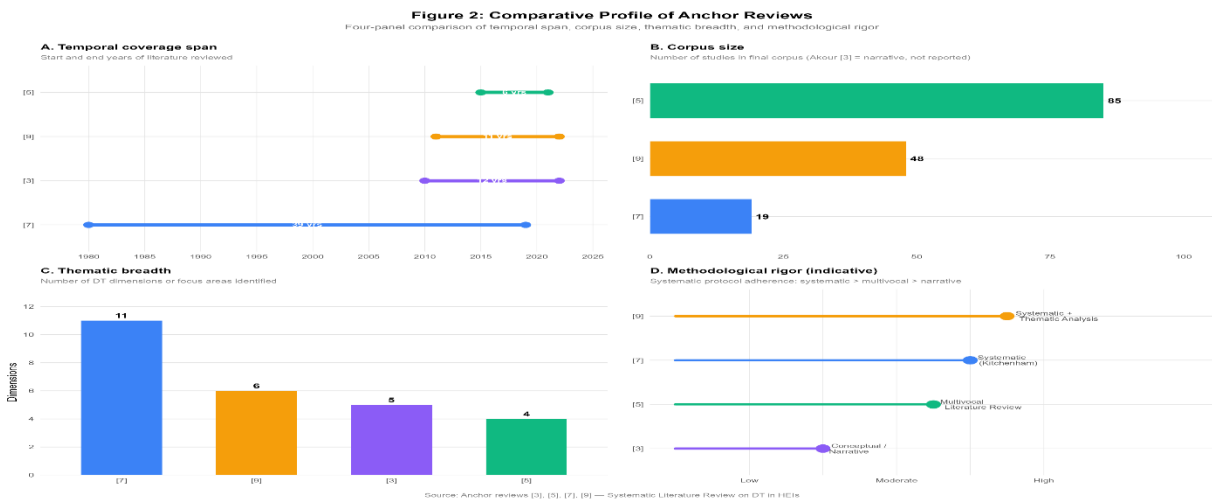
Critical Appraisal of Anchor Reviews

Because the umbrella review's quantitative findings depend on the four anchor reviews, a critical appraisal of each is provided in Table 1 to allow readers to assess the reliability of the synthesized findings.

Table 1: Critical Appraisal of Anchor Reviews

	Scope	Period	Corpus	Methodology	Key Strength	Key Limitation
Castro Benavides et al. [7]	Dimensions, actors, and characteristics of DT in HEIs	1980–2019	19 papers	Systematic literature review (Kitchenham protocol)	First comprehensive dimensional mapping of DT in HEIs; identifies 11 dimensions	Small corpus (19 papers); no holistic DT framework proposed; limited temporal scope
Fernández et al. [5]	DTIs, digital strategy, technology distribution, maturity	2015–2021	24 academics + 61 grey literature sources; 184 DTIs from 39 universities	Multivocal literature review	Largest DTI dataset; includes grey literature for practitioner perspective; quantitative maturity mapping	Technology data available for only 82 of 184 DTIs (45%); grey literature quality variable; geographic bias toward European institutions
Truong and Diep [9]	Technology trends in digital transformation in tertiary education	2011–2022	48 papers (from 4,723 screened)	Systematic review with thematic analysis	Comprehensive technology taxonomy; maps technologies to educational functions	Focused narrowly on technologies; limited attention to organizational or strategic dimensions
Akour and Alenezi [3]	Future of higher education in the digital transformation era	2010–2022	Narrative review with selective evidence synthesis	Conceptual review with literature integration	Strong COVID-19 contextual analysis; identifies digital divides and equity concerns	Not a systematic review; selection criteria not fully transparent; limited quantitative evidence

Figure 2. Among the four anchor reviews, offers the broadest thematic coverage (11 dimensions) and longest temporal span (~39 years), while leads in corpus size (85 studies) and applies the most rigorous methodology (Systematic + Thematic Analysis)



Data Extraction and Coding

These were extracted with the help of reference managing software, Mendeley and systematic documentation software, MS Excel. The extraction spreadsheet recorded governance structure, actors involved, country, goal, research methods, technologies described, DT definition used and journal. The coding taxonomy used here was derived from Castro Benavides et al. [7] who

distinguished three dimensions of the description of DT as Technological, Organizational, and social dimensions whereas they also distinguished DT goals, dimensions, actors, methods, and technologies. Thematic analysis involved four stages: coding based on data, assessment of eligibility and relevance, categorization for organising data and iterative refinement for identification of arising themes [33].

Data Synthesis

Data synthesis was conducted in an integrated manner of qualitative and quantitative approach. The frequency counts, percentages, and trend analyses were conducted in quantitative synthesis, which used the data aggregates of the anchor reviews as the primary data source. Qualitative synthesis used thematic narrative organized by the research questions; some additional primary studies supplemented the findings of the anchor reviews in explanation, in corroboration or otherwise to challenge their findings. Some of the most important visualizations covered are PRISMA flowcharts, publication distributions by year, DTI distributions by the strategic challenges, frequency analysis of actors and technology usage distributions as well as the integrative conceptual framework (Figure 2).

Results

Descriptive Overview

The synthesised corpus shows a gradual increase in the amount of literature about digital transformation in HEIs. Of the anchor reviews, Castro Benavides et al. [7] found 19 during the period from 1980 to 2019, with publications becoming a lot more significant from 2016. Fernández et al. [5] compiled a literature survey of 24 academic publications and 61 grey literature that comprised over 300 IT initiatives from 90 universities, from which they chose 184 DTIs from 39 universities. A total of 48 papers were then selected for thematic analysis through screening of 4,723 articles by Truong and Diep [9]. This umbrella review comprised 43 complementary primary studies that focus on various dimensions, actors, technologies, and strategic processes not fully captured by any one of the anchor reviews and range from 2016 to 2024. The temporal distribution reveals that the research interest is rising over time with more publications on DT in HEIs since 2016 and a further spike since 2020, due to COVID-19. Research perspectives have changed over time and are now more than ever inclusive of the technological aspects of change, while also embracing organizational and social aspects of change [7].

DT Definitions in HEI Literature

Different definitions for digital transformation can be found in the literature for HEIs. There are several definitions of digital transformation in the literature related to HEIs. These vary from technology-based definitions that highlight a technology component to digital tool adoption, to strategic definitions that focus on a business model transformation and to holistic definitions that include, organizational / culture changes along with stakeholder value. Hess et al [10] highlighted the impact that new technologies have had on altering business models. Westerman et al. [12] concentrated on creating radical performance improvement. In the field of improvements, Vial [11] emphasized on improvement of the entity using technology combinations. The framework of the OECD focused on digital capacities related to entrepreneurship and innovation [5]. Addressing the issue of the role that DT plays about enabling new processes, Grajek [34] referred to DT as an organizational shift at all levels. In this collection of definitions, there are some common themes: the deployment of new technologies, strategic organizational transition, development of new processes and value, and consumer sentiment [5, 7].

Digital Strategy and Maturity (RQ2)

A comparison of the evidence in the field of digital strategy and maturity in HEIs shows a number of gaps between recognition and acting. Of all the universities studied by Fernández et al. [5] only 23% have an IT strategy, whether it is a digital transformation strategy, disruptive innovation strategy or a business strategy that includes digital strategy. About a third of the universities have undertaken DT initiatives without any global business strategy, which represents an additional risk of wrong investments. Of the 39 universities analysed, 44% of them initiated their DT activities from an existing IT strategy plan and 56% created DT initiatives that were not connected to a separate IT strategy or plan [5]. With all universities that reported an IT strategy, there was an IT plan as well, indicating that the process of formulating strategy followed by planning is natural; however, the opposite is not necessarily true, as all universities with an IT plan also reported having an IT strategy.

Based on the md4u Digital Maturity Model analysis, digital maturity increases because of digitalization initiatives (i.e., technology-driven optimisation), IT governance best practices (i.e. support for the decision-making process), and digital transformation

initiatives (i.e. business-driven new process creation) [16]. Digital transformation efforts in an organization are neither limited nor confined to a single scope and relate to the digital maturity of the organization [5]. When there is already some level of digital maturity within an organisation, transformation efforts reap more benefits, thus fostering further maturity and creating a virtuous circle.

DT Dimensions (RQ1)

There are unbalanced attention and development in the eleven dimensions of DT in HEIs. It is evident that teaching is the dimension that is most fully saturated, which is what universities are best known for: for teaching. Follows infrastructure and curriculum, backed by good investments in learning management systems, digital and updated course content. More administrators have come to the table as universities try and streamline the way they manage and minimize expenses by increasing their automation. What has been covered in relation to research dimensions is inspired by open science, data-sharing and collaborative tools. The works undertaken in business process transformation have been centered around standardization, automation, and shared services [5, 7].

Less well stated dimensions jump out as significant gaps. Although there is consensus that transformation of human resources in the context of digital transformation is significant, there is a lack of investment in it, especially in relation to increasing the competence and capacity of faculty to embrace ICTs [5]. There is some attention to extension activities; these do not adequately have any systematic integration with the community in engagement practices and industry involvement. Although DT Governance is essential to achieving successful transformation covering leadership, strategy, and change management it is under-resourced. The importance and fragmentation of information management and data governance, cross institution. The least studied dimension is marketing which describes the non-commercial nature of the public universities' tradition but increasingly is under concern with growing competition for enrolling students [7].

Strategic Processes and Technology Distribution

Digital transformation can be considered in terms of the seven strategic challenges offered by the 'md4u' framework [5, 16] which provides a structured view of the application of digital transformation in HEIs:

Competitive Education (24% of DTIs): This is the largest category including programs in the area of lifelong learning (30%), industry involvement (18%), work experiences in curriculum (16%), Internet-based programs (16%), blended learning (11%), competency-based programs (4.5%) and skills certificate authenticity (4.5%). The market is growing for non-traditional students, such as working adults, degree completers, and practitioners without a university degree [5] who are being targeted by universities' expanding academic programs.

The commitment towards Quality of Services (17%) is via shared data and services (52%), via standardization and automation of processes (27%), and via industry collaboration (21%). Shared solutions free up resources for innovation, make the information available to all, bring visibility and guarantee information quality [5].

Information Security (16%): Areas of concern for Security work are staff training for Data policies (28%), definition of new security policies (25%), solutions for safe sharing information (19%), centralized services and data sources (9.5%), deployment of multifactor authentication (9%), collaboration with other industries (6%), risk prediction (3%) [5].

Decision-Making (14%): Data-driven decision-making efforts includes solutions that involve having multiple data collection sources (77%), setting up single sources of data for collection (14%), and promoting culture (9%). The growing universities are shifting towards adopting data driven models on knowledge culture and integrated systems of data [5].

Only 12% of DTIs target a student demand as an outcome of the transformation, while 94% of HEI leaders state this will be the most important as an outcome of digital transformation. These are identified as to raise student-staff interaction (44%), provide ongoing self-service (36%), and assess student potential and then provide tailored advice (20%) [5].

Digital Skills and Culture (9%): Training to build digital skills (59%), working collaboratively between IT and other units (23%), and training staff by engaging in new digital initiatives (18%) are the top under-invested challenges. Fernández et al. [5] found that around 70% of the leaders interviewed in UK universities considered that organizational culture was the main obstacle to digital change.

University Vision (6%): The least addressed challenge includes current challenges being met through the delivery of knowledge (45%), quality experience through technology (36%) and increase of the student population (18%) [5].

Use alternative methods to identify emerging technologies that are indirectly relevant to the DTIs (RQ3).

Adoption patterns in technology use shows that there are patterns across DTIs. Of these 184 DTIs, 82 reported on the technologies used, the subset accounting for 45% of the total; these percentages should be taken as indicative of those that were used. Analytics leads (23%) are used for tracking student progress, for creating student groups, personalized learning, and helping with decision-making. Cloud computing is at 20% behind, but has a variety of applications for security, anytime, anywhere access, DR, business continuity, and centralization of shared services. AI contributes 16% to generating insights to ensure student and staff understandings, helping to make informed decisions, and offering customized experiences. Overall, MOOCs make up 10%, digital learning environments 4% and open badges 1% of the total online teaching objectives. VR/AR technologies account for 9% and provide VR/blended learning. Automation with Chatbots (6%), Virtual Assistants (5%) and RPA (1%) makes processes easier. It is distributed securely using blockchain technology (4%) and combined with IoT technology (3%) to develop smart campus applications.

Important relationships are apparent in the technology to process mapping - Analytics primarily maps with data analysis and decision making for all the strategic challenges. Cloud Computing allows for the sharing of services, security, and collaboration. VR/AR and MOOC are Learning Innovation. Student interactions, personalization, and chatbots are powered by AI. RPA helps simplify administrative tasks [5, 9]. The versatility of analytics across various strategic processes, coupled with the adoption of cloud and AI still in earlier stage with more specialized applications, is the reason behind the dominance of those technologies. Newer areas such as blockchain and IoT have a few more use cases and are still at early adoption stages. Remarkably, these distributions precede the use of generative AI tools in higher education institutions to a much extent (as explained in Section 5.2), which could have changed the landscape of the technology in use since the dates of the data collection for these source reviews.

Actors Involved in DT (RQ1)

Students, faculty members, and various other stakeholders at the university are engaged in digital transformation efforts. Students and teachers are therefore prominently represented, with 95% of studies analysis having them as actors, across all social, organizational, and technological aspects, thus confirming their central role in all the studied studies [7]. The increasing relevance of University-Industry partnership is evident from the number of industry partners that appear in 53% of the studies. The dedicated DT teams and the university managers are essential for the effective functioning of the organisation. Policy frameworks and funding mechanisms are reflected in government involvement, which is found in 42% of studies. Organic institutional units (42%) make contributions as part of departmental action plans. Alumni (32%) and researchers (32%) participate in the following modes: Feedback, funding, and Knowledge Generation. The least involved categories of actors are community engagement (26%) and faculty governance bodies (26%) [7].

The function of every actor is different from her or his point of view. Rooted in a social view, students and teachers are the forces behind cultural adaptation for transformation. Organisational perception, managers, and DT teams create strategies. From industry partners' point of view, they invest infrastructure and technical support [7] to the IT department.

When implementing, where and how should the method be applied? (RQ1)

Implementations of DT in HEIs show a variety of approaches to DT implementation that are not necessarily equally successful. The most prevalent guidelines are DT guidance (68%) which offer guidelines for action. Digitalization focus is present in 47% of implementations, showing that most often the first step towards digitalization is to optimize processes before engaging in the transformation. Dedicated institutional capacity is offered by competence centers (42%) and DT centers (37%). Re-engineering approaches (37%) are the basic redesign of processes. Groups (26%) and change management (26%) are two groups that help implement the operation. More complex and structured solutions for institutional transformation are enterprise architecture (EA; 16%) and IT architecture management (ITAM; 11%).

RQ4: Effect of COVID-19 on the digital transformation path

The COVID-19 situation was a defining moment for digital transformation in higher education, not only because of the speed with which it pushed-up adoption but also because of the weaknesses it revealed in structures. The findings of the primary studies that supplement the evidence in this primary study, and those provided in the Akour and Alenezi anchor review [3] align to several salient findings. In the first place, the pandemic accelerated these years of digital adoption over the course of a few months: institutions quickly introduced LMS, video communication software and digital assessment tools [3, 29]. Second is that the move to remote teaching brought to light that many institutions lacked the digital infrastructure, teaching skills, and student support to

effectively teach remotely. Second, the shock to online teaching brought to light the fact that many institutions did not have a robust digital teaching infrastructure, nor any faculty preparation nor any of the student supports necessary for effective distance classes to be taught. Third, the digital divide grew both in socioeconomic and geographic aspects, and lower-income and students in developing regions of the world suffered disproportionately from limited access to connectivity, devices, and digital literacy [3, 29]. Fourth, the pandemic brought about institutional realization of digital transformation as a strategic need, rather than an optional improvement. The disruption urged HEIs to rethink their models of operation [29] - but whether these innovations are yet to settle into a more stable future (as opposed to being watered down by pre-pandemic reality) is yet to be determined [30].

Challenges and barriers (RQ5)

The synthesis identifies five cross-cutting challenges. There are still challenges to the infrastructure, such as limited connectivity and hardware access in rural areas, which hamper digitalization efforts [3]. Digital literacy knowledge, understanding, and skills are still not widespread among faculty in all the regions, and the training program resourcing and level of engagement are often inadequate, with full training occasionally inconsistent with the overall institutional strategy [5, 7]. As providers gather and analyze more and more student data, questions of data privacy and security are being raised, in addition to ethical concerns regarding surveillance, algorithmic equity and consent [9]. Most DT initiatives have been isolated, tackling each of its aspects, without a broader profile or coordination throughout the organizational system [7]. Last, resistance to change stemming from traditions of faculty autonomy, governance systems, and institutional culture makes technological fixes a tough challenge that can be difficult to achieve [3, 5].

Discussion

Answering the Research Question(s)

In relation to changes in HEI context, dimensions and characteristics, digital transformation in HEIs has been discussed on the social, organizational, and technological aspects with a recent increasing emphasis on social approach in existing research [7]. Teaching is the most permeated dimension and there is no overall approach which combines all the eleven dimensions. The literature documents a patchwork of initiatives that aim at specific aspects rather than at coordinated efforts in the institutional as a whole.

Perhaps the biggest challenge identified in this review, is the fact that only 23% of HEIs have a digital strategy (RQ2) [5]. DTIs by themselves are high risk for low strategic returns if they are only working on optimising component processes and do not foster wider institutional change. Transformation efforts and level of digital maturity are typically correlated, which implies that the strategic planning is a vital aspect of effective digital transformation.

In terms of Strategic processes and technologies, competitive education has the highest adoption status at 24%, a result of universities' core mission. Analytics, cloud, and AI are leading the technology landscape. The plotted areas of satisfaction with student demand (12%) and digital culture (9%) raise questions, however, as these are highly cited but are under-resourced. This means that the e-learning outcomes in this area that are cited do not enjoy the greatest attention in practices [5].

RQ4 COVID-19 Impact: The pandemic drove up the rate of DT on all fronts while revealing deep digital divides in access to, and skills in, as well as the robustness of digital infrastructure. We are not destined to an either scenario, as some schools incorporate aspects of past innovations in pandemic response, and others use schemes from before the pandemic. COVID-19 might have had a more permanent impact on the process of institutionalizing digital transformation, rather than on technologies.

The major challenges that arose out of the HEIs involve the lack of holistic frameworks, infrastructure gaps, digital education levels of the faculty and concerns relating to data privacy [3, 7, 9]. Implementing digital culture is a persistent problem because of the lack of connection between it being important and investing in it.

Cross-Cutting Themes

The gap between strategy and execution: HEIs are facing the change towards 'Digital' but are often short of the appropriate strategic architecture to support digital transformation. Our findings show that only 23% of universities have a digital strategy, with much higher numbers starting individual Digital University Initiatives, reflecting a reactive approach to adopting digital rather than a strategic approach [5].

Technology is Not the Driver: The common thread among all literature is that successful DT involves people, processes, and models first, and technology second. As Kane et al. [14] pointed out, strategy, not technology, is what enables digital transformation. The technologies are essential but not sufficient - they need to be supported by changes in organizations, culture, and strategy.

Improving student experience is seen as the greatest DT outcome by 94% of HEI leaders, but only 12% of DTIs are tackling student demands directly [5]. The absence of a connection between ideas of student-centered transformation in the institutional discourse and investment and action priorities suggest a lack of connection between ideas and action.

Resistance from faculty: 9% of the DTIs focus on Digital culture but about 70% of the UK University leaders say culture is the primary hurdle to Digital transformation (as cited in [5]). No technology solution can be adopted without rectifying faculty reluctance in adopting the new technologies and teaching methods. To achieve a successful transformation, it is essential to invest in the development of skills and capacities, in participatory process of change management, as well as in incentives to promote digital innovations.

The Generative AI Disruption: The source reviews' data collection dates are often before the era of tools that heavily rely on generative AI, especially those called large language models (LLMs) like ChatGPT from late 2022; nevertheless, generative AI has, arguably, changed the DT landscape the quickest, most impactful, and most directly in higher education. The need for Councils' institutional responses to AI, academic integrity, assessment reconstruction, AI literacy curricula, and integrating AI-supported learning into pedagogy are more urgent than ever due to Generative AI. This review's technology distribution of 23% analytics, 16% traditional AI is highly likely to underestimate the current level of use of AI in HEIs, however. Moving forward, we must consider the seismic shift in the review and institutions with previously well-established strategic digital models can be expected to have a more nuanced approach when incorporating generative AI, meaning they are more likely to tap into it proactively.

Tensions Across Source Reviews: The four anchor reviews are more complementary than in some, but there are some interesting tensions. Fernández et al. [5] report on the distribution of technology over a reduced set of 82 DTIs for which technologies were declared; Truong and Diep [9] report on a larger taxonomy built from 48 found fundamental research papers. The two sources are not identical in their taxonomy: In case of chatbots and virtual assistants, this means that while the category of AI applications is applied the impression of AI's prevalence would differ, that is from Truong and Diep but Fernández et al. see them as two different technology categories. On the other hand, Castro Benavides et al. [7] document 11 dimensions of DT through 2019 from 19 papers, of which the literature on DT since the onset of the pandemic enumerates further dimensions, especially on the subject of digital equity and DT related to well-being, which are less neatly combated. This reflects and highlights the dynamic and multifaceted aspect of the conceptualization of DT within HEIs and implies that it is impossible to have an unambiguous taxonomy of DT.

Integrative Conceptual Framework

Based on the results of the four analytical lenses, this review postulates an integrative conceptual framework of DT in HEIs (Figure 2). The framework puts the digital strategy and institutional vision at its centre and wraps around four interwoven layers: (1) the 11 institutional dimensions in which DT is present and shapes HEIs [7]; (2) the 7 strategic challenges to address to make DT a reality [5, 16]; (3) the 7 enabling technologies/solutions that are implemented across those 7 challenges [5, 9]; and (4) the actor ecosystem that enables and is challenged by transformation [7]. Digital maturity as a dynamic outcome variable increases as initiatives are implemented across all layers of scope, coordination & strategic alignment. Additionally, the framework accounts for external influences on the trajectory of transformation, such as regulatory contexts, disruption by COVID-19, the emergence of generative AI, and digital equity challenges. While previous models focused on one layer or a couple at a time, this model explicitly highlights inter-dependencies between various layers of the organization, strategy, dimensions, technology, and actors, which make it easier to share with institutional leaders as a planning tool and with researchers as an analytical one.

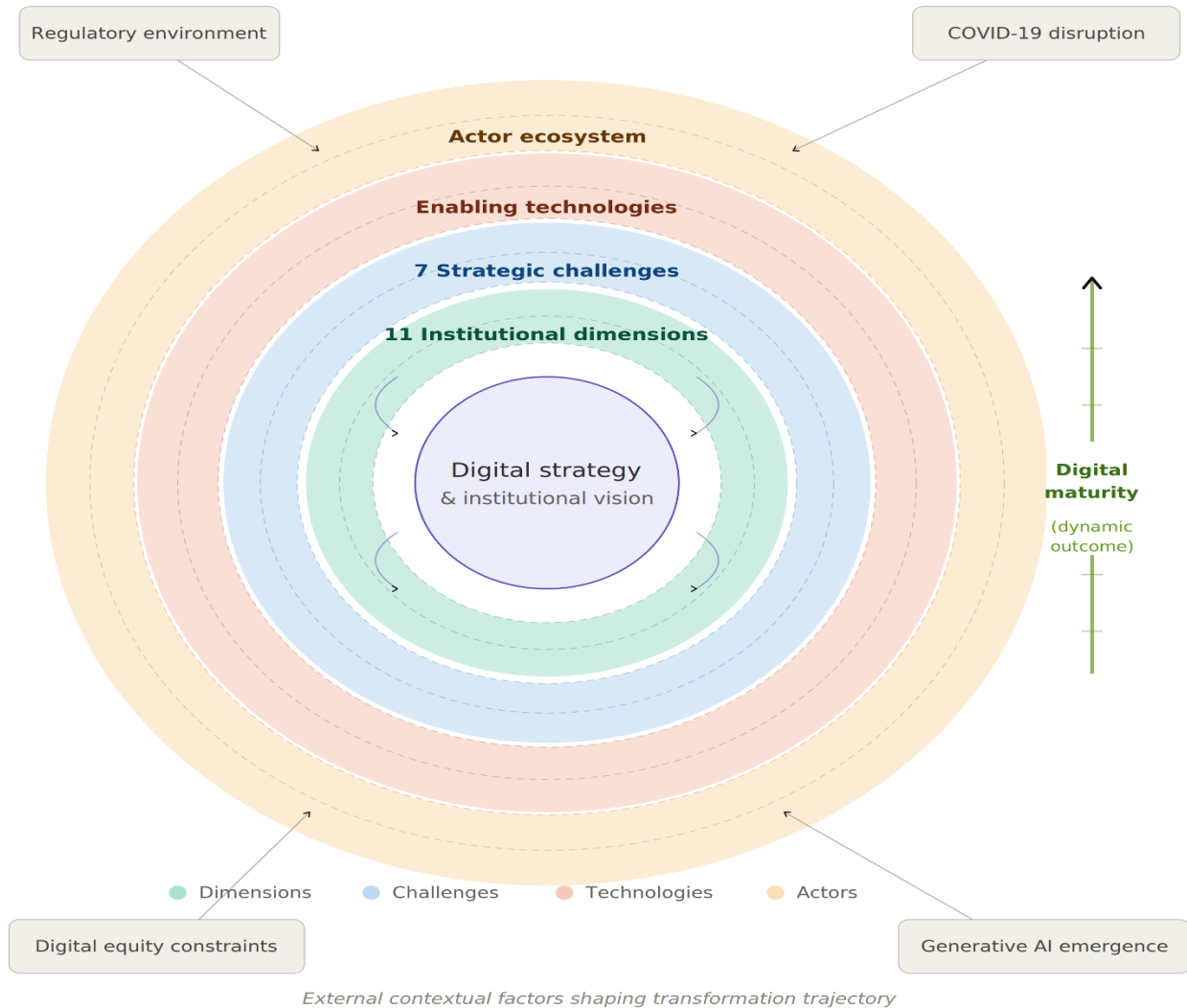


Figure 3. This concentric-circle framework illustrates how a central digital strategy and institutional vision is shaped by progressively broader layers institutional dimensions, strategic challenges, enabling technologies, and an actor ecosystem all operating within external contextual forces (regulatory environment, COVID-19 disruption, digital equity constraints, and generative AI emergence) that together drive digital maturity as a dynamic outcome.

Theoretical Implications

This Review is an attempt to step out of the one-dimensional single stakeholder single technology reporting and explore how the various dimensions and stakeholders of DT in HEIs might interact in ‘meta-trends’ alongside the various technological actors that have emerged. This review aims to take a step beyond the one dimensional single stakeholder single technology reporting and introduce the possibility of some ‘meta-trends’ the many different dimensions and the various stakeholders involved in DT in HEIs and the many technological actors that have emerged to date. The synthesis reinforces a sociotechnical view of technology adoption, which sees technology, organization, and society as four intertwined elements, rather than three distinct ones [7, 27]. The md4u framework adds the element of technology mapping to each problem statement and delineates the technology's importance in the institutional goal, giving a finer-grained grain of technology in terms of a specific institutional challenge [5, 16]. In the L&T theoretical framework [25, 26] interpretations of findings indicate that the major technology deployments (analytics, cloud, and AI) can have a positive impact on supporting competency-based learning and evidence-based pedagogy when integrated into specifically created learning environments instead of used as small and separate components. The social theory perspective [27, 28] is that the main constraint to DT is institutional culture not technology and thus, to make the transformation, the sociotechnical dimension must be considered, such as organizational identity and governance.

Practical Implications

The results have a number of implications for the day-to-day University leaders. First, before implementing individual DTIs, institutions should develop a digital strategy which has to be aligned with institutional vision [5]. Second, along with investing in technology, investments in digital culture and faculty training are essential to shift into gear, with human factors being a dominant constraint to transformation [3, 5]. Third, the value of analytics and AI for evidence-based decision making should be capitalized: institutions should be progressing toward data-driven models [5, 9]. Fourth, industry partnerships need to be established and nurtured for co-design of curriculum, and for the source of financing for DT [3, 7]. Fifth, digital divides need yet again to be tackled proactively, with explicit policies and investments that enable equal access to digital learning resources and opportunities [3, 29]. Finally, with this generative AI disruption, institutions must design AI governance policies and AI literacy initiatives into their digital plan, instead of dealing with generative AI as a stand-alone problem.

Comparative Evaluation with Precedents Review.

In this review this work builds upon the findings of the four preceding anchor reviews in several respects. This is despite Castro Benavides et al. [7] establishing the dimensional framework and actor mapping for DT in HEIs; their review included just 19 papers until 2019 and found no single holistic DT proposal. In our synthesis we follow their framework but enrich it with the strategic process analysis and the technology mapping carried out by Fernández et al. [5]. In addition to grey literature and academic literature, our review combines the work of Fernández et al. in terms of quantities in one hand, and the work of Akour and Alenezi [3] which provides the theoretical background for the DTI, as well as the Truong and Diep quantitative analysis of the technology trends in another. What this synthesis adds to the literature is the integration of strategic (Fernández et al.), dimensional (Castro Benavides et al.), technological (Truong and Diep), and contextual (Akour and Alenezi) points of view in a single analytical perspective and the attention paid to potential tensions and gaps that could not be captured in individual reviews.

Conclusion, limitations, and future research.

Conclusion

This extensive umbrella review has brought together the previous status of higher education institutions' digital transformation from different perspectives, technologies, actors, and strategic processes. The analysis shows that while HEIs have moved significantly in their use of emerging technologies such as analytics, the cloud and artificial intelligence, the organizational and strategic processes which could be increased to better support effective transformation are still not well developed. Around three-fourths of the universities do not have a digital strategy, over half of all Digital Technology Institutes (DTIs) are not part of the institutional planning process and the need for digital culture and competence among faculty members is the least invested.

The key output of this review, however, is a multi-dimensional, multi-source synthesis of the whole landscape of DT in HEIs, the synthesis of dimensions, technologies, actors, strategic processes, and maturity levels, all in one picture. The review combines the content of systematic reviews, multivocal literature analyses and thematic syntheses to give a broader overview than any individual source. The integrative conceptual framework presented in this review (Figure 2) can be a tool for researchers to analyze their work, and it can be a planning tool for institutional leaders.

Moving forward, the ability to successfully achieve the mission of the HEI in the digital era, and a digital approach that is properly grounded in a strategy, is critical in keeping HEIs competitive, ensuring they provide effective services to students and enhancing their societal roles. Technology will keep changing and the critical problem is still organizational: how to establish institutions that can learn, adapting, and changing along with the world's fast-changing demands, as the rise of generative AI clearly shows.

Limitations

There are a number of limitations in this review. It is an umbrella review as such and should be understood as such, i.e. as a secondary synthesis of existing reviews and primary studies, thus having its results limited by source review coverage, methodological options and limitations (see Table 1, for a critical appraisal of every single one of the anchor reviews). The search was restricted to identified databases and publications that were in English, and materials that might be relevant to the search in other languages or in other databases were not necessarily included. Through the multivocal review methodology, grey literature is included, but quality control is a challenge. The snapshot in time takes place until 2024, leaving the possibility that post-2024 events, especially the swift expansion of the use of generative AI tools in education, could have left an even more impactful mark. There are representation gaps in geographical terms with limited representation of literature in Africa, and Latin America. The

percentages of technologies from the Fernández et al. (2001) distribution data may not be generalizable to all 184 DTIs since they do not include those that did not respond to the query for technology information. Finally, complementing these empirical studies would be additional empirical studies, especially longitudinal or stakeholder-oriented designs, expanding the evidence base.

Future Research Directions

The following future research directions, which correspond to the priority level of the specific gaps identified in this synthesis, are presented by priority level.

High Priority Addressing Critical Gaps Identified in the Review:

1. Development of overall DT frameworks bringing together all HEI dimensions in a single DT maturity model. Although it is well known that such a framework is essential, this review revealed none is currently available, and the integrative conceptual framework presented here (Figure 2) could be the basis for empirical testing and modification.
2. Development and assessment of faculty readiness towards information technology. This is the largest implementation gap in digital TV since only 9% of DTIs are concerned with digital culture, which is recognized as the biggest obstacle to transformation [5].
3. Research on data-equity and inclusiveness by Socio-economic and geographic. COVID-19 pandemic revealed major digitization gaps [3, 29] and the subsequent emergence of generative AI has added dimensions of inequity about access to, and skill with, and representation of cultures.
4. Standardisation of metrics for monitoring impact and ROI in HEIs. Without those indicators it is difficult to assess the success of the digital transformation projects undertaken or make tough decisions on resources that will support success.
5. How well current and local understandings are expanded.
6. Longitudinal assessment of the potential for digital changes affecting COVID to either strengthen or weaken. The issue of consolidation versus dilution highlighted in this review that of the need for multi-year tracking investigations, which are currently only becoming possible is just coming to the fore.
7. Qualitative research studies that focus on the perspectives of stakeholders (students and faculty) of transformation processes. The participatory gap can be noticed when students and teachers are subjects of the studies in 95% while they are rarely involved in co-design activity.
8. Cross-country comparison of DT readiness and approaches of implementation. Existing results are also not always generalizable as they are under-representative of Africa and Latin America.
9. Identifying emerging priorities and/or leading investigations.
10. (8)Research on how generative AI affects pedagogy, assessment, and institutional processes. The fast development of large language models and their impact on academic integrity, assessment, and artificially enhanced learning create a pressing need to conduct research in this area, although this specific research area is not directly extracted from the data collection periods from the literature reviewed.
11. (10)Modernisation of governance and policy research for the acceleration or delay of institutional DT.
12. Ethical and privacy-related aspects such as data governance, fairness of algorithms and surveillance issues in digitally transformed educational environments. (10).

References

- [1] Alexander, B. *Academia Next: The Futures of Higher Education*; Johns Hopkins University Press: Baltimore, MD, USA, 2020.
- [2] Park, C.Y.; Kim, J. Education, skill training, and lifelong learning in the era of technological revolution. *Asian Dev. Bank Econ. Work. Pap. Ser.* 2020, 34, 3–19.
- [3] Akour, M.; Alenezi, M. Higher Education Future in the Era of Digital Transformation. *Educ. Sci.* 2022, 12, 784. <https://doi.org/10.3390/educsci12110784>

- [4] Prasetyo, I.; Suryono, Y.; Gupta, S. The 21st century life skills-based education implementation at the non-formal education institution. *J. Nonform. Educ.* 2021, 7, 1–7.
- [5] Fernández, A.; Gómez, B.; Binjaku, K.; Kajo Meçe, E. Digital transformation initiatives in higher education institutions: A multivocal literature review. *Educ. Inf. Technol.* 2023, 28, 12351–12382. <https://doi.org/10.1007/s10639-022-11544-0>
- [6] Zain, S. Digital transformation trends in education. In *Future Directions in Digital Information*; Elsevier: Amsterdam, 2021; pp. 223–234.
- [7] Castro Benavides, L.M.; Tamayo Arias, J.A.; Arango Serna, M.D.; Branch Bedoya, J.W.; Burgos, D. Digital Transformation in Higher Education Institutions: A Systematic Literature Review. *Sensors* 2020, 20, 3291. <https://doi.org/10.3390/s20113291>
- [8] Ahmad, T. Scenario based approach to re-imagining future of higher education which prepares students for the future of work. *High. Educ. Ski. Work. -Based Learn.* 2019, 10, 217–238.
- [9] Truong, T.-C.; Diep, Q.B. Technological Spotlights of Digital Transformation in Tertiary Education. *IEEE Access* 2023, 11, 40954–40968. <https://doi.org/10.1109/ACCESS.2023.3270340>
- [10] Hess, T.; Matt, C.; Benlian, A.; Wiesböck, F. Options for formulating a digital transformation strategy. *MIS Q. Exec.* 2016, 15(2), 123–139.
- [11] Vial, G. Understanding digital transformation: A review and a research agenda. *J. Strateg. Inf. Syst.* 2019, 28(2), 118–144.
- [12] Westerman, G.; Bonnet, D.; McAfee, A. *Leading Digital: Turning Technology into Business Transformation*; Harvard Business Review Press: Boston, MA, USA, 2014.
- [13] Fitzgerald, M.; Kruschwitz, N.; Bonnet, D.; Welch, M. Embracing digital technology: A new strategic imperative. *MIT Sloan Manag. Rev.* 2014, 55(2), 1–12.
- [14] Kane, G.C.; Palmer, D.; Phillips, A.N.; Kiron, D.; Buckley, N. Strategy, not technology, drives digital transformation. *MIT Sloan Manag. Rev.* 2015, Summer, 1–25.
- [15] Schallmo, D.R.A.; Williams, C.A. History of Digital Transformation. In *Digital Transformation Now!*; Springer, Cham, 2018; pp. 3–8.
- [16] Molina-Carmona, R.; Llorens-Largo, F.; Fernández-Martínez, A. Proposal for a digital maturity model for universities (MD4U). *EUNIS 2019 Conference*, 2019, 8–11.
- [17] Sayaf, A.M.; Alamri, M.M.; Alqahtani, M.A.; Al-Rahmi, W.M. Information and communications technology used in higher education: An empirical study on digital learning as sustainability. *Sustainability* 2021, 13, 7074.
- [18] Li, X.; Bergin, C.; Olsen, A.A. Positive teacher-student relationships may lead to better teaching. *Learn. Instr.* 2022, 80, 101581.
- [19] Batista, J.; Santos, H.; Marques, R.P. The use of ICT for communication between teachers and students in the context of higher education institutions. *Information* 2021, 12, 479.
- [20] Comi, S.L.; Argentin, G.; Gui, M.; Origo, F.; Pagani, L. Is it the way they use it? Teachers, ICT, and student achievement. *Econ. Educ. Rev.* 2017, 56, 24–39.
- [21] Alenezi, M. Deep dive into digital transformation in higher education institutions. *Educ. Sci.* 2021, 11, 770.
- [22] Goulart, V.G.; Liboni, L.B.; Cezarino, L.O. Balancing skills in the digital transformation era: The future of jobs and the role of higher education. *Ind. High. Educ.* 2022, 36, 118–127.
- [23] Ilori, M.O.; Ajagunna, I. Re-imagining the future of education in the era of the fourth industrial revolution. *Worldw. Hosp. Tour. Themes* 2020, 12, 3–12.
- [24] Brown, M. Digital maturity in higher education: An overview. *EDUCAUSE Rev.* 2018.

- [25] Reiser, B.J. Scaffolding complex learning: The mechanisms of structuring and problematizing student work. *J. Learn. Sci.* 2004, 13, 273–304.
- [26] Ambrose, S.A.; Bridges, M.W.; DiPietro, M.; Lovett, M.C.; Norman, M.K. *How Learning Works: Seven Research-Based Principles for Smart Teaching*; John Wiley & Sons: Hoboken, NJ, USA, 2010.
- [27] Roth, S. Digital transformation of social theory. A research update. *Technol. Forecast. Soc. Chang.* 2019, 146, 88–93.
- [28] Luhmann, N.; Albrow, M. *A Sociological Theory of Law*; Routledge: London, UK, 2013.
- [29] García-Morales, V.J.; Garrido-Moreno, A.; Martín-Rojas, R. The transformation of higher education after the COVID disruption: Emerging challenges in an online learning scenario. *Front. Psychol.* 2021, 12, 616059.
- [30] Rapanta, C.; Botturi, L.; Goodyear, P.; Guàrdia, L.; Koole, M. Online university teaching during and after the Covid-19 crisis: Refocusing teacher presence and learning activity. *Postdigit. Sci. Educ.* 2020, 2, 923–945.
- [31] Kitchenham, B. Procedures for Performing Systematic Reviews. Keele University Technical Report TR/SE-0401, 2004, 1–33.
- [32] Shamseer, L.; Moher, D.; Clarke, M.; Ghersi, D.; Liberati, A.; Petticrew, M.; Shekelle, P.; Stewart, L.A. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: Elaboration and explanation. *BMJ* 2015, 350, g7647.
- [33] Braun, V.; Clarke, V. *Thematic Analysis: A Practical Guide*; Sage Publications: London, UK, 2021.
- [34] Grajek, S. Top 10 IT issues, 2020: The drive to digital transformation begins. *EDUCAUSE Rev.* 2020.
- [35] Santos, H.; Batista, J.; Marques, R.P. Digital transformation in higher education: The use of communication technologies by students. *Procedia Comput. Sci.* 2019, 164, 123–130.
- [36] Bond, M.; Marín, V.I.; Dolch, C.; Bedenlier, S.; Zawacki-Richter, O. Digital transformation in German higher education: Student and teacher perceptions and usage of digital media. *Int. J. Educ. Technol. High. Educ.* 2018, 15, 1–20.
- [37] Leonardi, P.M.; Treem, J.W. Behavioral visibility: A new paradigm for organization studies in the age of digitization, digitalization, and datafication. *Organ. Stud.* 2020, 41, 1601–1625.
- [38] Orr, D.; Luebcke, M.; Schmidt, J.P.; Ebner, M.; Wannemacher, K.; Ebner, M.; Dohmen, D. *Higher Education Landscape 2030: A Trend Analysis Based on the Ahead International Horizon Scanning*; Springer Nature: Berlin, 2020.
- [39] McKnight, K.; O'Malley, K.; Ruzic, R.; Horsley, M.K.; Franey, J.J.; Bassett, K. Teaching in a digital age: How educators use technology to improve student learning. *J. Res. Technol. Educ.* 2016, 48, 194–211.
- [40] Erol, M.; Yıldırım, İ. The development of higher education life satisfaction scale. *Eğitimde Kuram Uygul.* 2016, 12, 221–243.
- [41] Jackson, D. Developing graduate career readiness in Australia: Shifting from extra-curricular internships to work-integrated learning. *Int. J. Work.-Integr. Learn.* 2018, 19, 23–35.
- [42] Cunningham, W.V.; Villaseñor, P. Employer voices, employer demands, and implications for public skills development policy. *World Bank Res. Obs.* 2016, 31, 102–134.
- [43] European University Association. *EUA 2020: Preliminary Results of the EUA Survey on Digitally Enhanced Learning at European Higher Education Institutions*, 2020.
- [44] Stokes, P.; Baker, N.; DeMillo, R.; Soares, L.; Yaeger, L. *The Transformation-Ready Higher Education Institution*. Huron Consulting Group, 2019.
- [45] Kelchevskaya, N.; Shirinkina, E. Institutional Model of Drivers of Digital Development of Human Capital in the Strategic Perspective. In *Proc. 2nd International Scientific and Practical Conference (MTDE 2020)*, 2020, pp. 499–503.

- [46] Seres, L.; Pavlicevic, V.; Tumbas, P. Digital Transformation of Higher Education: Competing on Analytics. In Proc. INTED 2018, 2018, pp. 9491-9497.
- [47] Moreno, V.; Cavazotte, F.; Alves, I. Explaining university students' effective use of e-learning platforms. Br. J. Educ. Technol. 2017, 48, 995-1009.
- [48] Arkorful, V.; Abaidoo, N. The role of e-learning, advantages, and disadvantages of its adoption in higher education. Int. J. Instr. Technol. Distance Learn. 2015, 12, 29-42.
- [49] Gee, J.P.; Hayes, E.R. Language and Learning in the Digital Age; Routledge: London, UK, 2011.
- [50] ao, M. Enhancing employability in engineering and management students through soft skills. Ind. Commer. Train. 2014, 46.
- [51] Bloomberg, J. Digitization, Digitalization, and Digital Transformation: Confuse Them at Your Peril. Forbes, 2018. Available online: <https://www.forbes.com/sites/jasonbloomberg/2018/04/29/digitization-digitalization-and-digital-transformation-confuse-them-at-your-peril/>
- [52] Fry, H.; Tinson, A. Digital Transformation in UK Higher Education: Strategies and Barriers. JISC Report, 2019.



2026 by the authors; Journal of Global Social Transformation (JGST). This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).